Middle School Journal

Teaching Content with the Help of Writing Across the Curriculum

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*_This We Believe_ Characteristics

- Students and teachers engaged in active learning
- Curriculum that is relevant, challenging, integrative, and exploratory
- Multiple learning and teaching approaches that respond to their diversity

*Denotes the corresponding characteristics from NMSA's position paper, _This We Believe_, for this article.

Shelley Stagg Peterson

If you are a subject specialist, you may be looking for ways to enrich your students' learning of concepts and motivate them to complete written assignments. If you teach a number of subjects including English/language arts, you may be looking for ways to address the many objectives in the various curricular areas by integrating subjects in meaningful ways. In either case, you would likely be overjoyed if students engaged wholeheartedly in a writing project, voluntarily using the Internet after school to look up more information on an assigned topic, and handing in high-quality work showing a good understanding of the concepts.

Students in Leonora's eighth grade science classroom in Ontario wrote mystery stories, cartoons, manuals, parodies, newspaper articles, and plays to show how mechanical advantage concepts could be applied to real life. An example of narrative writing composed by a boy in Leonora's class is found in Figure 1. Students' motivation and success in learning science concepts through writing strengthened Leonora's belief in writing as a powerful tool for learning content. She now makes writing an integral part of her science program.

Figure 1

Eighth grade student's narrative writing in science class

Jim was a very lazy and ignorant kid. "Who needs mechanical advantage!" he would always say. Of course, this always made his life harder, especially since he wasn't that strong himself. Soon he began to forget what mechanical advantage really was, and was simply lost in a world of hard work. He couldn't keep up with it, and his laziness only made matters worse. It seemed that there was no hope left for this poor soul. Fortunately for him, though, he was being watched. And hope would come sooner than he thought. One night he fell asleep, but right after he fell asleep, he found himself sitting on his bed.

"Ah, this is one odd dream," he said to himself. He turned around to see him or what seemed to be his "body" sleeping on his bed.

"OK, this is getting weird," he said. It would soon get weirder, for a shadowy figure emerged out of nowhere. Jim couldn't help letting out a high, girlish cry for help.

"SILENCE!" said the figure.

"I, the Ghost of Pulleys has appeared before you today to teach you a lesson. I am one of the three Ghosts of Mechanical Advantage. You have been very foolish lately, being ignorant about the power of mechanical advantage! Prepare to be educated!" Jim was quickly sucked into what seemed to be ... a science classroom? There, standing in front of him was the Ghost of Pulleys.

"Now, it is time for your enlightenment. The pulley can greatly help you be reducing the force needed to lift an object." Jim slowly, but surely began to understand how helpful pulleys were. Moveable pulleys, fixed pulleys, double pulleys, the works.

"So, the more sections of rope I have, the easier it is to lift?" Jim asked.

"Of course," replied the ghost.

After an adequate lesson with the Ghost of Pulleys, Jim was sent to the next ghost. A swirling vortex opened up before him and he jumped in.

Whoosh! Jim landed in a playground where he saw a see-saw in the middle, and a bunch of other things lying around, such as a hockey stick, a pair of shears, a hammer, and a crowbar.

"Alas, the uneducated mortal has arrived," sounded a booming voice.

"Let me guess," Jim replied, "The Ghost of Levers."

The ghost was very pleased, "Ah, that gets a lot of things out of the way. Now, it is time for your enlightenment." Jim was told about Class 1, Class 2, and Class 3 levers, as well as how you can find them in real life.

"Yes, levers can help you greatly when used correctly. Now for your final destination." The vortex appeared before Jim again and he jumped in, wondering what was next.

Tick-Tock, Tick-Tock, Tick-Tock.

"Where am I??" Jim said in exasperation. His surroundings were quite different from the last two. First the classroom, then the playground, but now … inside a clock tower? There were gears everywhere, all kinds of gears, all working together to make the clock precisely accurate.

Suddenly, a shadowy figure leaped out from behind one of the gears. "Howdy there, partner! You ready for some gear education?"

"Sure, I'm guessing the gear ghost, right?" replied Jim.

"Right you are," said the ghost. The ghost quickly launched him to the top of the tower and proceeded to explain all about gears: driver gears, follower gears, even rack and pinion gears.

At the end of his lesson with the gear ghost, a vortex appeared and sucked him in without warning. After a couple of seconds, he was quickly sent to his room, and returned to the position he was in before on the bed. In front of him were the three ghosts. The Ghost of Pulleys stepped forward, took a deep breath and said, "Use the knowledge you have just learned to assist you in daily life."

Then the Ghost of Levers stepped forward and said, "Do not forget what we have taught you."

And finally the Ghost of Gears stepped forward and said, "I reckon we could do this again sometime. We'll be here if you're ever in need." The three ghosts quickly huddled together and before you could say, "Mechanical advantage," they disappeared.

Jim sighed and then climbed into his bed. "Wow," he said, "I really need to lay off the junk food."

Leonora's beliefs in writing across the curriculum have deep roots in the literature on teaching writing (Britton, Burgess, Martin, McLeod, & Rosen, 1975; Moffett, 1968; Newell, 2006; Shanahan, 1997; Tchudi & Huerta, 1983). Throughout the decades, writing has been recognized as a process that helps learners to think more deeply about ideas and information they encounter

through reading, listening, viewing, and physically experiencing the world around them. Brozo and Simpson (2003) explained that "writing not only facilitates the learning of content-area concepts but also engages students in higher thinking and reasoning processes" (p. 155). What I call *discovery writing*, the type of writing over which students have some control of the format, topic, purpose, and audience, leads to greater understanding of concepts across the middle school curriculum. *Staccato writing*, the term I give to the quick, short writing required when filling in blanks, copying notes from a blackboard, or providing short answers to questions, does not generate the same deep levels of understanding. Discovery writing requires greater concentrated attention to sorting through and making sense of ideas than staccato writing does.

In this article, I add to the longstanding literature on writing across the curriculum by showing that content area classrooms are ideal places for helping students to develop as writers, as well as content learners. Writing is a natural and easy fit in content classes. As teachers teach writing, they help students to reinforce and build on their content understandings. As content concepts are taught, students will be creating pools of knowledge that they can draw upon when they write. In the following, I make a case for teaching writing alongside content across the curriculum and then show what planning and organizing the classroom to teach content concepts and writing might look like.

A case for teaching writing in content classrooms

Consider the possibility that students write on any topic they choose, using whatever genre and tone seem appropriate for the topic. Drawing on their imagination, knowledge, and interests, students incorporate what they have learned in the unit of study. This is the only constraint placed on their writing. Within these parameters, there is great scope for students to write narrative, non-narrative text, and poetry that they find personally meaningful and enjoyable. Equally important, students have space to explore the content knowledge that they are learning and connect it to their experiences, observations, and understandings of the world in ways that make sense to them.

As students are learning about the concepts within a subject, they can also be learning about writing. Content area subjects provide real-life questions and topics, as well as authentic contexts for student writing. In science classes, for example, students may create an advertisement for a model solar heating device they have designed and constructed. In social studies classes, their writing may take the form of a diary or Weblog (blog) of someone who lived during a period of time addressed in the curriculum. Even in subject areas that are not typically associated with writing, topics and contexts can be found. In mathematics classes, for example, students may write question-answer poems about probability problems and their solutions. In music classes, students may write a biography of a musical instrument, describing its history, construction, and use.

Content areas also provide a breadth and depth of knowledge about concepts and genres that

students can draw upon in their writing. Students who are studying a health unit on healthy and unhealthy food choices, for example, can use what they have learned whenever the topic of food shows up in their writing.

Students learn about good writing whether they read books, magazines, newspapers, or articles on Web sites to learn about concepts in various subject areas. When students read explanations for creating a first-class lever in their science class, for example, they see how explanations are written and can use these explanations as models for their own writing in any subject. Smith (1983) called this "reading like a writer"—a propensity that teachers can encourage students to take up whenever they read a new genre. As students read, they think about how the author organized ideas and formatted print, headings, visual images, and other features of writing and what the author did to achieve purposes such as informing, explaining, entertaining, and persuading.

Finding spaces for teaching writing

Unit planning and organizing the classroom
The types of activities that have long been associated with content classes—working with concrete materials, field trips, interviews, reading print-based materials of all types, small-group discussions, among others—provide information for students' writing and, of course, teach the content concepts. This means that content classes do not have to change greatly, although planning is complicated to some degree by juggling content area and writing objectives.

In the initial weeks of a science unit on simple machines and mechanical advantage, for example, Leonora (a) introduced the writing assignment (Use any genre to communicate information about two or more simple machines.), (b) provided examples of multigenre picture books, and (c) showed how content topics can be incorporated into many genres. Students began planning, gathering information (through reading about the topic and doing hands-on activities related to the content area topic), and drafting their writing. In some classes, 15 to 20 minutes were devoted to writing. In other classes, all of the time was used for reading, discussing, and hands-on activities.

In subsequent weeks, students continued reading about the topic and doing hands-on activities related to the topic they were studying, just as they would in any content area unit. They continued planning, gathering information, and drafting their writing. Leonora taught lessons to support students' writing, devoting 15 to 20 minutes to writing or conferencing in some classes, although many other classes were devoted entirely to reading and hands-on activities. On their own initiative, students did some of their writing and researching on the Internet at home.

In the final week of the unit, students revised and edited their writing. They read it to a partner, to a small group of peers, or to the whole class, depending on their comfort levels with sharing

their writing with peers. Students then handed in their writing to Leonora
for a grade.

Leonora's content objectives were drawn from the mandated curriculum (Figure 2). The writing objectives and assessment criteria came from both the language arts curriculum and from assessments of students' writing. The focus of writing lessons included developing characters in fiction writing, supporting the main point with examples and details in non-narrative writing, and making decisions about line breaks in poetry writing. Lessons were also needed to support students in determining the types of information that would be important and in helping them to record that information so it could be later used in their writing.

Figure 2
Grade eight science objectives: Simple machinges

> **Subject Area Knowledge:** Students will demonstrate an understanding of:
>
> - Mechanical advantage
> - Types of levers, pulleys, and gears
> - How each simple machine makes work easier
>
> **Writing Objectives:** Students will assess the validity of information they gather and proofread their writing for spelling.
>
> **Writing Activity:** Students write using a genre of their choice about two types of simple machines.
>
> **Activities for Gathering Information:** Reading books and using the Internet, making catapults and other simple machines, classifying everyday simple machines. Students use Cornell Note-taking template to take notes.
>
> **Mini Lessons:** 1) Assessing the validity of information, 2) Using Cornell Note-taking framework, and 3) Deductive teaching of proofreading skills for spelling.

While Leonora did not include a written project for every science unit, she would select some science units, such as "simple machines and mechanical advantage," "water systems," and "optics," that provided plenty of scope for students' writing. Students carried out writing projects during those units. During the rest of the year, students' writing in science included more staccato writing. She did, however, emphasize elements of good writing in her feedback and assessments of all the writing that students did in her science classes. By doing this, Leonora demonstrated that she, as a science teacher, expected good writing from her students. She showed that communicating effectively through writing is important in all subject areas, not just language arts.

When students are writing in any subject area, it is important to schedule writing time as often as possible during the week. Students can work on content writing or free-choice writing during writer's workshop, if you teach both language arts/English and content area subjects. The lessons, conferencing, and sharing of the writing in small groups, with a partner or the whole class, can take place during language arts classes or content area classes. It is also possible that the writing started in content area classes could be included in the writing that students complete per term for their language arts/English grade. The content area classes could be used to help students gather information for their writing; writer's workshop could be used for the actual writing and writing instruction.

What will be new when incorporating writing into content classes is the time allotted to lessons on writing and time devoted to writing and conferencing with the teacher and getting feedback from peers. If content teachers also teach language arts, this time can be drawn from the writer's workshop time in language arts. If teachers teach content areas exclusively, some time will have to be taken from other activities, and students will have to do some writing at home.

Students who have put a great deal of effort and time into their writing will want a wide audience, not just their teacher. Students may do a formal reading of their writing to small groups of trusted classmates, or they could read to small groups of students in younger grades or in another school. Students could also audiotape or videotape readings of their writing and have the tapes available for peers to listen to or view in the classroom library. Where appropriate, students' writing could be uploaded to a school Web site or included in newsletters sent home by the teacher or the school. Students' motivation and commitment levels will be much higher if they know that their writing is going to have an impact on someone else and will not simply be the source of a grade for their report card.

Defining writing assignments in content classrooms
To provide opportunities for students to say something worthwhile in their writing, teachers open topic and genre possibilities to whatever students can imagine in writers' workshops in English/language arts classrooms (Graves, 1994; Ray, 2001). Sometimes, however, teachers assign topics and genres to encourage students to venture into new territory and try something that they would not try on their own. The same is true in content classrooms. The difference is that teachers provide students with a range of topics that are related to the content area objectives. This extends and enriches students' conceptual learning and allows them to demonstrate their learning through their writing.

In a sixth grade classroom, Leslie asked students to show what they had learned about motion and simple machines using whatever genre they chose but ensuring that they included at least two of eight concepts (e.g., motion, oscillation, linear motion, rotational motion, reciprocating motion, force, friction, fulcrum, lever). When I interviewed students about their writing and writing processes, I found that what they wanted to say and their audience's response were at least as important to the students as showing what they knew about the science concepts. They

were engaged in the writing because they wanted to entertain their peers, and also because they had to show Leslie what they had learned in the science unit.

Writing instruction that teaches content concepts

Of course, the bulk of formal instruction that takes place in content classrooms is directed toward the content objectives. The hands-on activities, reading, field trips, and guest speaker experiences will always play a large role. Learning activities that support students' writing complement and extend the teaching of content concepts. Students have to give sustained attention to texts they read or visual images they view, to physical phenomena they observe, or to people they listen to in order to write about them. Once they have expressed their learning in writing and visual images, they have something to look back and reflect on to shape and consolidate their learning. What follows is one example of how teaching writing also deepens students' understanding of content concepts.

Line breaks in poetry writing. For many students, deciding where to put line breaks when writing poetry is contingent upon how many words will fit on a page, rather than where readers would naturally take a breath or where certain ideas are emphasized. In this activity, students play with sentences from a content area textbook or trade book to get a sense of how the meaning and rhythm change depending on where the lines are broken. They also learn the content and make it their own, as they create poems from the text.

To begin, copy a sentence from a content area textbook on an overhead transparency. Teacher and students can identify important words, cutting the extraneous ones and experiment with varying places where line breaks might go. I have found it helpful to have students read aloud the results of the group efforts to see how the line breaks influence the way they read and the way they think about the ideas in the sentence. An example showing the original paragraph, taken from Ross (2003), and a poem that students and teacher created about the Mercator Projection are found in Figure 3.

Figure 3
Creating poems from nonfiction text to deepen concept learning

Create a poem from the following paragraphs about the Mercator Projection by cutting words, changing words, rearranging words and phrases, and making line breaks. Show the most important ideas that you learn about the Mercator Projection in your poem.

The Mercator Projection
Mercator knew that sailors who depended on their compasses for long ocean crossings had a problem. If you placed a compass on the surface of a globe and then tried to steer a straight line along the compass bearing, you would spiral slowly but inexorably toward one of the poles. On long journeys, sailors had to constantly correct their compass bearings. How could these

curving lines be made straight on a map?

Mercator's breakthrough was to make the lines of longitude—which converge toward the poles on a globe—parallel on a flat map by distorting the distances between them. His strategy makes scale, and therefore area, inaccurate, but it preserves shape and direction. *(Ross, 2003, p. 50)*

One poem created from the two paragraphs:

The Mercator Projection
Sailors dependent on compasses
for long crossings
Constantly corrected compass bearings.
Steering straight lines
along a globe's surface
Made them spiral toward the poles.

Mercator made lines of longitude
Parallel
on a flat map.
Distances are distorted
So scale is inaccurate.
But shape and direction
are preserved.

In this example, students learned something about writing poetry that they carried into their own writing. At the same time, they read and thought about the content in the text on mapmakers. To make decisions about the line breaks and the words and phrases they wanted to include in their poems, they had to have a good understanding of the concepts.

Giving feedback and assessing content area writing

Students' writing gives teachers a clear picture of how well students understand the concepts and how well they are able to communicate their learning. Students continue to learn when they receive teachers' feedback on their content learning and on the communication of their learning through writing. Where appropriate, I invite students to help me put together checklists for assessing their writing. I learn what students know about writing through their suggested criteria for the checklists. More important, my students have a shared sense of ownership of the assessment procedures. Most often, students are highly motivated to meet expectations outlined in the checklists they helped to create.

If you are a subject area specialist, the grade you assign to a student's content area writing will

reflect that student's conceptual learning to the greatest degree. You would likely work with students to set due dates for two to three pieces of writing throughout a six-week unit. Alternatively, you might use a number of samples of staccato writing and one discovery writing sample that students work on throughout the unit.

If you teach both content areas and writing, your assessment may be balanced between content knowledge and demonstrations of writing competence. You might ask students to complete two to three pieces per reporting period for content area grades. They could select either writing that has come from content areas or personal choice writing for their English/language arts grade.

Before students submit their writing for grades, they should receive some feedback from you (and also from peers, if possible) to help them become better writers and gain a deeper understanding of the content. This could take the form of a few comments provided on the spot while they write or a conversation with students in scheduled student-teacher conferences. You could also write your impressions on works in progress handed in before the due dates. If you teach English/language arts and content classes, you could schedule a student-teacher conference with each student during each unit.

Figure 2 outlines Leonora's science and writing objectives for an assignment on simple machines and mechanical advantage. Figures 4, 5, and 6 display notes taken by one student, Brandon, the newspaper report he submitted, and Leonora's assessment of the report and her thoughts as she assessed the report, respectively (from Peterson, 2005, pp. 161–165).

Figure 4

Brandon's notes using the Cornell Framework

Topic: How pulleys and levers work	
Questions	**Notes**
How do pulleys work?	Pulley is a grooved wheel that turns around an axle (fulcrum), a rope or a chain is used in the grove to lift heavy objects.
	Pulley changes the direction of the force—Instead of lifting up, you can pull down using your body weight against the load (what you are lifting).
	Examples—On top of the flag pole to raise and lower the flag, to hoist a sail, to open curtains.
How do levers work?	
	Lever is a bar that is free to turn about a fixed point called the fulcrum. Has two other parts:

- force (what you are trying to move or lift)
- effort arm (the work done on the lever)

First class lever has fulcrum between the effort and load (e.g., see-saw, scissors). Effort goes down in order to lift the load.

Second class has the load between the effort and the fulcrum. Produce a gain in force (e.g., wheelbarrow, bottle opener).

Third class has effort between load and fulcrum. Loss in force, but gain in speed and distance (e.g., broom, shovel, fishing pole, baseball bat).

Short Summary of Notes
Pulleys are ropes around grooved wheels that change direction of force to lift things. Three types of levers have load, effort, and fulcrum in different positions to lift or move things or to produce a gain in force or make things go faster and farther.
Sources Used: http://www.sirinet.net/~jgjohnso/simple.html

Figure 5
Brandon's newspaper article

Pulleys Used to Rescue Stranded Whales

There was a large commotion last week at the coast near the town of Fake Lake. A large group of whales had been stranded on the shores of the beach. This presented a problem of not enough space for patrons seeking an afternoon of fun in the sun. The bigger problem was that the rescue team had to return the whales to the water before they died.

They tried every idea that came to their mind, including pushing the whale with a tractor and offering the whale $50.00 to just get up and swim back into the water. All failed miserably. Time was running out when Pat Mercury, a concerned passer-by, proposed that they implement a pulley system to lift and carry the whales to safety. Pat explained that a construction crane would do the work because cranes are designed to lift large amounts of weight.

The rescue workers hooked the whales and raised them one-by-one. They positioned the whales above a safe amount of water, lowered them into the water and detached the hoist. The whales were saved! The rescue team was befuddled as to why they did not think of this earlier. If it were not for a knowledgeable stranger's assistance, the whales would surely have perished. With that in mind, the members of the rescue team resigned, sure that staying on duty would

hurt more than help.

Figure 6

Assessing Brandon's writing

Content	Points out of 4
1. Provides information about all concepts	1
2. Provides accurate information about all concepts	2
3. Creates a context that presents a thoughtful and perhaps new way of looking at the concept	3
4. Provides specific supporting details consistently so that the writing is easy to understand and creative/engaging	1
5. Consistently shows connections between the concepts	2
6. Maintains a clear focus	3
7. Uses multiple sources of information	1
Organization	
1. Beginning and ending clearly identify what writer is trying to achieve	2
2. Uses the structure of the genre to communicate effectively	3
3. Readers get a clear sense of the writer's voice	4
Style	
1. Uses language appropriate for the audience and genre	3
2. Uses specific words and expressions, a variety of sentence structures/line breaks/graphic design in a creative and effective way	3
Conventions	
1. Consistently and effectively uses spelling, grammar, and punctuation	4
Total	32/52=62%

Content

Brandon had much more information about levers and pulleys in his notes than he was able to incorporate into his newspaper article. (I will plan mini lessons teaching students how to incorporate content information into newspaper articles and narratives in the next unit.) He created an interesting context for using a pulley and provided some accurate supporting details about how pulleys work, but did not include any information about levers. The article was

focused on the rescue of the whales, and there were connections between ideas. There aren't many science ideas, so I cannot get a good sense of the connections he is making between science concepts. Brandon used only one source of information for his notes.

Organization

Brandon introduces the whale problem in the first paragraph, shows how the rescue workers tried to solve the problem in the second paragraph, and then explained how they finally rescued the whales in the final paragraph. The title also summarizes the main idea of the newspaper article. In this respect, Brandon used the structure of the genre quite effectively. He just did not clearly achieve the purpose of demonstrating what two simple machines are and what they can be used for.

Style

Brandon uses specific language, such as "stranded," "patrons," and "construction crane," and readers get a clear sense of his voice through the humorous ending. There is a variety of sentence structures, as Brandon uses compound, complex, and simple sentences. He uses short sentences for effect (e.g., "The whales were saved!"). He uses an appositive correctly. The tone and language are generally appropriate for a newspaper article, though some details seem more narrative-like than newspaper article-like (e.g., "This presented a problem of not enough space for patrons seeking an afternoon of fun in the sun.")

Conventions

Brandon uses punctuation, spelling, and grammar effectively to make it easy for readers to follow his ideas. Even the less commonly-used words are spelled correctly, and the complex sentences are punctuated correctly. In this example, Leonora has assessed both the science content objectives and the writing objectives. She plans further instruction to support Brandon as both a science learner and a writer.

We all teach writing

Undeniably, writing is an important life skill that promotes clear thinking and deeper understanding even as computers and the Internet alter our means of communication. Students are not only expected to know, they are expected to communicate what they know, both in school and in the world that we imagine our students living in as adults. Integrating the teaching of writing across the curriculum underlines the significance of writing in daily activity beyond the school walls and enriches students' content learning and their motivation to learn. It also provides a real-life forum for students to become better writers of a wide variety of genres. Students can use the writing they do in any subject area to explore new ideas and consolidate their content understanding. Across the curriculum, we can enrich students' learning of content when we also teach them
to write well.

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