**Science Day 0:**

**Unit Setup – “BIO-,” “Tune In to Interesting Words” and AlphaBoxes**

**Levels of Organization & Biotic and Abiotic Factors**

**OBJECTIVES:**

* After activating their prior knowledge about “ecology” on a semantic web, students will read textbook chapter, “3-1: What is Ecology?” in order to sequence, define, and draw the ecological levels of organization on a graphic organizer.
* After discussing four categories of “interesting words,” students will identify, circle, and record jargon and unknown vocabulary in the first textbook chapter – “3-1: What is Ecology?” - on AlphaBoxes through the CAFE strategy, “Tune In to Interesting Words,” in order to become more aware of text language and self-monitor vocabulary comprehension during reading.
* After defining the Greek element, “BIO-,” in a morphology mini-lesson, students will predict the difference between abiotic and biotic factors in order to define them, identify the ecological level at which both come into play, and list examples of each.

**STANDARDS:**

**RST.9-10.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics* (ST CCSS, p. 62).

**RST.9-10.5** Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*) (ST CCSS, p. 62).

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).      
  
    1. Living things are both similar to and different from each other and nonliving things.  
  
    6. Plants and animals depend on each other and their physical environment.

**MATERIALS:**

* Smartboard or White Board
* Prentice Hall: Biology Textbook (Ch. 3-1: “What is Ecology?”)
* “Ecology” Semantic Web Worksheet
* “Tune In to Interesting Words” Reference Sheet
* AlphaBoxes
* Greek/Latin Element Graphic Organizer
* “Ecological Levels of Organization” Graphic Organizer
* “Abiotic v. Biotic Factors” T-Chart Worksheet
* Four-Square Vocabulary Cards

**DESCRIPTION:**

In this introductory lesson to the science portion of the interdisciplinary unit, students learn about the ecological setup of the biosphere while experiencing several mini-lessons that setup the structure of the unit. The teacher will first distribute the same reference sheet for the CAFÉ strategy, “Tune In to Interesting Words,” that students received in their English class (which outlines four general categories of “interesting words”), explaining the fluidity of the reading strategy and the general importance of vocabulary awareness but also reinforcing the difference between the language of the two disciplines by having students record their “interesting words” on science-specific AlphaBoxes. Students will then brainstorm ideas about “ecology” – which is the study of interactions among organisms and their environment – on a semantic web before the teacher begins to read aloud the first textbook chapter of the unit (“3-1: What is Ecology?”) to model “interesting word” selection and how the strategy’s general categories appear in science nonfiction (since the English classroom modeled its implementation on literary texts). The teacher will continue reading the chapter, pausing after another page to elicit the “interesting words” students circled and then continuing on uninterrupted so students have independent practice with the vocabulary strategy.

Before referring back to the textbook’s description of the six ecological levels of organization, the teacher conducted a morphology mini-lesson for the Greek element, “BIO-,” explaining why word part knowledge helps us decipher unknown vocabulary words and revealing that several Greek/Latin elements will be introduced in both disciplines during the unit. By brainstorming example words that began with that prefix, students filled out a basic graphic organizer. On a teacher-made chart projected on the SmartBoard, the class looked at the root words, discussed their meanings, and then added the prefix "bio" and described what happened to the meaning of the word to hypothesize the specific meaning of the Greek element. To ground Greek prefix immediately in text, students revisited the textbook chapter’s description of the levels of organization and discussed why two levels might start with that Greek element (“biosphere” and “biome”). After first identifying which box on a graphic organizer stood for those two levels – “biosphere” and “biome” – students sequenced the remaining levels, including a definition and quick sketch of them on the graphic organizer. For each level, students listed the title down the center of the diagram, defined it in the right side bar, and drew a quick sketch in the left side bar. After discussing the general levels of organization, students looked at the two main components at play in the environment: biotic and abiotic factors. After predicting the difference between them based on their new knowledge of the Greek prefix, "BIO-," students defined them, listed examples, and determined their role in each level of organization previously discussed (i.e. Which level or organization do both factors finally come into play [ecosystem]? Which factor was the sole component of the prior levels [biotic]?). To brainstorm examples, the teacher read through a list of biotic and abiotic factors and students had to classify them on a T-chart. Then students compared their charts with a partner to check their answers. At the end of class, the teacher will draw attention to how the Venn Diagram Word Wall and the daily “exit ticket” dice roll that is associated with it and the AlphaBoxes is present in the science classroom during the unit just as it is in the English classroom.

**ASSESSMENT OF STUDENT LEARNING:**  Informal formative assessments will occur throughout the lesson in the form of discussion input, “BIO-“ word brainstorming and whether students can predict the difference between abiotic and biotic factors based on “BIO-“ prefix, during-reading vocabulary identification (visible by circled words and AlphaBoxes), completion of semantic web, and level of engagement during the various lesson activities. To scan student work, the teacher will circle as she reads aloud the textbook chapter and while students reread the textbook to complete the levels of organization graphic organizer. The more formal formative assessment appear in the form of the two graphic organizers, although they will not be collected by the teacher. The daily exit ticket Word Wall dice roll at the end of every lesson will integrate an informal vocabulary assessment into every lesson.

**RATIONALE:**

The science lesson begins a day before the English unit, so students are not experiencing the introductory, overarching mini-lessons on the same day (i.e. “Tune In to Interesting Words, Four-Square Vocabulary Cards, AlphaBoxes). Instead of being redundant if done on the same day, the English classroom reinforces them by bringing them up the next day. Bull and Dupuis (2014) proposed the benefits of a dissimilar start date between disciplines in a cross-curricular unit.

With two reading strategy mini-lessons – “Tune In to Interesting Words” and a Greek/Latin element – embedded in this introductory unit, the science classroom immediately recognizes the need for explicit reading strategy instruction in science (Fang & Wei, 2010; Grant, 2004). According to Grant (2004), reading strategy explicit instruction “can help students learn to make sense of difficult texts and tough vocabulary” (p. 35), and Fang & Wei (2010) label it as a “key component” to reading infusion in the science content area (p. 263). Since the prefix, “BIO-,” will appear in myriad future words, it was chosen as the first Greek/Latin element to be explicitly taught. Aiding student word knowledge by explicitly teaching morphology through Greek and Latin elements is supported by many researchers (Kirby & Bowers, 2012; Boushey & Moser, 2009; Gore, 2010). By immediately grounding the Greek prefix “bio” in the levels of organization in the textbook reading, the mini-lesson aligns with a key point that Boushy & Moser (2009) make in regards to word part instruction: “As quickly as possible we anchor the words into text…” (p. 187). Similarly, as Parkinson (2004) states, any “strategies for working out the meaning of new vocabulary” in a theme-based course should be embedded in a real topic (p. 374). While the textbook is an inadequate resource for science learning alone, it is still a main disispline-specific literacy event in the science classroom (i.e. it serves as a model for scientific writing (Parkinson, 2004, p. 387)), and thus an indispensible part of the content area’s disciplinary literacy (Plummer & Kuhlman, 2008, p. 96-97).

The abundance of vocabulary activities – like the “Tune In to Interesting Words” strategy, the AlphaBoxes, and the Venn Diagram Word Wall - exists because vocabulary is one of the primary components of literacy for both content areas. Just as vocabulary knowledge accounts for as much as 80% of reading comprehension – making a case for vocabulary instruction in the English classroom – one of the main ways scientific language differs from everyday language is in its vocabulary – making a case for vocabulary instruction’s heavy presence in the science classroom (Parkinson, 2000, p 370). Therefore, varied but consistent vocabulary instruction is one of the most integral components of this unit as a whole. Semantic webs are the overarching pre-reading activity for both the English and science sections of this unit because they provide students with a free-form graphic organizer on which they can activate their prior knowledge, whether it be on general topics or scientific concepts

**PROFESSIONAL REFERENCES:**

Boushey, G. & Moser, J. (2009). Ready reference form: Strategy – Use word parts to determine the meaning of words (compound words, prefixes, suffixes, origins, abbreviations, etc.). In The CAFE book: Engaging all students in daily literacy assessment & instruction (p. 187). Portland, ME: Stenhouse Publishers.

Boushey, G. & Moser, J. (2009). Ready reference form: Strategy – Tune in to interesting words and use new vocabulary in speaking and writing. In The CAFE book: Engaging all students in daily literacy assessment & instruction (p. 185). Portland, ME: Stenhouse Publishers.

Bull, K. B., & Dupuis, J. B. (2014). Nonfiction and interdisciplinary inquiry: Multimodal learning in English and biology. *English Journal, 103*(3), 73-79.

Fang, Z., & Wei, V. (2010). Improving middle school students’ science literacy through reading infusion. *The Journal of Educational Research, 103,* 262-273.

Gore, M. C. (2010). Key 15: Teach Greek and Latin morphemes. In Inclusion strategies for secondary classrooms: Keys for struggling learners (pp. 58-59). Thousand Oaks, CA: Corwin.

Grant, R. (2004). Science libraries in the classroom. *Green Teacher, 74*, 35-38.

Kirby, J. R., & Bowers, P. N. (2012). Morphology works. *What works? Research into Practice,* 1-4.

Parkinson, J. (2000). Acquiring scientific literacy through content and genre: A Theme-based language course for science students. *English for Specific Purposes, 19*(4),369-387.

Parkinson, J., & Adendorff, R. (2004). The use of popular science articles in teaching science articles in teaching scientific literacy. *English for Specific Purposes, 23*(4), 379-396.

Plummer, D. M., & Kuhlman, W. (2008). Literacy and science connections in the classroom. *Reading Horizons, 48*(2), 95-110.

**Science Day 1:**

**Food Chains: Trophic Levels, Energy, & Biomass + Popcorn Lab Report**

**(Nonfiction Text Features Mini-Lesson for Textbook Reading)**

**OBJECTIVES:**

* After discussing the effect and purpose of the pull quote in Bradbury’s “A Sound of Thunder” (p. 74), students will examine the role of six (6) main nonfiction text features found in the class textbook (through a case study of their role in chapter “3-2: “Energy Flow”) in order to outline each’s appearance, location, and purpose on an anchor chart.
* After activating their prior knowledge of “food chains” on a semantic web, students will analyze pages 72-73 of the textbook chapter based on their text features in order to diagram the four food chain pyramids (biomass, numbers, energy, trophic levels) on a graphic organizer.
* After diagramming the “Energy Pyramid” of food chains on a graphic organizer, students will calculate the 10% energy transfer between trophic levels in terms of popcorn weight in order to explain how energy flow limits and sustains food chain trophic levels in a lab report.

**STANDARDS:**

**RST.9-10.3** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text (ST CCSS, p. 62).

**RST.9-10.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics* (ST CCSS, p. 62).

**RST.9-10.5** Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*) (ST CCSS, p. 62).

**WHST.9-10.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes (ST CCSS, p. 65).

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).      
  
    6. Plants and animals depend on each other and their physical environment.

**MATERIALS:**

* Smartboard or White Board
* Ray Bradbury’s “A Sound of Thunder”
* “Nonfiction Text Features” Anchor Chart Worksheet
* Prentice Hall: Biology Textbook (Ch. 3-2: “Energy Flow”)
* “Food Chain” Semantic Web Worksheet
* Pyramid Graphic Organizer
* Bags of Popcorn
* Electronic Balances
* Calculators
* Petri Dishes, Plastic Cups, Plastic Bags, etc.
* Broom , Dustpan, Disinfectant Wipes

**DESCRIPTION:**

Since high school science classrooms usually have two-period blocks every once in a while to accommodate for lab completion, this lesson would most likely fill one of those longer time slots. To begin the regular classroom section, the teacher would elicit a student summary of their English classroom lesson the day prior (which revolved around the Time Safari, Inc. advertisement and Eckels’s opinion on time travel), and then prompt students to flip through their copies of Ray Bradbury’s “A Sound of Thunder” from their English class to pinpoint how they could immediately gauge the protagonist’s opinion on time travel just by skimming the first several pages of the short story. Studnets should be prompted to fingerpoint on the page to where they find the information. The teacher would direct students to the third page (p. 74) and lead a discussion about the page’s enlarged quote, identifying it as a “pull quote.” Introducing a “Nonfiction Text Features” anchor chart, the teacher would model its completion in an “I do” setup by walking students through the description and purpose of the “A Sound of Thunder” pull quote, drawing on students prior knowledge of its context gained from English class. The teacher will then explain that both fiction and nonfiction can have text features that enable us to navigate them more efficiently and effectively – since each has its own specific role and function in a text (i.e. some highlight main ideas while others add supplemental information) – but some text features are, more or less, unique to each type. The teacher will encourage students to tune in future pull quotes as they read “A Sound of Thunder,” but will turn their attention to the six (6) nonfiction text features pulled from the class textbook (headings, bold vocabulary, figures, captions, and key symbolsa). After the teacher leads students through filling out the second row – “headings” – of the anchor chart (“We do”), students work in pairs to skim the textbook chapter “3-2: Energy Flow” and identify the role of the remaining four text features. A whole-class discussion will conclude the mini-lesson. The teacher will explain that students should use the text features whenever assigned a textbook readings. Returning to a two-page spread in the textbook (p. 73-74), the teacher will leads students through a graphic organizer that requires them to diagram the main components of food chains (trophic levels, biomass, engery, and numbers). To do so, the teacher will ask students which text feature they should read first, second, third, etc. to gain the best understanding of the pyramids from the textbook pages.

In the first lab of the unit, students will work with popcorn and electronic scales to calculate and measure the exact amount of energy that would be transferred to each successive trophic level in food chain, keeping in mind that only 10% of energy progresses from one level to the next. Bags of SmartFood popcorn for energy, various plastic dishes for each trophic level, and an electronic scale should be distributed to each group of two to three students. Students will need to develop a procedure for calculating how much popcorn should be at each level of their food chain and should develop their food chain until there is not enough energy to sustain another level. Given two formulas to use to calculate the energy transfer (is/of = %/100; weight of popcorn dish – weight of dish = weight of popcorn), students will work together to create each trophic level, but each individual student is responsible for filling out their own lab report (i.e. purpose, materials, steps, conclusion). Once students have the teacher check their food chains and answer any questions that the teacher may have about it, students will individually answer the conclusion lab report questions to demonstrate key knowledge of why another trophic level was impossible, why all energy is not transferred, etc. The lab report should be submitted at the end of class.

**ASSESSMENT OF STUDENT LEARNING:**  Informal formative assessments will occur throughout the lesson in the form of discussion input, finger pointing on the “A Sound of Thunder” pull quote, and level of engagement during the anchor chart and graphic organizer completion. The teacher will circle the classroom as students fill in the anchor chart with their partners to listen to the discussion and gauge the thoroughness of their answers. The lab report will serve as the formal assessment, especially the conclusion questions because they must be completed independently. The accuracy of the lab’s calculations and whether or not students stopped at the right “highest” trophic level will be evaluated by the teacher when called over to grant students’ permission to move on to the conclusion questions.

**RATIONALE:**

To introduce the purpose of the textbook’s nonfiction text features, this lesson capitalizes on students’ “ready-made hooks in prior knowledge” about text features from English class, since students have already navigated – although unknowingly – one in “A Sound of Thunder”: pull quotes (Bull & Dupuis, 2014, p. 73). In addition to cross-curricular – or “generic” as Fang and Coatoam deemed them (p. 627) – reading strategies – like “Tune In to Interesting Words” and later on, “CHoMP” – explicit instruction in another more disciplinary – or “specialized” (Fang & Coatoam, 2013, p. 628) reading strategy – Nonfiction Text Features – comes into the science classroom to help students navigate the classroom textbook. However, to show students that text features are in both fiction and nonfiction, students draw from the pull quotes in the copy of “A Sound of Thunder” to gain an initial, general understanding of text features. Since students are tasked to interact with the textbook-specific (i.e. key symbols) text features, they continue the science classroom’s embrace of explicit reading strategy instruction in science (Fang & Wei, 2010; Grant, 2004).

Holding the first of several lab reports in this science unit, this lesson recognizes that lab writing is the primary literary event and “science genre” in the traditional science classroom, making up about 85% of 61 assignments derived from ten science and engineering courses (Parkinson, 2000, p. 372). However, since these disciplinary literacy events are surrounded by others throughout the unit (i.e. descriptive/explanatory/synthesis/reflection essays, persuasive letters, compare/contrast paragraphs), the science classroom also strives “to stretch [students’] science writing beyond the traditional laboratory report,” since “these usually unmotivating laboratory reports leave little room for the application of science concepts to different settings” (Peterson, Rochwerger, Brigman, & Wood, 2006, p. 32).

**PROFESSIONAL REFERENCES:**

Bull, K. B., & Dupuis, J. B. (2014). Nonfiction and interdisciplinary inquiry: Multimodal learning in English and biology. *English Journal, 103*(3), 73-79.

Fang, Z., & Coatoam, S. (2013). Disciplinary literacy: What you want to know about it. *Journal of Adolescent & Adult Literacy, 56*(8), 627-632.

Fang, Z., & Wei, V. (2010). Improving middle school students’ science literacy through reading infusion. *The Journal of Educational Research, 103,* 262-273.

Grant, R. (2004). Science libraries in the classroom. *Green Teacher, 74*, 35-38.

Parkinson, J. (2000). Acquiring scientific literacy through content and genre: A Theme-based language course for science students. *English for Specific Purposes, 19*(4),369-387.

Peterson, S. S., Rochwerger, L., Brigman, J, & Wood, K. (2006). Cross-curricular literacy: Writing for learning in a science program. *Voices from the Middle, 14*(2), 31-37.

**Science Day 2:**

**Biome-Specific “Nesting Cup” Food Chains**

**(Synthesizing Online & Textbook Research for Student-Created, Peer-Teaching Stations)**

**OBJECTIVES:**

* After activating their prior knowledge about “biomes” on a semantic web, students (in groups of four) will research the predator-prey relationships in their assigned land biome using laptops in order to construct two (2) Styrofoam “nesting cup” food chains with species illustrations and color-coded trophic levels.
* After brainstorming words that begin with the Greek prefix, “MICRO-,”on a graphic organizer, students will deduce the meaning of the Greek element by discussing the commonality in the words’ definitions in order to apply the Greek morpheme onto “microclimate” in the teacher read-aloud of the first two pages of textbook chapter “4-3: Land Biomes.”
* After reading aloud the first two pages of the textbook chapter, “4-3: Land Biomes,” students will apply their “Nonfiction Text Feature” anchor chart to the subsequent chapter page dedicated to their group’s assigned biome in order to restate its climate and location biome information on a graphic organizer.

**STANDARDS:**

**RST.9-10.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics* (ST CCSS, p. 62).

**RST.9-10.7** Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words (ST CCSS, p. 62).

**WHST.9-10.7** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation (ST CCSS, p. 66)

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).      
  
  1. Explain how diversity of populations within ecosystems relates to the stability of ecosystems.  
  
    6. Plants and animals depend on each other and their physical environment.

**MATERIALS:**

* Smartboard or White Board
* Prentice Hall: Biology Textbook (Ch. 4-3: “Land Biomes”)
* “Biomes” Semantic Web Worksheet
* Greek/Latin Element Graphic Organizer
* “Nonfiction Text Features” Anchor Chart
* Land Biome Graphic Organizer
* Styrofoam Coffee Cups
* Construction Paper
* Colored Pencils and/or Crayons
* Glue Sticks
* Scissors
* Laptops

**DESCRIPTION:**

Mixing print-based and online research methods, this lesson introduces a new Greek element, "MICRO-" and revisits the "Nonfiction Tex Features" anchor chart to aid studnets’ textbook portion of the research process. A styrofoam "nesting cup" food chain activity grounds students’ online research in analog creativity. A morphology mini-lesson will begin the class period. Students will brainstorm words that begin with the Greek prefix, “MICRO-“ (i.e. microscope, microchip, etc.), discuss each word’s definition as a whole-class, and, in a Think-Pair-Share activity, deduce the specific meaning of the Greek prefix by analyzing the underlying commonality between the definitions. The teacher will inform the students that the Greek element will come into play in the lesson’s textbook chapter and that the textbook chapter discusses different land biomes. The teacher will distribute a semantic map on “biomes” to activate students’ prior knowledge of the term, since it was previously discussed in the first lesson of the unit on ecological levels of organization. A whole-class discuss will follow-up the independent brainstorming session, reminding students where “biome” falls on the levels of organization (between “ecosystem” and “biosphere”) and identifying the land biomes that will be researched. After flipping through photographs of the biome options (which will also serve to dispel student misconceptions, like the tundra being only ice and snow), students will choose their first and second preferences and the teacher will group students into groups of four accordingly.

Once in their research groups, the teacher will model the assignment requirements by showing students a pre-made “nesting cup” food chain from the aquatic biome (a biome not assigned to any student group). The teacher will explain that online research on the laptops must yield two different biome-specific food chains and that students should refer to the textbook page dedicated to their specific biome to fill in the graphic organizer (every student must complete his or her own graphic organizer). With the aquatic example (kelp, sea urchin, sea otter, orca), the teacher will explain how to construct the nesting cup food chains and color-code them according to trophic level with construction paper and a pre-made key (i.e. yellow for producer). In their groups of four, students will then use their “Nonfiction Text Features” anchor chart to navigate their textbook page and fill in the associated graphic organizer by coloring in their biome’s location on a blank global map and restating its “climate diagram” (which they have experience deciphering from the teacher-read aloud that provided a “We do” look at a “climate diagram”). With a given list of possible websites, students will find two food chains (with at least four trophic levels) in their biome to construct their “nesting cup” food chains. Students will draw the species on 2.5 inch x 2.5 inch squares, link each to a trophic level, back the illustration with its associated construction paper trophic level color according to the provided key, glue the illustration to a Styrofoam cup and writing the species name on the rim of the cup. There will be signs for each biome around the room, and students will set up their “nesting cup” food chains (in a jumbled order) and display one of the textbook graphic organizers as a station through which their peers will rotate at the end of class. Students will explain their animals to their peers, enabling the peers to assemble the food chains. Students will receive photocopies of the each group’s graphic organizer tomorrow.

**ASSESSMENT OF STUDENT LEARNING:**  Informal formative assessments will occur throughout the lesson in the form of discussion input, level of engagement and participation in the group research, and the thoroughness of their “biome” and “MICRO-“ brainstorming session (as indicated either through graphic organizer completion or oral input). The formal formative assessments are the products of the group research: the textbook graphic organizer and the two “nesting cup” food chains. When students are cycling through the different biome stations, the teacher will rotate also, informally quizzing every group member on his/her biome to order to avoid assessing individual student knowledge just from the group products.

**RATIONALE:**

The science classroom is often seen as a place for “hands-on learning” – from both the student (Howes, Hamilton, & Zaskoda, 2003, p. 500) and teacher (Fang & Wei, 2010, p. 265) perspective. Therefore, with the sytrofoam “nesting cups” food chain activities, this lesson upholds that and simultaneously combats the common belief of science teachers that because of the subject’s hands-on nature, it “has little to do with reading” (Fang & Wei, 2010, p. 265). This “nesting cup” food chain activity crops up in several lessons afterwards, so its benefits exceed this lesson. The teacher model “nesting cup” food chain (an kelp forest aquatic food chain consisting of kelp, a sea urchin, a sea otter, and an orca) will be used in a future science lesson to introduce the concept of keystone species. And, in the English classroom, students will construct “nesting cup” food chains for the one described in “A Sound of Thunder,” applying the trophic level color-coded system established in this lesson to prove the scientific accuracy of the fiction, an important understanding that will bridge the two disciplines (Lightman & Goldstein, 2011; Kesler, 2012, p. 341).

**PROFESSIONAL REFERENCES:**

Fang, Z., & Wei, V. (2010). Improving middle school students’ science literacy through reading infusion. *The Journal of Educational Research, 103,* 262-273.

Howes, E. V., Hamilton, G. W., & Zaskoda, D. (2003). Linking science and literature through technology: Thinking about interdisciplinary inquiry in middle school. *Journal of Adolescent & Adult Literacy, 46*(6), 494-504.

Kesler, T. (2012) Evoking the world of poetic nonfiction picture books. *Children’s Literature in Education. 43*, 338-354.

Lightman, A., & Goldestein, R. N. (2011). Bridging the two cultures: A conversation between Alan Lightman and Rebecca Newberger Goldstein. *World Literature Today, 85*(1). Retrieved from <http://www.worldliteraturetoday.org/2011/january/bridging-two-cultures-conversation-between-alan-lightman-and-rebecca-newberger#.UstLk_sliAY>

**Science Day 3:**

**Symbiotic Relationships – Commensalism, Mutualism, & Parasitism**

**(Definition Coloring Activity & *Spider-Man 3* Pop Culture Tie-In)**

**OBJECTIVES:**

* After thinking beyond predator-prey relationships on a “How Do Species Interact?” semantic web, students will define the three symbiotic relationships in their own words based on textbook chapter “4-2: What Shapes an Ecosystem?” in order to color-code illustrations of symbiosis and list dominant features of each relationship on a graphic organizer.
* After defining the three symbiotic relationships in a coloring activity, students will examine the captions in a photograph slideshow of different real-life examples of symbiosis in order to, in a Think-Pair-Share activity, discuss and identify which symbiotic relationship each photograph depicts.
* After activating their prior knowledge about the movie, *Spider-Man 3*, on a semantic web, students will analyze the cause and effect relationship between Peter and the extraterrestrial “symbiote” in several video clips in order to use text details to classify the Peter-Symbiote relationship as mutualistic, commensalistic, or parasitic in a writing activity.

**STANDARDS:**

**RST.9-10.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (ST CCSS, p. 62).

**RST.9-10.2** Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text (ST CCSS, p. 62).

**RST.9-10.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics* (ST CCSS, p. 62).

**RST.9-10.7** Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words (ST CCSS, p. 62).

**WHST.9-10.1** Write arguments focused on *discipline-specific content* (ST CCSS, p. 64).

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).      
  
    6. Plants and animals depend on each other and their physical environment.

**MATERIALS:**

* Smartboard or White Board
* Prentice Hall: Biology Textbook (Ch. 4-2: “What Shapes an Ecosystem?”)
* Photograph SlideShow
* Symbiotic Relationship Coloring Activity Graphic Organizer
* *Spider-Man 3* Cause/Effect Graphic Organizer
* *Spider-Man 3* Writing Assignment Worksheet
* 313 Badwolf (2014). Spider-Man 3: Symbiote bonds with Spider-Man [Video file]. Retrieved from <http://www.youtube.com/watch?v=qKGMxa7fOJw>
* Joker133759 (2014). Spider-Man 3 Bell Tower Scene [Video file]. Retrieved from <http://www.youtube.com/watch?v=KtHpEAYSilQ>
* GFX / Gaming Channel :) (2012). Peter Parker's dance (Spiderman 3) full [Video file]. Retrieved from <http://www.youtube.com/watch?v=SPN1BvR02Xo>
* The Oatmeal (2014). Realistic Spider-Man [Image]. Retrieved from <http://theoatmeal.com/pl/realistic_batman/spiderman>

**DESCRIPTION:**

To expand student thinking about how different species interact beyond the food chain predator-prey relationships that were the focus of the previous lessons, students brainstormed ways in which species interact on a semantic web. The teacher will remind them that species begin to interact with one another at the “community” level of organization. A whole-class discussion will conclude the brainstorming session. The teacher will record student ideas on a class semantic web written on the write board or projected on the SmartBoard. In a whole-class setting, students will read-aloud the first two pages of textbook chapter, “4-2: What Shapes an Ecosystem?” and discuss the three symbiotic relationships that they define. On a graphic organizer, students will design a color code to represent the three effects symbiotic relationships can have on its parties: benefit, harm, or unaffected. Students then defined, in their own words, mutualism, parasitism, and commensalism in the box provided on the graphic organizer. After linking a color to each possible effect, paired students looked at a visual that summarized a real-life example of each relationship, discussed them, and colored in the picture according to the key and the type of interaction in which the two species were involved. With teacher guidance, students then listed prominent characteristics as bullet points beneath each definition (i.e. dominant forms that a relationship assumes, specific characteristics or terminology associated with a relationship, etc.). A photograph slideshow of twenty (20) real-life examples of symbiosis were projected on the SmartBoard. Students read the captions for each, and – in a Think-Pair-Share activity – predicted which symbiotic relationship – mutualistic, commensalistic, or parasitic – each portrayed. A non-example was provided in the slideshow to initiate a dicscussion on why predator-prey relationships are not symbiotic relationships.

To conclude the photograph slideshow, the teacher projected a webcomic from *The Oatmeal* entitled, “Realistic Spiderman.” Depicting not only a relatable and humorous scenario of arachnophobia, it captures the negated mutualistic relationship between humans and house spiders and leads into the *Spider-Man 3* popular culture tie-in. On a semantic web, students will brainstorm what they know about the movie, *Spider-Man 3*. The teacher will precede a screening of several video clips from the movie with background information, explaining the general plotline of the movie. During the video clips, students will record the different effects of the black symbiote on Peter Parker after identifying the cause of the symbiotic relationship (i.e. the nighttime bonding of the symbiote on Parker). Students will pair with another student to briefly discuss their graphic organizer. But then, in an independent writing extension activity, students will apply their new knowledge of symbiotic relationships onto the Peter-symbiote relationship in order to argue whether the cinematic relationship is commensalistic, mutualistic, or parasitic. Students must use text details from the video clip to justify their classification and, in a sentence or two at the end of their paragraphs, to infer why the “symbiote” would be entitled so ambiguously and not specifically defined as one of the three relationships through its name.

**ASSESSMENT OF STUDENT LEARNING:**  Informal formative assessments will occur throughout the lesson in the form of discussion input, participation in the Think-Pair-Share photograph slideshow activity, and level of engagement during the movie clip screening and paragraph writing. The teacher will circle the room and scan student work during the movie screening and coloring activity. Since it requires students to apply the key scientific terms of the lesson on a fictional biological interaction, the *Spider-Man 3* paragraph serves as the formal formative assessment in the lesson.

**RATIONALE:**

In the slideshow of approximately twenty (20) photographs depicting real-life examples of symbiosis, there are several photographs are nonexamples (i.e. food chain, unlikely animal friendships). Since the examples cover all three types and show animal-animal, animal-plant, and plant-plant examples, the slideshow caters to how “not only do teachers need to provide many examples, but…teachers must provide a sufficient *range* of examples to adequately define the concept (Gore, 2010, p. 80-81, italics in original). The “nonintituitive” nonexamples (or nonexamples that bear a strong resemblance to examples) are important because students often overgeneralize and nonexample exposure “[prompts] correct classification of newly encountered items” (Gore, 2010, p. 82). The food chain nonexample reinforces that symbiosis is a close, long-term relationship (and therefore, not a one to two minute eating session every so often). The unlikely animal friendship reinforces the physical survival benefit characteristic of symbiosis (the unlikely friendship is emotionally mutualistic).

The popular culture tie-in through *Spider-Man 3* serves as an engaging and audiovisual text for students to think critically about the learned concepts and apply their knowledge of symbiotic relationships to classify a new example of symbiosis. Students prior interaction with examples consisted solely of photographs, a flat medium that does not bring symbiosis to life.

**PROFESSIONAL REFERENCES:**

Gore, M. C. (2010). Key 26: Provide a plethora of examples. In Inclusion strategies for secondary classrooms: Keys for struggling learners (pp. 80-81). Thousand Oaks, CA: Corwin.

Gore, M. C. (2010). Key 27: Provide nonexamples. In Inclusion strategies for secondary classrooms: Keys for struggling learners (pp. 82). Thousand Oaks, CA: Corwin.

**Science Day 4:**

**Chaos Theory - Niche and Invasive Species**

**Baseball Analogy & “Nab the Aquatic Invader!” Website**

**OBJECTIVES:**

* After role-playing a baseball play with and without an extra player, students will read textbook chapter excerpts on the “niche” and “introduced species” in order to apply the relationship between the two key concepts onto the roles of each baseball player and the competition that emerges with the addition of a player.
* After recalling “chaos theory” from Ray Bradbury’s “A Sound of Thunder” through a semantic web, students will analyze an animated video and the textbook except on “introduced species” in order to synthesize the three sources of information and deduce the general causes and the effects of invasive species on a T-chart.
* After researching aquatic invaders through an online website, “Nab the Aquatic Invader!,” students will illustrate and summarize a self-selected species on a cause/effect graphic organizer in order to select the “worst” aquatic invader through group sharing and a class poll.

**STANDARDS:**

**RST.9-10.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (ST CCSS, p. 62).

**RST.9-10.2** Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text (ST CCSS, p. 62).

**RST.9-10.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics* (ST CCSS, p. 62).

**RST.9-10.5** Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*) (ST CCSS, p. 62).

**RST.9-10.9** Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts (ST CCSS, p. 62).

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).   

6. Plants and animals depend on each other and their physical environment

7. Human decisions and activities have had a profound impact on the physical and living environment.

**MATERIALS:**

* Smartboard or White Board
* Beach Ball
* Prentice Hall: Biology Textbook (Ch. 4.2: “What Shapes an Ecosystem?” – “The Niche” Excerpt; Ch. 6-3: “Biodiversity” – “Introduced Species” Excerpt)
* YouTube Video: Entomological Society of America (2013). Invasive species [Image]. Retrieved from <http://www.youtube.com/watch?v=HAY_UsGjyZk>
* Ray Bradbury’s “A Sound of Thunder”
* “Chaos Theory” Semantic Web
* Invasive Species Cause/Effect T-Chart
* Laptops
* Cause/Effect Aquatic Invasive Species Graphic Organizer
* “Nab The Aquatic Invader!” Website: <http://www.iisgcp.org/NabInvader/index.html>

**DESCRIPTION:**

Although Ray Bradbury's "A Sound of Thunder" primarily focuses on how nature can be thrown into chaos if an organism is removed (i.e. a mouse, a butterfly), it does hint at the opposite possibility: that nature can also be massively disrupted by the addition of an organism. Travis mentions the necessity of oxygen helmets so that bacteria are not “introduced into the ancient environment.” By activating not only students prior knowledge of “chaos theory” through their English class reading of the short story, but that specific piece of dialogue, this lesson brings the fictional idea to a real-life context through two key science concepts: “niche” and “invasive species.” As a kinesthetic activity to introduce the key concepts before reading their associated textbook excerpts, six student volunteers (batter, catcher, pitcher, first/second/third baseman) will first role-play a baseball play by rolling a beach ball to one another as the teacher narrates the play: “Batter hits lowball to third base and third baseman throws to first" (i.e. Student batter rolls beach ball to third and third baseman student throws the ball to first while batter runs). The teacher will lead a discussion of how effective the situation was handled and how the specific roles for each player contributed to the effectiveness. The teacher will read-aloud the excerpt on “niche” in textbook chapter, "4-2: What Shapes an Ecosystem?” and the class will discuss how an organism’s specific role in an ecosystem helps it run smoothly and apply it to the specific roles of baseball players. Student volunteers will role-play the same baseball play again, but with an additional third baseman, so that – when the ball is rolled to third base, two students compete to obtain the beach ball and roll it to first. By reading the section on “introduced species” in textbook chapter “6-3: Biodiversity” afterwards, students will discuss the relationship between niche and invasive species (and the negative effect of invasive species on native species) by applying the terms to the baseball game replay. An animated video will bring to life (apart from the analogy) the terms from the textbook reading, and students will then work in pairs to complete a T-chart on the causes and effects of invasive species. The teacher will first guide students with the T-chart by having them, in two Think-Pair-Share activities, predict the negative effects of time travel-caused invasive bacteria as posed by “A Sound of Thunder” and record the general “steal resources” effect of invasive species as depicted by the animated video (i.e. Frank ate all the island’s rare orchids once he arrived from the city).

Since students' exposure to the aquatic biome emerged only through teacher modeling of the "nesting cup" food chain activity in a prior lesson, students explored an online site dedicated to spotlighting marine invaders and their effect on their non-native oceanic region. Given laptops and choice, students will navigate the website to summarize a self-selected marine invader on a cause/effect graphic organizer. Students will then come together in groups of four to explain their invader to one another. Each group will pick the “worst” invader from the four presented (i.e. which species causes the most “chaos” when introduced to a non-native habitat?), and share that top invader with the class. Of those group-selected top invaders, each student will then vote on the “worst” invader in a secret ballot whose results would be revealed at the beginning of the next class period.

\* “Niche” and “Invasive Species” are added to the science side of the Venn Diagram Word Wall. “Chaos Theory” is moved from the English section to the middle.

**ASSESSMENT OF STUDENT LEARNING:**  Informal formative assessments will occur throughout the lesson in the form of discussion input, aquatic invader illustration and summarization, and participation in the Think-Pair-Share activities. The more formal formative assessments emerge from the Cause/Effect T-chart in which students must synthesize three sources of information – the textbook reading, the animated video, and the “A Sound of Thunder” quote – to deduce the impacts and natural/man-made causes of invasive species. The teacher will circulate around the room as students complete the T-chart to scan student work and listen in on discussions to gauge student comprehension. Students’ selection of the “worst” aquatic invader – in each of the two voting rounds (group and individual) – will serve to assess whether students’ understand the effects of invasive species.

**RATIONALE:**

This lesson capitalizes on students’ “ready-made” hooks in prior knowledge” from English class on “chaos theory” (from “A Sound of Thunder”), since it links to invasive species (Bull & Dupuis, 2014, p. 73). For the invasive species T-chart, students synthesize three sources (textbook, video, fictional short story, “A Sound of Thunder”). The use of “A Sound of Thunder” to have students predict the effect of invasive species serves as a cross-curricular connection that shows Travis’s fear of modern bacteria’s exposure to the prehistoric environment and the consequent use of oxygen helmets is actually valid – scientifically speaking – because nonnative species can disrupt an entire ecosystem. Showing students the scientific accuracy of fiction text is important to link the disciplines of science and English (Lightman & Goldstein, 2011; Kesler, 2012, p. 341). The “Nab the Aquatic invader!” website provides student choice in a free exploration, motivating and engaging students.

The abundance of vocabulary activities – like the “Tune In to Interesting Words” strategy, the AlphaBoxes, and the Venn Diagram Word Wall - exists because vocabulary is one of the primary components of literacy for both content areas. Just as vocabulary knowledge accounts for as much as 80% of reading comprehension – making a case for vocabulary instruction in the English classroom – one of the main ways scientific language differs from everyday language is in its vocabulary – making a case for vocabulary instruction’s heavy presence in the science classroom (Parkinson, 2000, p 370). The baseball game role-playing in this lesson to teach both “niche” and “invasive species” adds to the vocabulary strategies: a “vocabulary drama,” or brief skit that caters to kinesthetic learning and aids memory retention (Gore, 2010, p. 54). It addresses how textbook explanations of concepts can be “dense and abstract” (Fang & Wei, 2010, p. 263). The “vocabulary drama” continues the science classroom’s commitment to hands-on learning, as well (Howes, Hamilton, & Zaskoda, 2003, p. 500; Fang & Wei, 2010, p. 265). By using the same baseball game analogy and play to teach “invasive species” as used beforehand to teach “niche” better shows the relationship between the concepts.

**PROFESSIONAL REFERENCES:**

Bull, K. B., & Dupuis, J. B. (2014). Nonfiction and interdisciplinary inquiry: Multimodal learning in English and biology. *English Journal, 103*(3), 73-79.

Fang, Z., & Wei, V. (2010). Improving middle school students’ science literacy through reading infusion. *The Journal of Educational Research, 103,* 262-273.

Gore, M. C. (2010). Key 13: Total physical response and vocabulary drama. In Inclusion strategies for secondary classrooms: Keys for struggling learners (pp. 54). Thousand Oaks, CA: Corwin.

Howes, E. V., Hamilton, G. W., & Zaskoda, D. (2003). Linking science and literature through technology: Thinking about interdisciplinary inquiry in middle school. *Journal of Adolescent & Adult Literacy, 46*(6), 494-504.

Kesler, T. (2012) Evoking the world of poetic nonfiction picture books. *Children’s Literature in Education. 43*, 338-354.

Lightman, A., & Goldestein, R. N. (2011). Bridging the two cultures: A conversation between Alan Lightman and Rebecca Newberger Goldstein. *World Literature Today, 85*(1). Retrieved from <http://www.worldliteraturetoday.org/2011/january/bridging-two-cultures-conversation-between-alan-lightman-and-rebecca-newberger#.UstLk_sliAY>

**Science Day 5:**

**Individual Worth, Accountability, Conservation - Niche & Invasive Species**

**“Shooting Owls to Save Other Owls” + CHoMP Reading Strategy**

**OBJECTIVES:**

* After activating their prior knowledge about “invasive species” on a semantic web, students will analyze a map and video about the invasive barred owl in order to identify and explain the general cause of the barred owl infiltration and the general effect of barred owls on spotted owls in terms of “niche.”
* After the teacher reviews abbreviations and the during-reading strategy, CHoMP, by modeling the introduction of *National Geographic’s* “Shooting Owls to Save Other Owls,” students will work in groups of three to summarize, using CHoMP, an assigned article section in order to share the “gist” of their section with the alternative groups.
* Weekend Homework Objective: After analyzing the *National Geographic* article, “Shooting Owls to Save Other Owls” in class, students will analyze, using CHoMP, *Ensia Magazine’s* article, “Consider the Cane Toad,” in order to assess the quality of the spotted owl conversation effort in a writing activity that incorporates the unit theme of individual worth and requires the synthesis of the articles’ opposing viewpoints on the necessity of eradication for invasive species management.

**STANDARDS:**

**RST.9-10.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (ST CCSS, p. 62).

**RST.9-10.2** Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text (ST CCSS, p. 62).

**RST.9-10.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics* (ST CCSS, p. 62).

**RST.9-10.9** Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts (ST CCSS, p. 62).

**WHST.9-10.1** Write arguments focused on *discipline-specific content.*(ST CCSS, p. 64).

**WHST.9-10.8** Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (ST CCSS, p. 64).

**WHST.9-10. 9** Draw evidence from informational texts to support analysis, reflection, and research (ST CCSS, p. 64).

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).   

6. Plants and animals depend on each other and their physical environment

7. Human decisions and activities have had a profound impact on the physical and living environment.

**MATERIALS:**

* Smartboard or White Board
* *National Geographic’s* “Shooting Owls to Save Other Owls”
* *Ensia Magazine’s* “Consider the Cane Toad”
* CHoMP Anchor Chart
* “Invasive Species” Semantic Web
* YouTube Video: National Geographic (2014). Killing one owl to save another owl? [Video file]. Retrieved from <http://www.youtube.com/watch?v=YGFPsgQzeds>
* Homework Writing Assignment Worksheet

**DESCRIPTION:**

To merge the relationship between “niche” and “invasive species” with the unit theme of individual worth, this lesson introduces students to the contemporary issue of the invasive barred owls and the native spotted owls through several texts in a case study: a map, a video, and a popular science article. Since students were introduced to the concept of “invasive species” in a previous lesson, students will activate that prior knowledge on a semantic web before analyzing a map of the invasive barred owls’s territory and identifying the general cause of their invasive spread in a Think-Pair-Share activity (i.e. natural migration). To gain an overview of the issue so that they can later put their assigned section of the article in a general context, students will watch a video and, in another Think-Pair-Share activity, explain how the main effect of the invasive barred owl lies in how they are successfully competing spotted owls for their “niche.” The video will also bring the issue to life, preventing students from only engaging with the two species through static pictures and print text.

Students were already exposed to the during-reading note-taking strategy CHoMP and its associated abbreviation direct instruction (for CHoMP step 3) in English class, but this lesson brings the strategy, for the first time, into the science classroom. Therefore, the teacher will remind students of the strategy by reviewing each of the four steps on the anchor chart and then modeling CHoMP on the introduction of a popular science article by *National Geographic*: “Shooing Owls to Save Other Owls.” The teacher will elicit student input during the modeling, due to their prior exposure with the strategy. Studnets will then break up into groups of three and the teacher will assign each a section of the article on which to read and summarize using CHoMP. However, instead of just giving out the article sections, the teacher will prompt students to consider how best to break up the article – activating their prior knowledge of text features. The sections will be determined based on the headings in the article: “Of Owls and Men,” “Better Adapted to Our World,” and “Ethnical Dilemma.” Since students gained a general sense of the issue through the map and video, students will not be reading the article sections out-of-context. Students will meet up with students from the alternative groups and share their CHoMP students, so all students understand the “gist” of the entire article. Students will take notes while the alternative group members share their summaries.

In the remaining time, the teacher will explain the requirements of the weekend homework: an opposing viewpoint article, *Ensia Magazine’s* “Consider the Cane Toad,” to which they must apply CHoMP and then use to argue whether or not the conservation effort for the spotted owls – as presented in the in-class *National Geographic* article – is the best and/or a necessary approach. To evaluate the quality of the conservation effort against the invasive barred owls, students must use text details from both articles and incorporate the unit theme of “individual worth” in their writing response. Students may begin the assignment if time permits.

\* “Accountability” and “Conservation” are moved from the English section of the Venn Diagram word wall to the middle.

**ASSESSMENT OF STUDENT LEARNING:**  Informal formative assessments will occur throughout the lesson in the form of discussion input and participation in the Think-Pair-Share activities that the teacher will listen in on. Students’ CHoMP marginalia, summaries, and oral explanations to their peers will also be an informal assessment. The formal formative assessment lies in the weekend homework assignment, which necessitates students integrate two sources of information to develop an evidence-based assessment of the spotted owl conservation effort: shooting the barred owls. The writing assignment assesses students’ ability to implement CHoMP independently (after two opportunities for group practice) and their understanding of invasive species and the theme of individual worth based on how well they synthesize the articles through those two lenses.

**RATIONALE:**

As one of the several “generic” reading strategies that the two disciplines – English and science – come together to teach and practice, CHoMP – a strategy for note-taking and paraphrasing, although specifically geared for research articles. Fang and Coatoam (2013) speicifcally cite note taking and summarizing strategies as “generic” (p. 627), further supporting CHoMP’s presence in both the English and science classroom. To supplement the third step of CHoMP – make notes through abbreviations, symbols, and pictures – every time CHoMP is used, it is accompanied by explicit instruction in common abbreviations, a necessity posed by Gore (2010) because “frustration is lowered because the abbreviation strategies help students write more quickly” (and CHoMP’s multi-step process can be tedious) and it naturally fits in with students’ familiarity with text messaging abbreviations.

Since popular science articles include more human participants (using their first names and “giving voice to scientists other than those of iconic status”), serve as “narratives of research” and are thus easier to comprehend, and give insight into the scientific progress (by showing situations unresolved or unfinished), they humanize the science field and grant students a break from textbook reading that use high levels of technical and impersonal language (Parkinson & Adendorff, 2004). Therefore, their use in this interdisciplinary unit resides in both disciplines to help students’ practice note taking and paraphrasing. Since textbooks “bury the individual researcher,” these popular science articles bring small-scale (in light of Newton’s discovery of gravity), but real-life examples of the concepts learned in science class (Parkinson & Adendorff, 2004, p. 382). Students will evaluate the quality of the conservation effort for spotted owls (“lethal removal”) by reading an opposing viewpoint found in “Consider the Cane Toad,” so the pairing of popular science articles upholds the traits of scientific learning: “critical, skeptical analysis of findings (Howes, Hamilton, & Zaskoda, 2003, p. 496). The homework article extends the lesson and completes the “I do, “We do,” “You do” gradual release of responsibility.

**PROFESSIONAL REFERENCES:**

Fang, Z., & Coatoam, S. (2013). Disciplinary literacy: What you want to know about it. *Journal of Adolescent & Adult Literacy, 56*(8), 627-632.

Fisher, D., Brozo, W. G., Frey, N., & Ivey, G. (2011). 15: Jigsaw. In *50 Instructional Routines to Develop Content Literacy* (2nd ed.) (pp. 46-47). Boston, MA: Pearson Education, Inc.

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Guinee, K. & Eageton, M. B. (2006). Spinning straw into gold: Transforming information into knowledge during web-based research. English Journal, High School Edition, 95(4), 46-52.

Howes, E. V., Hamilton, G. W., & Zaskoda, D. (2003). Linking science and literature through technology: Thinking about interdisciplinary inquiry in middle school. *Journal of Adolescent & Adult Literay, 46*(6), 494-504.

Parkinson, J., & Adendorff, R. (2004). The use of popular science articles in teaching science articles in teaching scientific literacy. *English for Specific Purposes, 23*(4), 379-396.

**Science Day 6:**

**Chaos Theory & Interconnectedness - Keystone Species**

**Fiction + Nonfiction Case Study: Bees**

**OBJECTIVES:**

* After activating their prior knowledge about “chaos theory” from English class on a semantic web, students will illustrate the two present-day settings in Bradbury’s “A Sound of Thunder” on a graphic organizer in order to compare and contrast the social change induced by Eckels’s butterfly with the ecological change for which keystone species removals are responsible.
* After predicting the consequences of sea otter removal in a kelp forest ecosystem in a “nesting cup” food chain activity, students will define “keystone species” on a Four-Square Vocabulary Card in order to choose two other keystone species from a photograph slideshow and illustrate their ecosystem with and without them.
* After reading aloud an excerpt from Bethany Wiggins’s novel, *Stung*, students will analyze the cause and effect text structure in order to design a Cause/Effect Campfire Metaphor graphic organizer for the fictional portrait of bee extinction.
* After analyzing the fictional portrait of bee extinction in Bethany Wiggins’s *Stung*, students will synthesize the cause and effect text structure of three nonfiction texts on a second Cause/Effect Campfire Metaphor graphic organizer in order to assess the scientific accuracy of Wiggins’s fictional take on bee extinction in a homework writing assignment.

**STANDARDS:**

**RST.9-10.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (ST CCSS, p. 62).

**RST.9-10.2** Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text (ST CCSS, p. 62).

**RST.9-10.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics* (ST CCSS, p. 62).

**RST.9-10.9** Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts (ST CCSS, p. 62).

**WHST.9-10.1** Write arguments focused on *discipline-specific content* (ST CCSS, p. 64).

**WHST.9-10.7** Conduct short as well as more sustained research projects to answer a question (including a selfgenerated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation (ST CCSS, p. 64).

**WHST.9-10.9** Draw evidence from informational texts to support analysis, reflection, and research (ST CCSS, p. 64).

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).   

6. Plants and animals depend on each other and their physical environment

**MATERIALS:**

* Smartboard or White Board
* Ray Bradbury’s “A Sound of Thunder”
* Bethany Wiggins’s *Stung* Excerpt
* Photograph Slideshow of Keystone Species
* With/Without Keystone Species Illustration Worksheet
* Teacher Model “Nesting Cup” (Kelp, Sea Urchin, Sea Otter, Orca)
* Campfire Metaphor Graphic Organizer (2 copies per student)
* YouTube Video: Time (2013). TIME explains: Why bees are going extinct [Image]. Retrieved from <http://www.youtube.com/watch?v=ykq3q5XDjnY>
* Bee Extinction Infographic: FFUNCTION (2010). The mysterious honey bee extinction [Infographic]. Retrieved from <http://dailyinfographic.com/the-mysterious-honey-bee-extinction-infographic>
* “If We Die…” Public Service Announcement

**DESCRIPTION:**

Bringing the English classroom’s fiction (Ray Bradbury’s “A Sound of Thunder”) to the ultimate test, this lesson introduced the concept of “keystone species” to examine the real-life validity of Travis's "chaos theory" in its main form: the removal of an organism. Students will arrive to this science lesson having read the conclusion of Ray Bradbury’s short story, “A Sound of Thunder,” for homework that previous night. Therefore, to both help the English class address the story’s ending and to link “chaos theory” to the effect of “keystone species,” students recalled “chaos theory” on a semantic web and then revisited the text to illustrate the present-day setting (i.e. government and language), before Eckels’s time traveled and after he returned from his safari. The teacher will lead a brief discussion on the magnitude of the change for which the butterfly was responsible. Bringing back the teacher model for the “nesting cup” food chains, the teacher will then choose a student volunteer to arrange the kelp ecosystem food chain in the correct order according to trophic level and the predator-prey relationships (kelp, sea urchin, sea otter, orca). Once it is arranged from producer to apex predator, the teacher will remove the third cup in the sequence: the sea otter, which happens to be a “keystone species.” Based on the remaining visual, students will predict (in a Think-Pair-Share activity) what will happen to the other organisms in the food chain if the sea otter no longer existed. In a think-aloud, the teacher will describe the trickle-down effect (i.e. “Since sea urchins have few other natural predators, the elimination of the sea otter allows their population to reproduce at a fast rate, so they feed more extensively on kelp. Since sea urchins feed on kelp holdfasts – the root-like structure of the plant – extensive sea urchin feeding on kelp will weaken the kelp’s grounding and allow the currents to sweep away the plants. Therefore, the loss of sea otters causes a sea urchin population explosion, which, in turn, decimates the kelp. Without the sea otter, a kelp ecosystem will no longer have kelp”). Based on the think-aloud, students will write the definition of “keystone species” on a Four-Square Vocabulary Card in preparation for their homework. Students will then read captions about other keystone species on a photograph slideshow, pick two, and illustrate their ecosystems with and without them to visually convey their ecological importance. In a follow-up discussion, students will compare and contrast the illustrated ecological changes with the previously illustrated social change induced by Eckels’s butterfly to discuss whether the fictional butterfly can be seen as a “keystone species” and whether keystone species are real-life catalysts for “chaos theory.”

To introduce a case study of a keystone species – honeybees – students will brainstorm about the insect on a semantic web. The teacher will introduce Bethany Wiggins’s YA novel, *Stung* and read-aloud the first two pages of an excerpt. After distributing a Cause/Effect Campfire Metaphor graphic organizer, the teacher will then model how to complete it by pulling a text detail about the effect of bee extinction from the excerpt introduction (i.e. “leafless trees”) and adding it to a “cloud” on the graphic organizer, which represents “effects.” The teacher will identify the other symbolism in the graphic organizer (matches = primary cause, fire = event, logs = secondary causes). A student volunteer will pick up the read aloud. The teacher will pause the read-aloud at predetermined points so that students can add to the Cause/Effect Campfire Metaphor graphic organizer and share their responses. Since the fiction-based completeion of the Cause/Effect Campfire Metaphor graphic organizer served to scaffold students to independent completion, students then worked in pairs to synthesize three nonfiction texts (an infographic, a Public Service Announcement, and a short video documentary) on a second Cause/Effect Campfire Metaphor graphic organizer to assess what scientists’ say about the consequences of bee extinction. The teacher will then introduce the homework writing extension: students will use both their Cause/Effect Campfire Metaphor graphic organizers to compare and contrast how fiction and nonfiction envisions Earth without bees and argue the extent to which Bethany Wiggins’s *Stung* is a scientifically accurate portrayal of life without the keystone species.

\* “Keystone Species” will be added to the science section of the Venn Diagram word wall.

**ASSESSMENT OF STUDENT LEARNING:**  Informal formative assessments will occur throughout the lesson in the form of discussion input, student volunteerism for the read-aloud of Bethany Wiggins’s *Stung,* the thoroughness and accuracy of “with/without” illustrations for both the keystone species and Eckels’s butterfly, and the quality of the Cause/Effect Campfire Metaphor graphic organizers. The homework writing extension serves as the lesson’s formal formative assessment, since it requires students to synthesize multiple sources, demonstrate an understanding of the cause/effect text structure in all of them, and apply the science between honeybees role as a keystone species to a fictional portrait of bee extinction.

**RATIONALE:**

This lesson capitalizes on students’ “ready-made” hooks in prior knowledge” from English class on “chaos theory” (from “A Sound of Thunder”), since it links to keystone species (Bull & Dupuis, 2014, p. 73). Bringing back the teacher model for the styrofoam “nesting cup” food chains, students receive a visual to predict the impact of a keystone species decline. Since students evaluate the impact of Eckels’ butterfly by comparing and contrasting Eckels’s present day setting before and after he time travels, students cross-compare a fiction and nonfiction example of species loss. Continuing that format, the concluding case study on honeybees pairs nonfiction with fiction to gain an understanding of bee extinction. Due to both the school-wide privileging of fiction that makes "expository genres...less familiar than fictional genres" (Parkinson, 2000, p. 380) and the fact that human thought occurs in a narrative format starting from a young age (Suckes, Trundle, Flevares, 2009, p. 416), introducing students to science concepts in a language they are familiar with holds an obvious benefit (Suckes, Trundle, & Flevares, 2009, p. 416). According to Plummer and Kuhlman (2008), "trade books do increase the opportunities for students to be involved with science concepts" (p. 97). According to Bixler (2007), “fictitious examples provide entertaining and easy-to-understand scenarios” for students (p. 337).

Therefore, Bethany Wiggins’s YA novel is an engaging and didactic addition to the case study. Students will determine its scientific accuracy in a writing activity. According to Czerneda (2006), science fiction should be used to reinforce science not by having students pick out the flaws in the text’s science, but by showing students good examples of accurate science in science fiction texts (p. 39).

Since the case study is set up to continue students’ work recognizing the cause/effect text structure, the fiction excerpt – read-aloud as a class (which also serves as an opportunity to refresh the strategy “Tune In to Interesting Words” and bring it back into the classwork from students’ extensive work with it for homework) - allows students to receive support filling out the Cause/Effect Campfire Metaphor graphic organizer before they are tasked to complete one in groups for the nonfiction portion. The graphic organizer supplements the traditional cause/effect flow chart that also appears in the unit in both subject areas to add variety to the skill and provide students with multiple forms from which they can pick independently (similar to why one should provide students multiple ways to take notes, so they can choose which works best for them). The graphic organizer helps visual learners master the cause/effect text structure because visual metaphors enable dual coding and it is also “important to incorporate visual thinking into science instruction…[since]…imagination and perception play a vistal role in scientific inquiry” (Gore, 2010, p. 154). The *Stung* excerpt is approximately four pages because, as Haviland (2005) stated, “You don’t have to overwhelm them with the whole book” (p. 2005). Since honeybee loss would severely impact the human diet, so it serves as a highly relevant and contemporary subject for the case study. According to Fang and Wei (2010), “If students can relate to the text in some way, they are more likely to want to read it” (p. 263). Such is applicable to the YA fiction and the three small nonfiction texts. Involving an infographic, a public service announcement, and a short video documentary, the multimodal format of the nonfiction portion caters to diverse learners, especially visual.

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**Science Day 7:**

**Human Threats to Biodiversity – Plastic Pollution**

**Stations & Boyan Slats**

**OBJECTIVES:**

* After activating their prior knowledge about “plastic pollution” on a semantic web, students will compare words that begin with the Latin element, “de-,” and deduce its specific meaning in order to apply the Latin prefix to several key unit terms (decomposition, biodegradable).
* Station Objectives:
  + After using a comic to diagram the decomposition rate timeline for a red Solo cup and bananas, students will predict the decomposition rates of nine common marine debris items and order the physical items on the classroom floor in order to compare and contrast their hypotheses with the actual rates.
  + After analyzing photographs showing marine animals and plants affected by oceanic plastic pollution, students will group and label the photographs in order to replicate an effect of plastic pollution in a classroom floor ocean gyre diorama.
  + After looking at two photographs of biodegradable food packaging prototypes from *Time Machine* and comparing them to their current packaging, students will evaluate two segments from Boyan Slat’s TedxTalk, “How the Ocean Can Clean Themselves,” in order to argue which approach – cleaning up the current plastic pollution or preventing more from entering - is more helpful in combating oceanic plastic pollution in a writing assignment.
  + Given two Public Service Announcements about the effects of plastic pollution, students will diagram the food chain each portrays verbally and/or visually in order to compare and contrast the effectiveness of each PSA’s persuasive lens (i.e. one appeals to human egocentrism by illuminating how the environmental concern impacts us; the other appeals to human compassion by illuminating its effect on other living beings)?

Lab Report:

* After reading aloud the textbook excerpt on pollution from Chapter 6-3: “Biodiversity,” students will dramatize the predatory-prey relationships in a three cup food chain through sand (digested food) and plastic beads (DDT/PCB chemical pesticides) in order to explain how biological magnification affects the food chain.

**STANDARDS:**

**RST.9-10.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (ST CCSS, p. 62).

**RST.9-10.2** Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text (ST CCSS, p. 62).

**RST.9-10.3** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text (ST CCSS, p. 62).

**RST.9-10.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics* (ST CCSS, p. 62).

**RST.9-10.9** Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts (ST CCSS, p. 62).

**WHST.9-10.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes *content* (ST CCSS, p. 65).

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).

7. Human decisions and activities have had a profound impact on the physical and living environment.

**MATERIALS:**

* Smartboard or White Board
* Textbook Chapter “6-3: Biodiversity” – “Pollution”
* Plastic Pollution Semantic Web
* “Beakers & Beads: Biological Magnification” Lab Report Instruction Sheet
* “Beakers & Beads: Biological Magnification” Lab Report Student Sheet
* *Surfrider Foundation* Public Service Announcement
* *Medettaerian Association to Save the Sea Turtles* Public Service Announcement
* Bag of Rice, Olive Oil Bottle, Oranges
* YouTube Video: Boyan Slat’s TedxTalk, “How the Oceans Can Clean Themselves” with Laptop
* Beakers, Plastic Beads, Sand, Small-Medium-Large Paper Cups
* 5 Gyres Website
* Greek/Latin Element Graphic Organizer
* Vivmeo Video: “Plastic Pollution and the Sargasso Sea”: <http://vimeo.com/60393400>

**DESCRIPTION:**

This lesson is split between a regular class period and a lab period. The class begins with a mini-lesson on the Latin element, “DE-,” which will be grounded in two key unit terms for this lesson: “decomposition” and “biodegradable.” To provide students with a sense of the global problem of oceanic plastic pollution that can they can bring to each of the four stations, the teacher will read aloud the “Circulation” tab on the “5 Gyres” website and show a clip from a Kickstarter video entitled, “Plastic Pollution and the Sargasso Sea.” The teacher will lead a discussion about the ocean trash gyres afterwards. Students will then break into groups of four or five and rotate through four stations. Each station will last approximately ten (10) minutes. Any remaining time in the class period will be allotted for students to finish any of the station’s worksheets. For the first station, students will predict the decomposition rates of common marine debris items, ordering the physical items on the classroom floor to ultimately compare and contrast with the actual rate. At the second station, students will group and label a bunch of photographs showing different effects of plastic pollution on marine wildlife (i.e. ingestion, strangulation, coexistence, habitation, etc.). In the third station, students will watch two segments from Boyan Slat’s TedxTalk, “How the Oceans Can Clean Themselves” and compare/contrast the current packaging of rice and olive oil to photographs of the biodegradable food packages proposed by *Time Machine*. If desired, students can peel oranges provided at the station, since the procedure mimics how the futuristic rice packaging would work. In a writing activity, students will pick which approach is best to fight plastic pollution (cleaning up the current plastic or preventing any more from entering the oceans) and use text details from the two texts to support their stance. At the last station, students will analyze two public service announcements, mapping their food chains and comparing/contrasting their persuasive tactic (one appeals to human egocentrism by showing how plastic pollution affects human; the other appeals to human compassion by showing how plastic pollution affects nature).

In the lab section of the unit, students read aloud the “Pollution” excerpt from textbook Chapter 6-3: “Biodiversity.” Students then worked in groups of three to pick a three-tier food chain. To bring to life the predator-prey relationships, students filled each cup halfway with sand (digested food) and four plastic beads (DDT or PCB chemical pesticides). Students had three small paper cup, three medium, and one large. Studnets punched holes in the bottom before filling and covered them with masking tape. Students then poured the small cups into the beaker by releasing the covered holes. The leftovers in the cups were deposited directly into the medium cups. The same process occurred for the medium cups, with their contents emptied into the large cup. Students answered concluding questions at the end of the lab.

\* “Biodegradable” and “Decomposition” and “Pollution” will be added to the science section of the Venn Diagram word wall.

**ASSESSMENT OF STUDENT LEARNING:**  Informal formative assessments will occur throughout the lesson in the form of discussion input, student volunteerism for read aloud (5 Gyres website and textbook except). Some stations have worksheets to assess students while others are more informal (i.e. the teacher will circulate and examine the photograph groups at station two and the predicted timeline at station one). The lab report is also a form of assessment, especially its concluding questions.

**RATIONALE:**

Similar to why popular science articles were integrated throughout both sections of this interdisciplinary unit, Boyan Slat’s TedxTalk was featured at one station. Students need a more “people-oriented science” than textbooks and research articles – traditional academic science reaing genres – can provide (Parkinson & Adendorff, 2004, p. 390). Just as popular science articles highlight everyday scientists instead of just spotlighting the iconic ones and show “science in the making” (Parkinson & Adendorff, 2004, p. 390), Boyan Slat is a teenage scientist, ineloquent in his speaking during the talk, so students can relate to him and see how he is currently pushing science forward through his own invention that has yet to be implemented. Boyan Slat’s TedxTalk contributes to the “empowering education” that the science unit seeks to provide, as Slat shows students that age is irrelevant to make a difference (Alvermann, 2001, p. 8).

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**Science Day 8:**

**Human Threats to Biodiversity – Industrial Pollution (Air & Oil)**

**China’s Smog & “Pesky Petroleum: Cleaning Up Oil Spill” Lab Report**

**OBJECTIVES:**

* After activating their prior knowledge about “industrial pollution” on a semantic web, students will analyze the text features of textbook excerpt, “Air Resources,” from chapter “6-2: Renewable and Nonrenewable Resources,” in order to discuss the basic causes and effects of industrial air pollution.
* After taking notes on China’s televised media coverage for their 2013 smog, students will activate their prior knowledge about “propaganda” from English class on a semantic web and analyze China State Media’s “5 Surprising Benefits of Smog” to which the video alluded in order to rewrite the propaganda as a “5 Surprising Detriments of Smog” Public Service Announcement based on the televised media coverage.
* After discussing the peppered moth during the industrial revolution, students will examine the predator-prey relationships between bugs and birds in a non- air polluted environment through a Kinetic City online stimulation in order to compare and contrast them to the relationships that result when the environment is virtually polluted.

Lab Report:

* After examining photographs from the 2010 Gulf of Mexico oil spill, students will predict the effects on marine life and the difficulty of cleanup in order to compare and contrast the perceived difficulty (i.e. Play-Doh covered plastic animals) to the actual difficulty (i.e. olive oil in water).
* After watching a video Public Service Announcement from *Greenpeace*, students will compare and contrast the effectiveness of different absorbents to extract olive oil from water in order to explain the difficulties of an oil spill cleanup based on their own lab experiences and argue against arctic drilling in a letter writing activity.

**STANDARDS:**

**RST.9-10.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (ST CCSS, p. 62).

**RST.9-10.2** Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text (ST CCSS, p. 62).

**RST.9-10.3** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text (ST CCSS, p. 62).

**RST.9-10.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics* (ST CCSS, p. 62).

**RST.9-10.9** Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts (ST CCSS, p. 62).

**WHST.9-10.1** Write arguments focused on *discipline-specific content* (ST CCSS, p. 64).

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).

7. Human decisions and activities have had a profound impact on the physical and living environment.

**MATERIALS:**

* Smartboard or White Board
* Textbook Chapter “6-2: Renewable and Nonrenewable Resources” – “Air Resources”
* YouTube Video: Chinese Communist Regime: ‘Smog helps Chinese people stay united’ [Video file]. Retrieved from <https://www.youtube.com/watch?v=oAboha1-_ck>
* Wang Lei’s “5 Surprising Benefits of Smog” List
* Greenpeace’s Lego + Shell Video PSA
* Water, Aluminum Trays, Olive Oil
* Plastic Spoons, Grass Blades, Cotton Balls, Sand, Paper Towels
* Minature Plastic Marine Animals, Black Play-Doh
* Photographs from the 2010 Gulf of Mexico BP Spill
* “Industrial Pollution” and “Propaganda” Semantic Webs
* Four-Square Vocabulary Cards
* Lab Report Instruction Sheet and Student Sheet with “Dear Shell…” Conclusion Worksheet

**DESCRIPTION:**

This lesson is split between a regular class period and a lab period. Students first brainstormed about “industrial pollution” on a semantic web. A read-aloud of the textbook excerpt, “Air Resources,” in chapter, “6-2: Renewable and Nonrenewable Resources” followed in which students circled “interesting words” and identified the nonfiction text features on the page. Based on the textbook’s diagram (which outlines the causes and effects of industrial air pollution), students predicted which was the dominant cause and which was the most common and/or most dangerous effect. Students filled in the definition of “smog” on a Four-Square Vocabulary Card in preparation for their homework. To bring one of the textbook’s identified causes – “smog” – to life, students then watched a video clip of a Chinese news program when it covered China’s 2013 smog. Students will be encouraged to take notes on the effects of the smog during the video. The teacher will preface the video by informing students that the video focuses on the smog’s effect on humans (i.e. traffic, health, etc.), so students will know what to tune in to and will help guide their note-taking. Since the video alludes to Wang Lei’s “5 Surprising Benefits of Smog” list, students will activate their prior knowledge about propaganda from English class (since the term was applied to the Time Safari, Inc. advertisement in Bradbury’s “A Sound of Thunder”), receive a copy of the list, and discuss how the attributes of propaganda apply. Based on their notes from the video, students will then rewrite the Lei’s list into a “5 Surprising Detriments of Smog” PSA for China. The rewrite will encourage students to summarize the video by pulling out the five most important ideas in it. To bring the international phenomenon to the United States so that students can relate to the effect of air pollution, student volunteers will interact with the SmartBoard through an online “Beijing smog stimulator” that enables students to change a clear skyline of famous cities – New York, Paris, etc. – into one polluted by smog. The teacher will lead a discussion afterwards, eliciting students’ theories on how they would react if smog descended upon their state.

In the lab section of the unit, an online game from Kinetic City will bookend the actual lab report experiment in order to address air pollution’s effect on nature and animals (since the regular class period focused narrowly on its human effects). The teacher will summarize the peppered moth phenomenon in England during the industrial revolution, and then read-aloud the game’s background information to contextualize the game’s introductory green, zero-polluted interface with crows and a mixture of orange and green bugs. Students will watch the predator-prey relationships, observing and discussing what occurs after several minutes (i.e. green bug population drastically exceeds the orange bug population). A student volunteer will then “pollute” the tree canopy environment by sliding a curser to the right nearest to the Orange-O-Dyne factory symbol. In a Think-Pair-Share activity, students will discuss why the trees turned orange based on how/why the trees changed in response to England’s industrial pollution. Students will also predict what will happen to the predator-prey relationships between the bugs and birds. The game will play in the background during the lab report. At the end of class, students will discuss not only what happened to the environment (i.e. orange bug population exceeds the green bug population), but the consequences of the change.

To begin the lab report, “Pesky Petroleum: Cleaning Up an Oil Spill,” students will watch *Greenpeace*’s video PSA in which an oil spill slowly blankets a Lego arctic setup to raise awareness about Shell’s current arctic drilling and Lego’s sponsorship of Shell. Through the lab, students will gain a better sense of the dangers that face the arctic if Shell continues drilling. Passing around photographs of the 2010 Gulf of Mexico oil spill, students will predict the effect on marine life. Then students will remove black Play-Doh from miniature plastic marine animals, deciding whether a second round of photographs – animals affected by the 2010 oil spill – mimics the appearance of the plastic animals in Play-Doh. The teacher will explain that oil removal is not as easy as it appears, leading into the main activity in which students test different absorbents to extract olive oil from an aluminum tray of water. Students will first try to scoop out the oil with a plastic spoon. The impossibility of the task suggests the necessity of absorbents. With a limited set of funds, students will purchase the different absorbents as they test each one, recording observations for each. Their budget is insufficient to purchase all four materials, providing students with a sense of a cleanup’s expensiveness. Using their observations for support, students will write a letter to Shell explaining the difficulty of oil spill cleanup based on what they found out in their own experiments.

\* “Smog” will be added to the science section of the Venn Diagram word wall. “Propaganda” will be moved from the English section to the middle.

**ASSESSMENT OF STUDENT LEARNING:**  Informal formative assessments will occur throughout the lesson in the form of discussion input, student volunteerism for the smog stimulator and Kinetic City game, task engagement, note-taking during the video, observation recording during the lab report, and Four-Square Vocabulary Card completion for “smog.” The formal assessments reside in the rewrite of the “5 Surprising Benefits of Smog” based on the video and the lab report’s conclusion activity: “Dear Shell…” persuasive letter.

**RATIONALE:**

By pairing the textbook chapter excerpt on air pollution with a case study on China’s infamous smog (via a piece of propaganda, a primary source news program with subtitles, and a smog stimulator), the lesson ensures that the human threat is brought to life and ensures that humanity is spotlighted, since the textbook often strips it away (Plummer & Adendorff, 2004, p. 382). Through the propaganda – “5 Surprising Benefits of Smog” – students receive a real-life supplement to the Time Safari, Inc. advertisement previously labeled as propaganda in the English classroom. Rewriting the list into a credible list of smog hazards, students “use scientific knowledge and scientific ways of thinking for…social purposes” (Peterson, Rochwerger, Brigman, & Wood, 2006, p. 31).

Holding the second of several lab reports in this science unit, this lesson recognizes that lab writing is the primary literary event and “science genre” in the traditional science classroom, making up about 85% of 61 assignments derived from ten science and engineering courses (Parkinson, 2000, p. 372). However, since these disciplinary literacy events are surrounded by others throughout the unit (i.e. descriptive/explanatory/synthesis/reflection essays, persuasive letters, compare/contrast paragraphs), the science classroom also strives “to stretch [students’] science writing beyond the traditional laboratory report,” since “these usually unmotivating laboratory reports leave little room for the application of science concepts to different settings” (Peterson, Rochwerger, Brigman, & Wood, 2006, p. 32). Therefore, even embedded in the lab report is an unusual conclusion: a persuasive letter to Shell. It allows students to synthesize and make meaning from their lab findings, but in a more authentic context that brings the lab full circle.

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**Science Day 9:**

**Human Threats to Biodiversity – Dehumanization & Poaching**

***Shark Tale* Video Clip & *NY Times Article* + CHoMP**

**OBJECTIVES:**

* After activating their prior knowledge about “shrimp” on a semantic web, students will analyze a video clip from the animated movie *Shark Tale* in order to list the fictional traits of the shrimp on a semantic web in a different color and explain the effects of the shrimp’s humanization.
* After discussing the purpose of humanization, students will analyze a *New York Time article*, “Documenting Elephants’ Compassion, and Their Slaughter” using CHoMP in order to apply the concept of humanization to elephant compassion and dehumanization to the poaching process.
* After defining “poaching” on a Four-Square Vocabulary Card based on the *NY Times* article, students will apply the term to Time Safari Inc. in Bradbury’s “A Sound of Thunder” in order to explain whether Time Safari Inc. is a hunting or poaching business in a writing activity.
* After reading a *NY Times* article on the compassion and poaching of elephants, students will research ten other species threatened by poaching in order to explain how their unique features are used by humans and to identify a humanizing characteristic of the species.

**STANDARDS:**

**RST.9-10.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (ST CCSS, p. 62).

**RST.9-10.2** Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text (ST CCSS, p. 62).

**RST.9-10.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics* (ST CCSS, p. 62).

**RST.9-10.5** Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*) (ST CCSS, p. 62).

**WHST.9-10.7** Conduct short as well as more sustained research projects to answer a question (including a selfgenerated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation (ST CCSS, p. 66).

**WHST.9-10.9** Draw evidence from informational texts to support analysis, reflection, and research (ST CCSS, p. 66).

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).

7. Human decisions and activities have had a profound impact on the physical and living environment.

**MATERIALS:**

* Smartboard or White Board
* *New York Times* Article, “Documenting Elephants’ Compassion, and their Slaughter”
* YouTube Video: Rikkiibell (2012). The shrimp from shark tale [Video file]. Retrieved from<http://www.youtube.com/watch?v=AJvsk7NsZe4>
* Ray Bradbury’s “A Sound of Thunder”’
* “A Sound of Thunder” Poaching v. Hunting Writing Worksheet
* Laptops
* Blank Heart and Animal Templates
* Ziploc Bags
* Colored Pencils

**DESCRIPTION:**

In this lesson, students will explore humanization as a persuasive technique for conservation efforts and examine dehumanization’s role in man’s maltreatment of nature and animals. With a colored pencil, students will brainstorm characteristics of “shrimp” on a semantic web. A movie excerpt from the animated film, *Shark Tale,* depicts an underwater restaurant in which a shark demands his brother, Lenny, to eat a shrimp. The shrimp appeals to the shark, explaining his sad life story (i.e. caretaker of his sister’s baby, working two jobs). Moved by the story, Lenny refuses, gathers up all the shrimp on the table, and helps them escape. During the clip, students will record – in a different color – the fictional traits of the shrimp. The teacher will lead a discussion, prompting students to reflect on the effect of the tale on Lenny and why the shrimp chose that method of persuasion (and why it worked). The teacher will then provide the definitions for “humanization” and “dehumanization” (which students will record on Four-Square Vocabulary Cards), and students will apply the terms to the movie excerpt. Students will then read a *New York Times* blog article, “Documenting Elephants’ Compassion, and Their Slaughter” using CHoMP. The article will be read-aloud (starting with the teacher, then student volunteers), but the teacher will stop at points for students to work in groups to summarize the section using CHoMP together. The teacher will review the CHoMP anchor chart and the abbreviation list prior to starting the article. Students will also brainstorm about elephants on a semantic web before-reading, as well. Afterwards, in a Think-Pair, Share activity, students will discuss how the presence of compassion and their engagement in mourning rituals “humanizes” elephants and how poachers “dehumanize” elephants by seeing their value as only their ivory tusks. Students will define “poaching” on a Four-Square Vocabulary Card.

In a cross-curricular writing activity, students will refer back to the beginning of the English class’s short story, “A Sound of Thunder,” to determine whether Time Safari, Inc. is a poaching or hunting organization. Students will use text details from the short story and the definition of “poaching” to support their classification. Lastly, in an informal class competition, students will work in groups of three to research ten other species that are threatened by poaching. The competition challenges students to represent species as BOTH their product/part that's useful to humans and as a living, breathing creature through a unique fact that humanizes the animal. The activity reinforces how species should not - and can not - be reduced and dehumanized to an anatomical part or biological feature, despite how often we do just that. Students will be given a set of ten animal product/part templates and ten blank heart templates. On the back of the animal product, they will write a simple, one-sentence summary of the how humans use the product (i.e. food, medicine, jewelry, etc.). Then, on a blank heart template, they will write a unique fact about the species that showcases its humanity. One laptop will be available to each group to conduct the mini research necessary to fill in the templates. After a group pairs a heart with an animal product, they must be approved by the teacher to ensure they've adequately represented the species beyond its human usefulness. Once approved, they can advance to the next animal product template in their pile. For each acceptable pair, students will receive a Ziploc sandwich bag adorned with a picture of the species in which they should insert the two templates. All groups must begin with the elephant tusk template, filling it and its associated heart template in using text details from the New York Times article. All subsequent templates may be filled in through mini-research searches on the provided laptop.

\* “Poaching,” “Dehumanization,” and “Humanization” will be added to the science section of the Venn Diagram.

**ASSESSMENT OF STUDENT LEARNING:**  Informal formative assessments will occur throughout the lesson in the form of discussion input, student volunteerism for the *NY Times* read-aloud, task engagement during the research-based groupwork, and CHoMP marginalia. Since it requires the application of the new term, “poaching,” the cross-curricular writing activity with “A Sound of Thunder” is a more formal formative assessment. The heart summaries (which are assessed by the degree to which they humanize each species) from the research competition also serve as a more formal formative assessment. The check-ins after each one’s completion allows the teacher to gauge progress and immediately clarify misconceptions or confusions.

**RATIONALE:**

By introducing another key unit term – dehumanization – with the Greek/Latin morpheme, “DE-,” this lesson adds to students’ prior direct instruction with the vocabulary element, reinforcing it and providing a new context in which to apply it. The prefix was first addressed through “decomposition” on Day 7 of the science unit. The reoccurrence of the Greek/Latin prefix helps prevent the vocabulary element’s isolation in a single day of the unit (although it does not reappear as many time as “BIO,” its reoccurrence several days after first introduced helps students see the benefit of knowing Greek and Latin elements).

As a motivational popular culture tie-in, the *Shark Tale* video clip introduces the idea of “humanization” in a friendly, nonthreatening format. Since the popular science article from the *New York Times* addresses both elephant compassion through the intelligent species’ mourning rituals, it is a prime example of an effective nonfiction text because such “must animate its subject, infuse it with life” (Kesler, 2012, p. 340). Since students break into groups to conduct small research on multiple other species endangered by poaching (plants and animals), the lesson provides diverse examples beyond its case study subject so students gain an understanding of the breadth of the problem (Gore, 2010, p. 80).

See previous rationale on Day 5 for CHoMP and the use of popular science articles.

**PROFESSIONAL REFERENCES:**

Boushey, G. & Moser, J. (2009). Ready reference form: Strategy – Use word parts to determine the meaning of words (compound words, prefixes, suffixes, origins, abbreviations, etc.). In The CAFE book: Engaging all students in daily literacy assessment & instruction (p. 187). Portland, ME: Stenhouse Publishers.

Gore, M. C. (2010). Key 15: Teach Greek and Latin morphemes. In Inclusion strategies for secondary classrooms: Keys for struggling learners (pp. 58-59). Thousand Oaks, CA: Corwin.

Gore, M. C. (2010). Key 26: Provide a plethora of examples. In Inclusion strategies for secondary classrooms: Keys for struggling learners (pp. 80-81). Thousand Oaks, CA: Corwin.

Kirby, J. R., & Bowers, P. N. (2012). Morphology works. *What works? Research into Practice,* 1-4.

Kesler, T. (2012) Evoking the world of poetic nonfiction picture books. *Children’s Literature in Education. 43*, 338-354.

**Science Day 10:**

**Human Threats to Biodiversity – The Sixth Extinction**

**Text Features Scavenger Hunt & Asher Jay’s “Hydrocarbon Hospice”**

**OBJECTIVES:**

* Given Chapter 6-3: “Biodiversity,” students will identify the nonfiction text features associated with given information in a textbook scavenger hunt in order to evaluate the textbook chapter and design Four-Square Vocabulary cards for its bolded vocabulary.
* After analyzing Asher Jay’s “Hydrocarbon Hospice” artwork, students will interpret a *IFL* *Science* article, “Scientists Warn We Are Approaching the Next Mass Extinction” through CHoMP in order to compare/contrast humans to an asteroid or the Grim Reaper through a student-created metaphor.

**STANDARDS:**

**RST.9-10.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (ST CCSS, p. 62).

**RST.9-10.2** Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text (ST CCSS, p. 62).

**RST.9-10.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics* (ST CCSS, p. 62).

**RST.9-10.5** Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*) (ST CCSS, p. 62).

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).

7. Human decisions and activities have had a profound impact on the physical and living environment.

**MATERIALS:**

* Smartboard or White Board
* Textbook Chapter “6-3: Biodiversity”
* Scavenger Hunt Worksheet
* “Mass Extinction” Semantic Web
* Asher Jay’s “Hydrocarbon Hospice”
* *IFL Science’s* “Scientists Warn We Are Approaching the Next Mass Extinction”

**DESCRIPTION:**

In this lesson, students will navigate chapter “6-3: Biodiversity” of the textbook using its nonfiction text features in a scavenger hunt for specific information in the chapter. Studnets will quickly brainstorm about the grim reaper on a semantic web before the teacher projects Asher Jay’s art piece, “Hydrocarbon Hospice.” In a teacher-facilitated discussion, students will interpret the artwork. Students will then brainstorm about mass extinction on a semantic web (they will probably know the term from the famous asteroid-based dinosaur extinction). The teacher will begin a read aloud of an *IFL Science* article about the sixth mass extinction, “Scientists Warn We Are Approaching the Next Mass Extinction,” pausing to give students time to apply to the section she/her read aloud. Then students will finish the rest of the article independently, applying CHoMP as they go. In small groups of four, students will discuss the article. Then students will compare humans to either the grim reaper (Asher jay’s “Hydrocarbon Hospice”) or an asteroid (dinosaur extinction) in a self-created metaphor that summarizes the article (i.e. “Humans are like the grim reaper because…”). In a Think-Pair-Share activity, students will reveal their metaphors to one another.

\* “Biodiversity” and “Extinction” will be added to the science section of the Venn Diagram.

**ASSESSMENT OF STUDENT LEARNING:**  Informal formative assessments will occur throughout the lesson in the form of discussion input, CHoMP marginalia, task engagement during scavenger hunt. The most formal assessment emerges in the form of the student-created metaphors, which summarize the *IFL Science* article by comparing humans to either an asteroid or the grim reaper.

**RATIONALE:**

While the textbook provides a flat overview of the concept of “extinction,” the *IFL Science* popular science article brings the concept to modern day and shows “science in the making” as we are in the middle of the “sixth extinction,” according to the article (Parkinson, 2004, p. 390). The nonfiction text feature scavenger hunt continues that reading strategy for students’ textbook reading.

**PROFESSIONAL REFERENCES:**

Parkinson, J., & Adendorff, R. (2004). The use of popular science articles in teaching science articles in teaching scientific literacy. *English for Specific Purposes, 23*(4), 379-396.

**Science Day 11:**

**Unequal Conservation Efforts: High v. Low Profile Endangered Species**

**Joy Williams’s “Save the Whales, Screw the Shrimp”**

**OBJECTIVES:**

* After activating their prior knowledge about “conservation” on a semantic web, students will analyze the first section of Joy Williams’s persuasive essay, “Save the Whales, Screw the Shrimp” in order to discuss their personal reactions to the three photographs to which Williams alludes.
* After analyzing a quote from Williams’s “Save the Whales, Screw the Shrimp,” students will identify the endangered species to which they would donate in order to differentiate between high-profile and low-profile endangered species through an analysis of WWF’s “Would You Care More…?” PSA series.
* After activating their prior knowledge about “conservation” on a semantic web, students will analyze a video documentary, “A Tale of Two Cockatoos,” in order to compare and contrast the two species – the Baudin and the Carnaby – on a Venn Diagram.
* After reading aloud the first section of Joy Williams’s “Save the Whales, Screw the Shrimp,” students will identify the main idea and three supporting details for two sections through a jigsaw activity in order to summarize and explain their sections to their home groups.

**STANDARDS:**

**RST.9-10.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (ST CCSS, p. 62).

**RST.9-10.2** Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text (ST CCSS, p. 62).

**RST.9-10.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics* (ST CCSS, p. 62).

**RST.9-10.5** Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*) (ST CCSS, p. 62).

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).

6. Plants and animals depend on each other and their physical environment.  
            Explain the importance of preserving diversity of species and habitats

7. Human decisions and activities have had a profound impact on the physical and living environment.

**MATERIALS:**

* Smartboard or White Board
* Joy Williams’s “Save the Whales, Screw the Shrimp”
* Photographs (Baby Condor, Panda with Bamboo, Turtle with Barnacles on Shore)
* World Wildlife Fund’s “Would You Care More…” PSA Series (Set of 3)
* Newspaper Notes Graphic Organizer
* “A Tale of Two Cockatoos” Venn Diagram
* “Conservation” Semantic Web

**DESCRIPTION:**

In this lesson, students will expand their knowledge of endangered species and the conservation efforts associated with them. Students will activate their prior knowledge about conservation on a semantic web. As students circle “interesting words,” the teacher will read aloud the first section of Joy Williams “Save the Whales, Screw the Shrimp.” The teacher will link the author with the short story read in the English class: “The Girls.” After a teacher-led discussion about students’ initial thoughts on the essay’s tone, students will view a photograph slideshow on the SmartBoard of the three animals to which Joy Williams alludes: a baby condor, a panda eating bamboo, and a turtle covered in barnacles on the shoreline. The teacher will reread the quote and ask whether students’s personal reactions to the photographs are similar or identical to the reaction Williams assumes (i.e. hopelessness, reminder of nature’s decline). On a sticky notes, the students will write the endangered species they would donate o if they only could donate to one. No list of endangered species should be provided. The activity serves to activate and gauge prior knowledge. Students will post their sticky notes on the front white board once they identify their species. The teacher will scan the sticky notes, and report the results. The teacher will explain the difference between low-profile and high-profile endangered species, identifying which classification the majority of the students’ endangered species fall under. The teacher will then project the three WWF “Would You Care More…?” Public Service Announcements on the SmartBoard. In a Think-Pair-Share activity, students will discuss the morality of the unequal conservation efforts by tapping into the unit theme of “individual worth.”

Students will then watch a short video documentary describing the unequal conservation efforts for two heavily similar birds because of their different relationships with humans. On a Venn Diagram, students will record the similarities and differences between the two cockatoos. In small group discussions, students will determine whether or not the difference in conservation efforts is acceptable. Returning to Joy Williams’s “Save the Whales, Screw the Shrimp,” students will work in groups of four to find the main idea and three supporting details for two sections in a jigsaw activity. Students will meet with their home groups to summarize and discuss their sections, enabling everyone to gain a general sense of the essay without reading the entire 11-page essay.

**ASSESSMENT OF STUDENT LEARNING:**  Informal formative assessments will occur throughout the lesson in the form of discussion input, Venn Diagram completion, and task engagement. The teacher will circle the room and tune in to the myriad group conversations throughout the lesson.

**RATIONALE:**

Since students read Joy Williams short story, “The Girls,” in English class, they meet her again through her environmental, persuasive essay, “Save the Whales, Screw the Shrimp” in this lesson. The difference between the texts serves as an interesting lens through which to view it (other than the obvious environmental and persuasive lenses which will be applied for scientific literacy). Before introducing the idea of high-profile and low-profile endangered species, the lesson activates students’ prior knowledge of endangered species through a sticky note activity, changing it up from the semantic web for a change of pace that should boost student engagement. By having students see their own bias in terms of endangered species and how media affects their knowledge of them, students will be more likely to be interested in the low-profile species that don’t make it into the news or into public knowledge.

For the “Tale of Two Cockatoos” video, students take notes during the viewing on a Venn Diagram graphic organizer to help organize student thinking, help them tune in to the important information, hold them accountable for the video content, and serve as a reference sheet in the follow-up discussion. Similarly, the Main Idea Reading Guide for Joy Williams’s “The Girls” guides student thinking about each section and prompts summarization and the identification of strong/relevant text evidence.

**PROFESSIONAL REFERENCES:**

Fisher, D., Brozo, W. G., Frey, N., & Ivey, G. (2011). 15: Jigsaw. In *50 Instructional Routines to Develop Content Literacy* (2nd ed.) (pp. 46-47). Boston, MA: Pearson Education, Inc.

Gore, M. C. (2010). Key 42: Main idea text structure study guide. In Inclusion strategies for secondary classrooms: Keys for struggling learners (pp. 118-119). Thousand Oaks, CA: Corwin.

**Science Day 12:**

**Final Project – Persuasive Letter and Conservation Poster**

**Overview, Modeling, & Topic Selection**

**OBJECTIVES:**

* After differentiating between high-profile and low-profile species in a previous lesson, students will choose an endangered species through World Wildlife Fund’s “Together” series in order to research the species through online popular science articles in a future lesson.
* After examining the requirements of the final project, students will asses teacher-led website and database searches about “monarch butterflies” in order to discuss the credibility and usability of their online popular science articles.

**STANDARDS:**

**WHST.9-10.7** Conduct short as well as more sustained research projects to answer a question (including a selfgenerated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (ST CCSS, p. 66).

**WHST.9-10.8** Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (ST CCSS, p. 66).

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).

6. Plants and animals depend on each other and their physical environment.  
            Explain the importance of preserving diversity of species and habitats

7. Human decisions and activities have had a profound impact on the physical and living environment.

**MATERIALS:**

* Smartboard or White Board
* World Wildlife Fund’s “Together” YouTube Playlist
* Proquest and ScienceDirect
* Assess to Popular Science Websites (i.e. National Geographic, Science Direct, etc)
* Final Project Requirement Sheet
* Laptops

**DESCRIPTION:**

In this lesson, students will be introduced to the basic requirements of their science final project – a popular science article-based persuasive letter and conservation poster. For the final project, students must research a self-selected endangered species, finding at least four popular science article (which, in total, address three main ideas: how human actions are threatening the species, current conservation efforts for the species, how the species “matters”). After applying CHoMP to each article, students must synthesize the research into a persuasive letter addressed to the main human threat endangering the species (i.e. poaches, industrialists, fishermen, foresters, etc.). There will be in-class time allotted to the research process and writing. In the introductory paragraphs of the persuasive letter, however, students must use Ray Brabdury’s “A Sound of Thunder” and its commentary on the importance of environmental conservation and accountability and the negative impact of interconnectedness if we don’t respect one another to preface the letter and provide a rationale for the letter. As the out-of-class component, student can choose to design either a “Wanted Poster” or a “Public Service Announcement” for their endangered species.

After reviewing the requirements, students will be allowed to ask questions. Given laptops, students will explore the YouTube playlist, WWF “Together,” in order to select the endangered species they wish to research. The playlist provides a list of sixteen (16) high-profile endangered species. The teacher will highly encourage students to use the playlist as a starting point and ultimately pick a low-profile species to research in concurrence with the unit theme of universal individual worth. After every student picks a species, the teacher will model how to naviagate the online recommended websites and search the databases through the “monarch butterfly” (which nods to Eckels’s butterfly from English class). The teacher will involve students in her think-aloud about whether the articles are credible and her brainstorming about “key terms” to input into the databases to yield the best, more relevant results.

**ASSESSMENT OF STUDENT LEARNING:**  Informal formative assessments will occur throughout the lesson in the form of discussion input during teacher modeling and question asking during the overview of the final project requirements. Students will also be informally assessed, if applicable, by their ability to stray from the WWF YouTube playlist and select an endangered species on their own.

**RATIONALE:**

Many activities and texts (in both disciplines) scaffolded students to this final project. The persuasive letter is pulled from persuasive text analysis (i.e. Time Safari, Inc. advertisement, Public Service Announcements, Joy Williams’s persuasive essay), persuasive writing mini-lesson (i.e. “Loaded Words” in English class), and lower-risk persuasive text creation (i.e. Invasive species characterization debate, “Dear Shell…” lab report conclusion). According to Fang and Wei (2010), science is a “mix of inquiry and argument” (p. 262). The persuasive letter component of this final project embraces that definition of science in that it prompts students to seek information about their endangered species and then formulate an argument based on that research to advocate for its conservation. The research component involves popular science articles, CHoMP, and student choice. With three parts, the final project caters to diverse learners and allows students to be assessed in three ways. The conservation poster is derived from prior activities, as well. For example, the “Wanted Poster” option comes from the YA novel, *Stung*, and the “Nab the Aquatic Invader!” website, so students can use those as models and sources of inspiration for their own creation. All the activities and practice throughout the lesson that are reflected in this final project served to build students’ “self-efficacy” so that by the time they reached this point (Alverman, 2001, p. 6), they would be confident in their ability to apply CHoMP to comprehend popular science articles and write persuasively.

The final project involves the creation of original texts (i.e. persuasive letter, conservation poster) to expand students’ thinking about science class because students except scientific writing to be in the form of taking notes on what they read or rewriting what they read, not creating an original text based on what they read, according to a study by Howes, Hamilton, and Zaskoda (2003, p. 501).

**PROFESSIONAL REFERENCES:**

Alvermann, D. E. (2001). Effective literacy instruction for adolescents. *Executive Summary and Paper Committee.* Chicago, IL: National Reading Conference.

Fang, Z., & Wei, V. (2010). Improving middle school students’ science literacy through reading infusion. *The Journal of Educational Research, 103,* 262-273.

Guinee, K. & Eageton, M. B. (2006). Spinning straw into gold: Transforming information into knowledge during web-based research. English Journal, High School Edition, 95(4), 46-52.

Howes, E. V., Hamilton, G. W., & Zaskoda, D. (2003). Linking science and literature through technology: Thinking about interdisciplinary inquiry in middle school. *Journal of Adolescent & Adult Literay, 46*(6), 494-504.

**Science Day 13:**

**Final Project – Computer Lab Day**

**“How to Read Science News” Video & Online Researching**

**OBJECTIVES:**

* Given Joe Hanson’s “How to Read Science News” video, students will interpret the video’s eight tips on differentiating good and bad science news in order to apply the tips to their independent online research and choose credible popular science/research articles.
* After self-selecting an endangered species in a previous lesson, students will research the species via a list of recommended websites and two databases in order to choose at least four articles, one of which must be from a database.

**STANDARDS:**

**WHST.9-10.7** Conduct short as well as more sustained research projects to answer a question (including a selfgenerated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (ST CCSS, p. 66).

**WHST.9-10.8** Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (ST CCSS, p. 66).

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).

6. Plants and animals depend on each other and their physical environment.  
            Explain the importance of preserving diversity of species and habitats

7. Human decisions and activities have had a profound impact on the physical and living environment.

**MATERIALS:**

* It’s Okay to be Smart’s “How to Read Science News” YouTube Video
* “How to Read Science News” Reference Sheet
* Final Project Requirement Sheet
* Computer Lab

**DESCRIPTION:**

As a follow-up to the teacher modeling of how to navigate the recommended websites and conduct database searches, students will watch a video from It’s Okay to Be Smart, entitled “How To Read Science News,” about eight different ways to differentiate between “good” and “bad science news. After the screening, students will receive a reference sheet listing the eight points made by Joe Hanson in the video. The teacher or librarian will prompt a student volunteer to read point four from the sheet (Use peer-reviewed sources) and elicit student interpretations of it based on the explanation provided by the video. Using ProQuest (one of the suggested online databases), the librarian will show students the two boxes to check before they conduct a search (advanced search screen: “full text” and “peer reviewed), connecting the video’s tip to students’ actual research process.

In the computer lab, students will receive the remaining time to research their endangered species through the list of recommended websites and databases on the final project requirement sheet. Students will be instructed to print out any articles they find and wish to use.

**ASSESSMENT OF STUDENT LEARNING:**  The teacher will circle and scan the classroom during students’ independent research to informally evaluate their research process, engagement level, and the quality of their article selection based on its relevance to one of the three points that needs to be addressed in the persuasive letter.

**RATIONALE:**

This lesson provides students with in-class time to conduct their online research. Ideally, the in-class time will increase the quality of the final projects (i.e. students will not have to dedicate as much time outside of class; students can use their peers and the teacher/librarian). The teacher can also supervise the process, informally assess students, and keep students on-track by being able to immediately address misconceptions as they arise and become visible.

Following up the teacher’s informal modeling of how to find and determine the credibility of online websites and science articles, the It’s Okay to Be Smart video provides eight concrete points that are comprehensible and immediately applicable to every students’ research (and such will be explicitly shown through the peer-review check box on the ProQuest database).

**Science Day 14:**

**Final Project – Reading the Popular Science Articles via CHoMP**

**OBJECTIVES:**

* After applying the during-reading strategy, CHoMP, on multiple popular science articles in previous English and science lessons, students will rewrite at least four articles into abbreviated notes in order to in order to paraphrase the information using the CHoMP four-step process.

**STANDARDS:**

**RST.9-10.2** Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text (ST CCSS, p. 62).

**RST.9-10.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics* (ST CCSS, p. 62).

**WHST.9-10.7** Conduct short as well as more sustained research projects to answer a question (including a selfgenerated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (ST CCSS, p. 66).

**WHST.9-10.8** Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (ST CCSS, p. 66).

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).

6. Plants and animals depend on each other and their physical environment.  
            Explain the importance of preserving diversity of species and habitats

7. Human decisions and activities have had a profound impact on the physical and living environment.

**MATERIALS:**

* At Least Four (4) Popualr Science/Researh Article (provided by each student)
* CHoMP Anchor Chart
* Final Project Requirement Sheet

**DESCRIPTION:**

From the previous lesson, students should come to lesson with at least four articles about their chosen endangered species printed out. At least one of the articles should be from a database. The teacher should circulate at the beginning of the class period to check in with each student and determine their progress (i.e. behind, on-schedule). The teacher will quickly review the CHoMP note-taking process and inform students they may (at their own risk) skip the first CHoMP step (C: Cross out small words, like prepositions and conjunctions). The teacher should also remind students that they will submit their CHoMP marginalia with their final projects on the due date and emphasize that the quality of their CHoMP notes will most likely factor into the ease at which they will be able to integrate the article information into their persuasive letters later on. Students will have the entire class period to read through their articles and apply CHoMP to each. Whatever they do not finish will be homework.

**ASSESSMENT OF STUDENT LEARNING:**  The teacher will circle and scan the classroom during students’ independent CHoMP reading. The teacher will review the CHoMP marginalia more closely when the articles are submitted as part of the final project.

**RATIONALE:**

This lesson provides students with in-class time to apply CHoMP to their four self-selected popular science articles. Ideally, the in-class time will increase the quality of the final projects (i.e. students will not have to dedicate as much time outside of class; students can use their peers and the teacher/librarian). The teacher can also supervise the process, informally assess students, and keep students on-track by being able to immediately address misconceptions as they arise and become visible.

**PROFESSIONAL REFERENCES:**

Guinee, K. & Eageton, M. B. (2006). Spinning straw into gold: Transforming information into knowledge during web-based research. English Journal, High School Edition, 95(4), 46-52.

**Science Day 15:**

**Final Project – Persuasive Letter Writing Session**

**OBJECTIVES:**

* After a mini-lesson on “evidence-based transitional terms,” students will integrate their science article research with their own ideas using transitional phrases in order to argue for the conservation of their species in a persuasive letter.
* After reading Ray Bradbury’s “A Sound of Thunder” in their English class, students will analyze how the way in which the short story approaches unit themes – accountability, interconnectedness, individual worth – applies to wildlife conservation in order to prepare a fictional rationale for their letter in its introductory paragraph.

**STANDARDS:**

**RST.9-10.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (ST CCSS, p. 62).

**RST.9-10.9** Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts (ST CCSS, p. 62).

**WHST.9-10.1** Write arguments focused on *discipline-specific content* (ST CCSS, p. 64).

**WHST.9-10. 4** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience (ST CCSS, p. 66).

**WHST.9-10.7** Conduct short as well as more sustained research projects to answer a question (including a selfgenerated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (ST CCSS, p. 66).

**WHST.9-10.8** Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (ST CCSS, p. 66).

**WHST.9-10.9** Draw evidence from informational texts to support analysis, reflection, and research (ST CCSS, p. 66).

**NYS Standards:**

**Standard 4 - The Living Environment:** Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science (p. 35).

6. Plants and animals depend on each other and their physical environment.  
            Explain the importance of preserving diversity of species and habitats

7. Human decisions and activities have had a profound impact on the physical and living environment.

**MATERIALS:**

* Popular Science/Research Articles with CHoMP Marginalia
* Final Project Requirement Sheet
* Ray Bradbury’s “A Sound of Thunder”

**DESCRIPTION:**

From the previous lesson, students should come to lesson with at least four articles about their chosen endangered species annotated with CHoMP marginalia. Students may make the executive decision to use this allotted writing session to finish their CHoMP notes, if they are behind in the process and were unable to catch up for homework. The entire class period should be dedicated to a writing session in which students can use the teacher and peers as resources while writing. The teacher will introduce the writing session with a mini-lesson on “evidence-based transitional phrases,” establishing their purpose (to emphasize and integrate outside information more seamlessly, clearly separating it from opinion and avoiding dropped quotes) and when to use them (when tasked to integrate information – directly quoted or paraphrased – from nonfiction or literary texts into a writing assignment). Students will receive a list they can reference during writing. Students should use ASPA Style citations. However, since no direct instruction on the method for this specific assignment will occur, the grading will not be strict. Students’ citations must show evidence of a genuine effort, however.

**ASSESSMENT OF STUDENT LEARNING:**  The teacher will circle and scan the classroom as students write, informally evaluating their approach to writing and providing feedback when asked by students. The formal assessment comes with the submission of the final project.

**RATIONALE:**

This lesson provides students with in-class time to conduct their online research. Ideally, the in-class time will increase the quality of the final projects (i.e. students will not have to dedicate as much time outside of class; students can use their peers and the teacher/librarian). The teacher can also supervise the process, informally assess students, and keep students on-track by being able to immediately address misconceptions as they arise and become visible.

Students can pull from the previous reading strategy mini-lesson – “Loaded Words” – from the English class invasive species debate in their persuasive letters. This lesson continues that explicit instruction in persuasive writing strategies through its “Evidence-Based Transitional Phrases” mini-lesson. Therefore, even in the last lesson of the unit, the science classroom is still explicitly teaching reading strategies, a component of instruction endorsed by many researchers (Fang & Wei, 2010, p. 263; Grant, 2004, p. 35).

**PROFESSIONAL REFERENCES:**

Fang, Z., & Wei, V. (2010). Improving middle school students’ science literacy through reading infusion. *The Journal of Educational Research, 103,* 262-273.

Grant, R. (2004). Science libraries in the classroom. *Green Teacher, 74*, 35-38.