

Nonfiction and Interdisciplinary Inquiry: Multimodal Learning in English and Biology

This article offers suggestions on teaching a nonfiction unit (in English) and a genetics unit (in biology) that, together, incorporate reading, researching, writing, and advocating for an environmental issue.

Often educators find themselves struggling with the amount of information they must cover within their content areas, leaving little time or space in their curriculum to collaborate with others. This lack of collaboration relates to the immense pressure felt by teachers to prepare students for state testing, as well as the lack of time to meet with other teachers, especially those teaching other subject areas. While these barriers can seem overwhelming and discouraging, they are not absolute and can be overcome by encouraging administrators to incorporate some in-common planning times into the schedule throughout the week or during professional development days. In particular, interdisciplinary instruction requires this kind of collaborative planning to enhance the connections students will make between subject areas and their relation to real-life encounters.

This integration of subject areas benefits both teachers and students, in that it is easier for students to see and make tangible connections between subjects, while teachers are building on one another's ideas making them more focused, engaging, and supported. Research in comprehension shows that students do not learn or retain content effectively when content is taught in isolation. This is particularly true of reading comprehension because, as William Kintsch asserts, readers' prior knowledge is a key factor in determining whether meaning will be made from

a text. "To learn more effectively, we need hooks in prior knowledge, long-term memory, or personal experience on which to hang the information to be learned . . . It is not enough that a hook in long-term memory is available—it must also be used" (330). Therefore, students who have these "hooks" are much more likely to understand and be able to interact meaningfully with texts. Central to effective instruction are the literacy skills that multiple subject-area teachers employ: the reading, writing, and speaking about texts.

If students do not come with "ready-made" hooks in prior knowledge, it is the job of educators to construct them, building prior knowledge so that new content can be integrated. Position statements and research in adolescent literacy recommend the use of nonfiction in English classrooms (Biancarosa and Snow 4; IRA 12). IRA updated *Adolescent Literacy: A Position Statement* last year and reiterated that adolescents deserve "content area teachers who provide instruction in the multiple literacy strategies" and "deserve access to and instruction with multimodal, multiple texts" (2). Similarly, *Reading Next* identifies elements of effective adolescent literacy programs, calling for "language arts teachers using content-area texts and content-area teachers providing instruction and practice in reading and writing skills specific to their subject area" (Biancarosa and Snow 4). Supporting this stance, Kathryn H. Au acknowledges that "by high school, many students of diverse backgrounds are reading and writing

far below grade-level expectations. These students need the boost provided when all teachers emphasize the importance of literacy and teach accordingly” (537).

Long-time advocates of content-area inquiry and critical thinking, science teachers who collaborate with English language arts teachers can promote such literacy practices across the high school curriculum. Increasingly, high-quality and award-winning books are available to supplement and extend the traditional science textbooks (Bull and Dupuis 36). The National Science Teachers Association (NSTA) publishes its annual *Outstanding Science Trade Books for Students K–12*, which represent excellent literature that both assist students with building literacy skills and developing science content knowledge. Additionally, the Young Adult Library Services Association (YALSA) awards its Excellence in Nonfiction for Young Adults and Great Graphic Novels for Teens annually, offering additional high-quality nonfiction titles—many of which can supplement and extend science content. With these resources in mind, savvy science teachers can start with these lists (and those awards identified in Table 1) when considering nonfiction they might incorporate into their curriculum. Science teachers who choose to pair up with English teachers to further their students’ literacy, critical inquiry, and technology skills can forge productive collaborations. Therefore, we—an English educator and a science educator—believe that a relationship well worth building is the collaboration between English and biology teachers. By engaging high school students in an interdisciplinary approach that uses interesting methods and materials, the

English-biology teacher-team can improve student learning and engagement.

Units of Study: Genetics and Nonfiction

To meet the curricular demands of both content areas, we offer guidelines for constructing an interdisciplinary inquiry to benefit all stakeholders: the English teacher, the biology teacher, and their students. The particular approach we suggest here centers on two units being taught simultaneously: a genetics unit in biology class and a nonfiction unit in English class. Presenting students with multimodal texts, engaging them with curricular inquiry, and guiding them in the construction of formative written projects will enable students to learn in depth and with meaning. Experiencing content in various formats and through multiple exposures (in both biology and English) will assist students in building, using, and maintaining their “hooks” in content comprehension.

Our approach of using multimodal texts is grounded largely in the International Reading Association’s (IRA) *Adolescent Literacy: A Position Statement*. To be literate in the 21st century, teens must be able to build, use, and adapt literacy skills and strategies to meet changing contexts. New technologies and media have altered the types of texts that teens read and create. Research suggests that 78 percent of teens “believe they would be more motivated to engage in writing in school if there were more multimodal tools available” (Lenhart et al. 7). Accordingly, “to engage fully in these new literacies, adolescents need teachers who are sensitive to the competencies that young people bring

TABLE 1. Awards for Young Adult Books and Potential Collaborations for English Teachers

AWARD	PROFESSIONAL ORGANIZATION	POTENTIAL COLLABORATIONS
Excellence in Nonfiction	Young Adult Library Services Association (YALSA)	Sciences, Social Studies, Health, Financial Literacy
National Book Award, Young People’s Literature and Finalists	National Book Foundation (NBF)	Social Studies, History
Outstanding Science Trade Books for Students	National Science Teachers Association (NSTA)	Sciences, Math, Social Studies
Notable Tradebooks for Young People	National Council for the Social Studies (NCSS)	Social Studies, History, Government, Economics
USBBY Outstanding International Books	United States Board on Books for Young People (USBBY)	Foreign Languages, Global Perspectives

to comprehending and producing texts of many forms and functions. At the same time, they need teachers who can help them develop into ever more competent readers and writers” (IRA 7). For these reasons, we recognize and welcome digital, non-print, and print formats as integral components in adolescents’ literacy development. In doing so, our multimodal approach described in this article seeks to integrate web-based learning experiences and digital texts along with traditional print media and books. It is through reading, analyzing, and constructing new knowledge across both the English and biology classrooms that this interdisciplinary approach seeks to increase adolescents’ comprehension of nonfiction and interdisciplinary inquiry.

In the Biology Classroom: Genetics and Darwin’s Finches

Reading, writing, and speaking are not activities exclusive to English. These actions are carried out on a routine basis by professional scientists. The learning of science is carried out by combining language and other graphic organizers of information such as tables, graphs, pictures, etc. to build a dialogue around scientific concepts. Lemke, in Jerry Wellington and Jonathan Osborne, makes a valid point in that it is not enough to ask our students to simply read the textbook or write a report; rather, they need to be trained to understand how to ask those subtle underlying questions as a scientist would and how to make logical connections based on sound reasoning. “Too many pupils care less and less for science as a school subject the more of it they’ve taken. Too often, with the best intentions, our teaching of science frustrates students who know we expect them to understand, but who also know that they don’t (even when they seem to)” (iv). This lack of care can be lessened through the use of multifaceted techniques involving the integration of another subject, in this example English.

The American Association for the Advancement of Science believes that literacy in the science classroom can be a tool to teach scientific content more effectively. By implementing the Common Core State Standards, science teachers enable their students to build and connect knowledge between subject areas. *Taking Science to School: Learning and*

Teaching Science in Grades K–8 (Duschl, Schweingruber, and Shouse) notes the necessity for teachers to include a range of instructional approaches to fully develop students’ scientific proficiency. Scientific literacy requires that our students engage in meaningful discussions that center on content-based texts and communicate effectively in writing, as well. These goals for students to be able to read, write, listen, and speak effectively in content-area classrooms align with the Common Core State Standards for Literacy in History/Social Studies, Science, and Technical Subjects (7).

According to the National Research Council, “evolution and its underlying genetic mechanisms of inheritance and variability are key to understanding both the unity and the diversity of life on Earth” (140–41). The examples of activities offered will focus on the Core and Component Ideas in the Life Sciences from *A Framework for K–12 Science Education*, which were developed using the *National Science Education Standards, Benchmarks for Science Literacy*, the *Science College Board Standards for College Success*, as well as maintaining consistency with frameworks for national and international assessments such as the National Assessment of Educational Progress (NAEP), the Programme for International Student Assessment (PISA), and the *Trends in International Mathematics and Science Study* (TIMSS).

The core ideas focused on in these activities are variation of traits, evidence of common ancestry and diversity, natural selection, and adaptation. It is expected that by the end of high school students should understand that environmental factors can cause mutations in genes and that viable mutations are sometimes inherited. Environmental factors affect the variation and distribution of traits observed. Students should also be able to understand that DNA can be used as a method of observing overlaps in organisms through branching and production of multiple lines of descent. Natural selection should be a well-understood topic, where students are able to explain how the traits that positively affect survival are more likely to be reproduced and are therefore more common. The final piece is that natural selection leads to adaptation owing to the distribution of traits in a population being able to change based on the conditions.

In the English Classroom: Nonfiction and Environmentalism

As the Common Core State Standards call for an increase in the use of nonfiction texts, English teachers have incredible opportunities to share resources for high-quality nonfiction texts, including young adult literature, videos, and film. Many secondary educators are not familiar with the wealth of excellent texts that can assist their students in deepening their content knowledge. Thus, English teachers have the welcome opportunity to share their

knowledge and skills with colleagues in various disciplines. Showing peers how to find high-quality literature and sharing resources with peers is a perk of interdisciplinary collaboration that benefits all stakeholders. Colleagues learn about new resources; students have more opportunities to

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read excellent nonfiction; and English teachers reap the rewards of increased student motivation, engagement, and academic achievement. Additionally, the writing of various nonfiction forms (as called for in the CCSS) offers ample opportunities for English teachers to shine by flexing their students' writing muscles. The Common Core Anchor Standards and high school grade-specific standards (ELA Standards: Writing) aim to have students write "routinely over extended time frames (time for research, reflection, and revision) . . . for a range of tasks, purposes, and audiences" (National Governors Association Center for Best Practices 47). Additionally, the new NCATE Standards for English Teachers calls for English teachers to instruct students in using "contemporary technologies and/or digital media to compose multimodal discourse" (NCTE/NCATE 1). Such integration of reading, writing, and technology offers immense possibilities and promise for students' learning.

For these reasons, we offer suggestions on teaching a nonfiction unit that incorporates reading, researching, writing, speaking, and advocating for an environmental issue. Immersing students in nonfiction as both readers and writers enables them to deepen their content knowledge (genetics, birds) and sharpen their writing skills. While it may not be feasible for *all* students in a high school English

class to write specifically about *finches*—as learned in biology—it is certainly possible for students to engage in critical inquiry into birds, habitats, and environmental issues. This kind of inquiry allows students to both deepen their knowledge of genetics and broaden their understandings of how change affects living things.

Interdisciplinary Study: Genetics and Nonfiction/Environmentalism

We have constructed an electronic text—further reinforcing our multimodal theme—to provide readers of this article with a *chronology that illustrates a sampling of student-centered activities and multimodal texts that biology and English teachers can use when collaborating on this unit of study*. This website's purpose is to detail how the activities and texts from one content area parallel and support the other content area, enriching and deepening students' content-area knowledge. To improve comprehension, build content-area knowledge, and engage students in multimodal learning, these activities employ literacy skills across content areas. To anticipate any parental concerns, we recommend sending an email to parents to inform them of this English-biology collaboration, providing them with the rationale behind the interdisciplinary approach. Mentioning how students learn and retain content more effectively when it is integrated will help avoid possible complaints.

In scheduling this interdisciplinary unit, we suggest biology teachers begin their unit first (perhaps one week prior to the Nonfiction and Environmentalism unit), enabling students to build background knowledge to be used in English class (see Table 2). As these units progress, we recommend the teachers meet twice per week for 30 minutes to discuss student progress and problem-solve any curricular issues that may arise. In doing so, neither teacher feels that he or she is "going it alone" and can offer one another support and instructional strategies—important elements that are sometimes lacking in high school collegiality. Each content area spends four full weeks on instruction: the biology unit begins week one and ends on week four; the English unit begins on week two and ends on week five. This format allows for the building of background knowledge, in-depth study and discussion, and the completion of summative projects in each discipline.

TABLE 2. Five Week Instructional Plan

	WEEK ONE	WEEK TWO	WEEK THREE	WEEK FOUR	WEEK FIVE
Biology	Introduction to beak and feet adaptations	Evolution	Observing and Researching	Conducting Research	
English		Nonfiction and Environmentalism	Nonfiction Literature Circles	Reading and Writing Connection	Preparing and Presenting Digital Media Projects

For detailed descriptions of activities, texts, instruction, and assessment rubrics for this interdisciplinary unit, please visit this article's companion website at <http://interdisciplinaryEnglishandscien.weebly.com/>.

This interdisciplinary unit represents a solid place to start for those considering such a collaboration. One of the most well-known scientists, Charles Darwin, is responsible for the theory of evolution. With his detailed notes and observations of finches from the Galapagos Islands, he became the authority on adaptation of traits having evolved to meet the demands of the environment. With this in mind, we offered examples of interdisciplinary activities focused on the subject of birds. Our multimodal approach engages students with web-based learning experiences and digital texts alongside traditional print media and books, allowing students to analyze and create different media. We incorporated enduring understandings into the interdisciplinary activities as key takeaways for students: birds' characteristics allow them to be specifically adapted to their environment, and writers craft arguments carefully through use of logical rhetoric and persuasive style. We reinforced the concept of the rhetorical triangle by having students both analyze professional texts and create their own texts, demonstrating how speaker, audience, and subject interact. Each of the activities outlined and resources provided help to increase the integration between content areas of English and biology. This opportunity for students to engage in content across disciplines helps to build their knowledge and skills by strengthening the relationship connecting the process of science and the processes of reading and writing.

Conclusion

We believe that when teachers assist students with building hooks in prior knowledge and then *activate and use* the hooks, as Kintsch (34) calls for, student comprehension deepens. In our approach, the biol-

ogy teacher builds students' knowledge of birds, adaptations, and genetics. The English teacher activates this knowledge by engaging students with multimodal texts that explore genetics, diversity, and environmental issues.

In tandem, the biology and English teachers are directing students in their studies as they observe, journal, investigate, and collaborate on inquiry projects. With this approach, students are not learning content in isolated pieces. Instead, they are presented with interesting and diverse texts across the curriculum, increasing their motivation, engagement, content-area knowledge, and writing skills.

Involving students with interesting methods and materials across the biology and English curricula empowers teachers to enact the kinds of 21st-century literacy skills called for in the CCSS. Multimodal texts that include web-based resources, film, and digital texts offer students multiple pathways to reading, analyzing, and constructing their understandings in both content areas. Our approach offered suggestions on teaching a nonfiction unit that incorporates reading, researching, writing, speaking, and advocating for an environmental issue. We believe that by immersing students in nonfiction as both readers and writers, we enable them to deepen their content knowledge and sharpen their writing skills.

Consider inviting your students' biology teacher to collaborate and try out the activities we offer in this article. We also suggest that English teachers look for additional opportunities to

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conduct interdisciplinary collaborations that will motivate and engage students at deeper levels. A nonfiction unit in English class offers tremendous possibilities for cross-curricular collaborations with multiple subject-area teachers. Begin by considering what award-winning nonfiction texts lend themselves to such collaborations. To find recently published award-winning nonfiction for your students, see Appendix C on this article's companion website. Helping students to forge connections and deepen comprehension while they improve their writing is well worth our time and effort. **EJ**

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READWRITETHINK CONNECTION

Lisa Storm Fink, RWT

Books about science allow readers to encounter new concepts, ask new questions, and discover what we can learn simply by paying close attention to our surroundings. Tune in to the ReadWriteThink.org podcast episode “Science Books for Teens” to hear about an array of science books for teens that offer crisp writing and memorable characters while telling a good story. You’ll hear about ecology and climate change, food production, infectious disease, ancient human history, the universe, and our power as humans for both ingenuity and destruction. <http://www.readwritethink.org/parent-afterschool-resources/podcast-episodes/science-books-teens-30939.html>

As It Turns Out

When I ask a group of very young people—
who are back outside now under the sky
re-creating the weather in their
new-glazed imaginations—

“What depends upon ‘a red wheel
barrow glazed with rain water beside
the white chickens?’” and

after we have all enjoyed the moment of
quivery silence we had all apprehended,
I like to ask

“What is the weather like? Describe the sky.”
And they argue among themselves:

“It’s raining.” “It’s cloudy.”

“No. The sun is out.”

“How do you know?”

“Because of ‘glazed’.”

“Then it’s sunny!”

“But then the wheel

barrow would be dry.”

“The clouds are going away!”

So they go away and go look at the blue
sky with a gray horizon
and the green grass

and the white house and the red
barn and the brown road that
they walk on until they can turn
around and see the rest of
the painting.

It’s a painting!

then the bell rings
and they

go out into the painting
that lasts

all the way to algebra, a
different

painting, maybe the great
figure 5

as it turns out.

—Richard Fenton Sederstrom

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