Curriculum Units by

Fellows of the

Yale-New Haven Teachers Institute

2007

Guide

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Preface

In March 2007, sixty-one teachers from twenty-eight New Haven Public Schools became Fellows of the Yale-New Haven Teachers Institute to prepare new curricular materials for school courses. Established in 1978, the Institute is a partnership of Yale University and the New Haven Public Schools, designed to strengthen teaching and improve learning of the humanities and the sciences in our community's schools. Through the Institute, Yale faculty members and school teachers join in a collegial relationship. The Institute is also an inter-school and interdisciplinary forum for teachers to work together on new curricula.

The Institute has repeatedly received national recognition as a pioneering model of university-school collaboration that integrates curriculum development with intellectual renewal for teachers. Between 1998 and 2003 it conducted a National Demonstration Project which showed that the approach the Institute had taken for twenty years in New Haven could be tailored to establish similar university-school partnerships under different circumstances in other cities. An evaluation of the Project concluded that the Institute approach promotes precisely the dimensions of teacher quality that result in increased student achievement. Based on the success of that Project, in 2004 it announced the Yale National Initiative to strengthen teaching in public schools, a long-term endeavor to establish exemplary Teachers Institutes in states throughout the country.

Teachers had primary responsibility for identifying the subjects the Institute would address. Between October and December 2006, Institute Representatives canvassed teachers in each New Haven public school to determine the subjects they would like the Institute to treat. The Institute then circulated descriptions of seminars that encompassed teachers' interests. In applying to the Institute, teachers described unit topics on which they proposed to work and the relationship of these topics to Institute seminars and to courses they would teach in the coming school year. Five seminars were organized, corresponding to the principal themes of the Fellows' proposals. Between March and August, Fellows participated in seminar meetings, researched their topics, and attended a series of lectures by Yale faculty members.

The curriculum units Fellows wrote are their own; they are presented in five volumes, one for each seminar. A list of the 181 volumes of Institute units published between 1978 and 2007 appears on the following pages. The units contain four elements: objectives, teaching strategies, sample lessons and classroom activities, and lists of resources for teachers and students. They are intended primarily for the use of Institute Fellows and their colleagues who teach in New Haven. Teachers who use these units may submit comments on them at http://teachers.yale.edu.

This *Guide* to the 2007 units contains introductions by the Yale faculty members who led the seminars, together with synopses written by the authors of the individual units. The Fellows indicate the courses and grade levels for which they developed their units; many of the units will also be useful at other places in the school curriculum. Copies of the units are

deposited in all New Haven school libraries. Guides to the units written in earlier years, a topical *Index* of all 1644 units written between 1978 and 2007, and reference lists showing the relationship of many units to school curricula and academic standards are available from the Institute. An electronic version of these curricular resources is available on the Institute's Web site at www.yale.edu/ynhti/.

The Yale-New Haven Teachers Institute is a permanently endowed unit of Yale University. The 2007 Institute was supported also in part by grants from the Sherman Fairchild Foundation, the Howard Hughes Medical Institute, and the National Science Foundation. The New Haven Public Schools, Yale's partner in the Institute, has supported the program annually since its inception. The materials presented here do not necessarily reflect the views of the funding agencies.

James R. Vivian

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I. American Voices: Listening to Fiction, Poetry, and Prose

Introduction

Young people learning to read literature need to learn to hear voices. This may be especially true for American readers. The literature of this nation arose in a vital culture of oral performance: sermons, speeches, debates, and drama were crucial forms of expression in early America. This tradition lies behind a continuing preoccupation with voice in American literature: over and over again, American writers imagine themselves not as writing, but as speaking, to their readers. Responding to American literature, we respond to its long history of individual voices.

This seminar explored American literature as the creation of particular speakers in multiple forms: fiction, poetry, and prose. We studied and discussed some of the most famous and arresting American voices—the poet who calls to us across time and place in Whitman's "Crossing Brooklyn Ferry," the entertaining teenager who narrates *Huckleberry Finn*, and the visionary Civil Rights leader who declared, "I have a dream"—while exploring the rhetorical techniques by which these voices were created, and through which they go on speaking. For voice in writing is always a special kind of illusion through which an author's words, although silent on the page, enter and resound in the reader's mind, full of feeling and implication, conveying multiple kinds of information, and rich in meaning.

Our readings and discussion included, in sequence, some classics of American literature: sermons and speeches by Jonathan Edwards, Patrick Henry, Abraham Lincoln, Sojourner Truth, and Martin Luther King, Jr.; poems by Walt Whitman and Emily Dickinson, Robert Frost (and Frost's letters on what he calls "the sound of sense" as well as his lecture "The Imagining Ear") and Langston Hughes; and Mark Twain's *Huckleberry Finn*, which we spent two weeks on. We were concerned in all of these classes with the ways in which voice is constructed on the page, and the particular expressive functions of sound in writing.

Twain's novel introduced the question of dialect, and its repeated use of the word "nigger" prompted extended discussion of what it means to use that word. In response to our discussion, I introduced the seminar to an essay called "Teaching the N-Word" by Emily Bernard, a professor of African American literature at the University of Vermont, which speaks about the author's experience discussing the word in her college classroom and some of the meaning the word has had in her life. We also read newspaper articles and personal essays dealing with the question of Black English, including materials relating to the public controversy over the status of Ebonics in the Oakland, California, school system in the 1990s. We read James Baldwin's short essay "If Black English Isn't a Language . . ." and selections from Alice Walker's novel *The Color Purple* and Ralph Ellison's novel *Invisible Man*. Ellison's novel, like Twain's, presents a view of American literature as multi-voiced, mixing multiple forms of speech and tradition.

Many of the teachers in our seminar teach students whose first language is Spanish, and we included two weeks of discussion of Latino/a authors who speak of the experience of

learning English, and who reflect on the situation of Spanish speakers in a nation dominated by English. We read essays by and interviews with Richard Rodriguez, and essays and fiction by Julia Alvarez, Gloria Anzaldúa, and Sandra Cisneros.

In an effort to find a contemporary voice that might speak to young people today with the force and relevance many of us remember from J. D. Salinger's Holden Caulfield's first-per- son in *The Catcher in the Rye*, we pooled suggestions and voted to read together *Push* by Sapphire. Then, in the final class session, each Fellow took part of class time to present a text orally—some suggesting models of how reading aloud might be used in the classroom, others simply sharing writing that was compelling to them.

My assumption in designing this seminar was that a focus on voice would be a useful way into the study of literature for students of all levels. Students are frequently intimidated by reading and writing assignments. In school, they learn to use language in unfamiliar ways; in a sense, they are learning another language, or, more precisely, they are learning how to use language in unfamiliar ways. The challenge is especially acute for students whose first language is not English.

But most students already understand and have access to the power of language through oral experience, and my hope was to devise ways to draw on this strength as we help students come to writing. Students are indeed more often than not resourceful and expressive speakers and shrewd listeners, well acquainted with the pleasure and power of speech from their daily interactions with each other and their families, and from their experience of music, film, and other media. The seminar aimed to develop conceptual and practical strategies for drawing on students' existing talents by using their oral skills to establish a foundation for their work as writers and readers.

The Fellows took up this project in a wonderful array of ways in a series of curriculum units designed for the full spectrum of the public school system in New Haven. Sean Griffin, for example, uses "Open Mic Fridays" to get his eighth-graders talking about themselves in his unit "The Search for Self: Voices of Adolescence in Literature"; this practice is modeled on Nikki Grimes's novel, *Bronx Masquerade*, the story of a New York school where an open mic classroom discussion becomes the basis for student poems and stories, which Sean's stu- dents read and imitate eventually by producing their own writing.

Like Sean's, many of the units focus on the process by which students come to write about themselves and their world, in response to selected readings. This is the project of Dana Buckmir's unit, "Discovering the Voice Within: Encouraging Students to See Themselves as Writers," designed for tenth-graders, which is centered on prose memoir and poetry, which Dana's students study and produce their own versions of. Judy Katz's unit for creative writing and language arts classes, called "Uncovering Your Students' Authentic Voice," has similar goals, while focusing on poetry and poetic technique, and using a "Master/Apprentice" model which encourages students to find their own voices by imitating and responding to powerful literature, from Whitman to Def Poetry. Sandy Friday, in "Searching American Literature to Find and Fall in Love with Your Own Voice," is doing something similar, but in a classroom setting where students have only the most basic literacy skills. Sandy has created a unit that encourages her students to see the process of finding a voice to describe their world and express their feelings as itself a dramatic story with a certain plot. To help students recognize and enter into this plot of introspection, self-discovery, and liberation, she introduces them to a

broad range of exciting texts, mostly poems and short stories, which model the project of coming to writing and enhanced self-expression in which they are themselves engaged.

In her unit "The Civil and the Wild in American Discourse," designed for an honors class of high school juniors, Melissa Dailey encourages students to become aware of the demands and opportunities of their own literary education. Dealing with a broad range of multicultural texts in American literature, Melissa's unit helps students reflect on the "sivilizing" process (to take a word from Huck Finn) in which they take part as they learn to read literary texts and to produce their own writing, both analytic and creative, prose and poetry. Dina Secchiaroli, whose unit includes serious reflection on the question of voice in writing, also encourages a "meta-cognitive" awareness of the learning process in her ninth-grade class. Dina's students are in many cases reading far below their grade level, and may have experienced frustration or unhappiness in school previously. Like Sandy Friday, Dina approaches this challenge by taking introspection and liberation as her theme. Her unit, "Bottled Up: Unlocking the Voice of the Struggling Reader," uses, among other texts, the novel *Bottled Up* by Jaye Murray to lead students toward complex self-expression.

Carlos Lawrence's unit, "Poetry and Prose to Increase Literacy and Writing Skills," is designed for special education students in the eighth-grade, where his challenge is to create a curriculum that can be modified to address students working at very different levels of literacy and with a range of individual needs. "Voice" provides common ground for students with different capacities for reading and writing. The first and third sections of his unit make connections between students' everyday experience and their literary education, the first focusing on "Hip Hop and the Classics," and the third, "What Are We Watching?," on media commercials. The middle section, using historical documents, including the drafts of Martin Luther King Jr.'s "I Have a Dream" speech, introduces students to the revision process.

Matthew Cacopardo, in "The Persuasive Voice: Communication as a Resolution to the Cold War," working with special needs students, also has a historical focus on public speeches, in his case on key speeches during the Cold War. Matthew is interested in the way communication can help resolve conflict, with examples from public life helping students envision how they can use their voices to solve problems in their daily life as well as on the level of the community and nation. His unit is conceived against the backdrop of the war in Iraq.

Susan LaForest has created a unit for bilingual students in grades four through six called "American Voices: The Varied Carols We Sing"—the second phrase there coming from Whitman. Susan uses a focus on voice to explore some of the various regions and cultures of the United States, in an effort to acquaint students with the nation, its culture, and its history, with an emphasis on the immigrant experience. Ekaterina Barkhatova, in her unit "Hearing Latino Voices as a Way for Students to Understand Their Own Hispanic Identity," proposes a curriculum for Spanish-speaking elementary school students learning English that does not

ask them to forget or put aside the Spanish language and their Hispanic culture but instead invites them to build on these resources and indeed to reflect on and deepen their knowledge of them by reading bilingual Latino/a authors, including Gary Soto and Sandra Cisneros. She wants to help her students take pride in their native language and culture even as they learn English and advance in American schools. María Cardalliaguet, teaching Spanish to high school students in New Haven, outlines a unit, called "Voces Latinas: Cultural Identity through Poetry and Lyrics," that introduces students of Spanish as a foreign language to the beauty and cultural richness of the language through a study of multiple expressive forms, including poetry and music primarily. Her unit stresses continuities between Spanish and various Latin American literatures, while enlivening the study of a foreign language with an energetic focus on diverse, compelling music, with accessible but suggestive lyrics.

The idea of voice—as a key property of written texts, of music and other cultural forms, and above all of the students' speech and experience—holds together this remarkably diverse but unified array of curriculum units, all addressed to a student body that is diverse in its social make-up and spectrum of individual needs.

Langdon Hammer

Synopses of the Curriculum Units

07.01.01
The Search for Self: Voices of Adolescence in Literature, by Sean Griffin

Utilizing literature of the adolescent search for self, my unit is designed not only to understand the characters' struggles, but to allow students to examine their own struggles, to open up to each other and more importantly, to themselves. I want our students to realize that writing is a vehicle that they can utilize to help themselves find their way. I hope to help students to understand the power of writing and poetry.

Through participation in "Open Mic Fridays" and journal writing throughout the unit, students will share their thoughts on a variety of issues. Students will also create a class book of poetry in which their most meaningful and intriguing work will be bound.

Finally, students will be introduced to the Harlem Renaissance. The study of the Harlem Renaissance is a nice addition to the unit because students are able to see that the movement was a collective "search for self" as African American artists gathered in Harlem to create one massive, glorious voice.

(Developed for English, grade 8, recommended for English Language Arts, grade 8)

07.01.02
Discovering the Voice Within: Encouraging Students to See Themselves as Writers, by Dana Buckmir

This unit explores the genres of poetry and memoir. Students will read and analyze a variety of famous authors such as Langston Hughes, Nikki Giovanni, Maya Angelou, Martin Espada, Julia Alvarez and Gary Soto. Students will participate in activities in which they share their writing with their peers and view student exemplars. Students will practice their writing in their journals, with multiple drafts in the effort ultimately to create their own original work. They will dis- cover how voice lives throughout all forms of writing in various forms across cultures, time periods, gender, race, ethnicity and even the human body. Students will see how voice is significant and an important motivator for change, growth and authority. Voice can empower, punish, and honor the dead. Finding one's individual voice can work through emotions of grief, anger, uncertainty in the search for self which is typical of adolescents. Students can use writing to express their feelings and cope with tragedy in a positive outlet. I will teach this unit in a secondary English classroom with various modifications and strategies for English Language Learners. Students will use writing as a means for self- awareness as well as cultural awareness and understanding the community. As they emerge as readers, writers and thinkers, they will grow to understand their emotions and better understand the world outside of themselves.

(Developed for English and Sheltered Content, grade 10; recommended for English and ESL, grade 10)

07.01.03
Uncovering Your Students' Authentic Voice, by Judith J. Katz

This unit proposes to show students how reading helps you become a better writer and vice versa especially as reading and writing both relate to the idea of authentic voice. The underlying idea is to give students a broader base of prior knowledge by exposing them to some great American writers they most certainly would not read on their own and by giving them the vocabulary they need to understand, analyze, and synthesize the voices of those writers. I want them to begin to ask and answer what is arguably one of the primary essential questions of literature: What is this writer doing and what effect is it having on me?

Students are rarely given a guided opportunity to use the well-developed voices of famous writers, speakers, and singers as an actively working model for finding their own authentic voice. Identifying and working with literary elements—including personalized content, audience, syntax, sound, and rhythm— contributes to the creation of an authentic voice whether that voice belongs to an established, revered writer or to a student whose voice is just emerging.

(Developed for English Language Arts, grade 10, and Creative Writing, grade 12; recommended for English Language Arts, grade 10, and Creative Writing, grade 12)

07.01.04
Searching Literature to Find and Fall in Love with Your Own Voice, by Sandra K. Friday

My unit focuses on how voice expresses attitudes and feelings of protagonists, some of whom think of themselves as helpless victims, some who are trying to break out of their victim image, and some who have managed to liberate and empower themselves completely. Students will experiment with a variety of ways of reading/acting the voices in poems, short stories, and excerpts from autobiography for the class. Based on these interpretive performances, the class will practice making observations backed up with evidence from the literature as to what the attitudes and feelings are that are being expressed. They will compare the degree to which the voices of the protagonists express a range of feelings of victimization or liberation and why. Some protagonists' voices express the whole range within one selection.

Throughout my unit, students will experiment with and explore their own voices, based on the voices in the literature we are reading. Ultimately, each student will produce a portfolio of his or her own work based on these experiments and explorations. Of course, students will share with the class the voices in their work.

My unit also includes activities that give students the opportunity to practice each of the four Language Arts CAPT questions in which they will all need to demonstrate proficiency in order to meet the state requirements for graduation.

(Developed for Writing Seminar, grades 9-12; recommended for Creative Writing, English, and Literature, grades 9-12)

07.01.05
The Civil and the Wild in American Discourse, by Melissa Dailey

This unit emphasizes the power of the spoken word to articulate an outsider's perspective on

society's problems. Tone, structure, style, sound, audience and content all play a role in voice. Each of these elements has the potential to be civil or wild although neither exists without the other. We will be reading Maya Angelou, Mark Twain, Martin Luther King Jr., Sojourner Truth, Henry David Thoreau, Claude McKay, and Miguel Pinero. Each of the texts comments on the ills of society.

Each of the writers is critical of the mainstream in one fashion or another. In addition to the texts above, we will listen to music and look briefly at art.

In this unit students will think critically about what they are reading as well as the world around them. They will engage in the writing process while being aware of their purpose and audience. Drawing connections between texts and personal life will be key to the intent of the unit.

Students will produce numerous writing assignments. A journal will be kept throughout the unit. The final projects will be published in a class magazine. Part of the intent of the unit is for students to sharpen their own voices. Through the study of different writers and artists students will develop an understanding of how to manipulate the elements of language in construction of their voices.

(Developed for English 3, grade 11; recommended for English 3, High School grade 11)

07.01.06
Bottled Up: Unlocking the Voice of the Struggling Reader, by Dina Secchiaroli

Many teachers find voice a hard concept to teach and an even harder one for students to master. Add a struggling reader into the mix, and it may seem as if voice is too complex a concept and skill to teach. What exactly do we mean by voice? How do we teach it? How do we know when students have found it?

Written for lower-level readers in high school, but applicable to higher levels, the unit consists of four parts: finding the voices we hear as we read, finding the author's voice, finding our voice in the classroom, and finding our voice as writers/creators. Part one focuses on teaching students to interact with texts to comprehend what is happening. Part two centers on teaching students to analyze a text for the author's voice. Part three speaks to teaching students how to have an authentic discussion in class: expressing their prerecorded thoughts clearly and articulately, actively listening, and responding in a way that encourages further thinking, while respecting and appreciating divergent thinking—having the difficult conversations and making our voices heard even when the rest of our peers disagree with our perspective. Part four challenges students to stop "playing school" so they see themselves as real writers doing the things real writers do.
Students create a non-print text (documentary, power point, etc.) to voice their perspective on an issue.

(Developed for English, grade 9; recommended for English and Language Arts, grades 9, and Middle-11)

07.01.07
Poetry and Prose to Increase Literacy and Writing Skills, by Carlos A. Lawrence

This unit is designed to provide literacy and writing teachers with strategies and activities that use poetry, songs, speeches, and historical documents to increase reading comprehension and encourage the revising aspect of the writing process. The unit is designed to fit the United

States national standards and objectives for language arts curriculum with regard to multicultural understanding, evaluation strategies, communication skills, and applying language skills. This unit is also designed to adhere to the No Child Left Behind Act and the Individuals with Disabilities Education Act with regard to standard-based and individualized education methods.

The methodology includes integration of literacy and writing objectives through analysis, interpretation, and comparisons that teachers may use to stimulate meta-cognition. This unit is designed to be inclusive of students with different learning styles and cognitive abilities and will be especially useful for teachers who use a multi-level approach of instruction that addresses these learning diversities in the classroom. The analytic approach focuses on the analysis of distinction in a writer's voice with a focus on allusion, repetition, alliteration, simile, anaphora, analogy, metaphor parallelism, and imagery. This unit is divided into three sub-units entitled "Hip Hop and the Classics," "Who Gets It Right the First Time?," and "What Are We Really Watching?" These units encourage critical thinking, oral discussion, collaborative learning, and written responses based on Connecticut Mastery Test (CMT) objectives. These objectives are: understanding of the main idea, developing an interpretation, making connections to a text, and demonstrating a critical stance. The teacher will guide the students toward com- posing and articulating their own poems and speeches and creating their own mock television commercials. The unit is intended to provide activities that teachers can use to help students appreciate and enjoy poetry, the writing process, and encourage public speaking.

(Developed for Literacy and Writing, grade 8; recommended for Language Arts, Literacy, and Writing, grades 5-8)

07.01.08
The Persuasive Voice: Communication as a Resolution to the Cold War, by Matthew Cacopardo

This unit assists students with specific learning disabilities in basic reading skills and written expression to make an informed decision about ways to resolve conflict. It will challenge students to investigate and seek answers to why it is important to communicate when conflict arises. They will explore this issue and demonstrate their ability to construct meaning by analyzing and responding to presidential speeches that were influential during the Cold War. Students will analyze how the voice of the speaker is used to persuade an audience by viewing video clips, listening to audio recordings and reading along with speeches that were influential in ending the threat of nuclear war. Students will examine the material both individually and collaboratively to determine what the speaker was implying by their words and body language. Students will conclude the unit by taking a critical stance on how to solve a problem between two parties that have conflicting views. This argument will be in the form of a persuasive speech which will be presented as a final summative assessment. This unit will provide students with the skill of organizing their thoughts about a topic in essay form and using expression in voice to persuade their audience.

(Developed for Special Education, grade 12; recommended for U. S. History and English, grade 11, and Special Education, grades 11-12)

07.01.09
American Voices: The Varied Carols We Sing, by Susan LaForest

The objective of this unit is to use "Sheltered English" strategies to teach elementary English language learners social and academic language, while at the same time they actively engage in tasks that enhance their content and literacy skills.

English language learners will work on lessons that promote knowledge in the four skill areas of language acquisition: listening, speaking, reading, and writing. This unit will provide activities that English language learners can successfully accomplish whether they are at the beginning, intermediate or advanced language proficiency level. Students will learn that America is a country of many different kinds of people. This unit provides an opportunity for these students to learn the diverse voices of different groups of Americans including: women, African Americans, Latino Americans, and Native Americans. It also will foster the students' understanding of various geographic regions in the United States. The les- sons are based on "Sheltered English" methodology and, in particular, use the components of the "Sheltered Instruction Operational Protocol" or the SIOP methodology.

(Developed for Reading and Literacy, Bilingual grade 4; recommended for Literacy and Language, grades 4-6 bilingual, and mainstream elementary students, grades 4-6)

07.01.10
Hearing Latino Voices in American Literature as a Way for Students to Understand Their Own Hispanic Identity, by Ekaterina Barkhatova

This unit is designed for fourth-grade bilingual students (with origin from Latin American countries) who receive Language Transitional Support Services in English in the mainstream classroom. It focuses on teaching how to find a distinctive writer's voice through appealing to one's cultural background. Along with this, reading Latin American authors is incorporated to bring students to identify themselves with the narrators who speak very explicitly about their Latino culture. The ultimate goal of the unit is for each student to be able to communicate his or her cultural experience to the audience through pieces of writing portraying his or her own unique image. This goal is based on the fact that one's voice serves as a vital part of his or her identity, so one obviously cannot conceal his or her cultural and family belonging when he or she has a chance to use voice. The unit guides students to realize that when they speak passionately, they reveal something about their family and their culture. As writers, they should capitalize on this fact and learn how to make *their* voice an integral part of their writing.

(Developed for Elementary Literacy Program, Reading Comprehension, Writing, and Language Transitional Support Services, grade 4; recommended for Elementary-Reading Comprehension and Writing, grade 4, bilingual in the mainstream classroom)

07.01.11
Voces Latinas: Cultural Identity through Poetry and Lyrics, by María Cardalliaguet Gómez-Málaga

This unit seeks to achieve a variety of different goals. It will give me the opportunity to introduce literature, and the concepts of "cultural identity" and "voice," in the classroom. By teaching students to analyze, interpret and understand poems (and songs), I will provide them with the tools to value and enjoy poetry, to acknowledge the relevance of the Latinos in the United States, and also the opportunity to learn Spanish while they take in the importance of

history and cultural connections.

As a result of this unit, students will value "voice" as a vehicle to express points of view and feelings. They will also learn about the Nuyorican Movement, its major poets and the musical tradition of the "trova" in Cuba and Puerto Rico.

The unit is designed to be taught in my Spanish I levels, but with proper modifications it could be used with upper levels: Spanish II and Spanish III.

(Developed for Spanish I, grades 9-12; recommended for Spanish I and II, grades 9-12)

II. Voyages in World History before 1500

Introduction

As anyone who has ever tried it knows, teaching world history is almost impossible. There is simply too much to cover. Our seminar tried to make world history more digestible by focusing on a specific traveler rather than attempting to cover everything about a given society. Our seminar embarked on over ten different journeys—starting with Kennewick man's walk to the New World some 8400 years ago and ending with a Muslim traveler who covered more ground than anyone else before 1500 (75,000 miles). In between, we traveled to Mesopotamia with Gilgamesh, to the New World with the Vikings, to China with a woman poet, and to the Mongols during the time of Chinggis Khan. The narratives of these travelers offered an entrée into both the home societies of the travelers and the new civilizations they visited.

Five members of the summer 2007 seminar chose to focus on an individual traveler or society or on two travelers. Kristen Grandfield's unit "Teaching the *Epic of Gilgamesh*" takes the hero of the epic poem as the focus of her language arts unit. Her breakdown of the plot, tablet by tablet, is particularly helpful to anyone teaching the epic. Barbara Natale's unit, "China: Soldiers, Sudoku, and Stories," offers grade-school teachers an interdisciplinary introduction to Chinese civilization, including the writing system, the terracotta warriors, and Chinese numbers (which are also used in the Japanese game of Sudoku). This unit also emphasizes fun reading. Sarah Black's unit, "Fact versus Film: How Hollywood Depicts the Crusades in the *Kingdom of Heaven*" takes advantage of high school students' interest in film to teach them how to read and analyze primary sources, both from the Crusaders' point of view and from that of their Islamic opponents. Justin Boucher's "The 1183-1185 Hajj of Ibn Jubayr and teaching Islam" focuses on a single Islamic traveler, Ibn Jubayr. This unit allows high school history teachers to teach the broad tradition of Islam by focusing on a single traveler, who left an extremely detailed account of his hajj pilgrimage to Mecca, which has been fully translated into English. By the end of the unit, students will come to know Ibn Jubayr extremely well.

Niki LaMontagne's unit, "Two Twelfth-Century Couples: Heloise and Abelard of France and Li Qingzhao and Zhao Mingcheng of China," is designed to teach students in high school about relationships by studying two relationships far from their own time and place.

Six members of the seminar were drawn to the last group of travelers that we encountered, including Ibn Battuta (1304-1368/69), who covered 75,000 miles in Afro-Eurasia in the 1300s. Ibn Battuta's account of his travels is available in translation and makes fascinating reading; in addition Ross Dunn has written an excellent book about his travels that is required reading for anyone interested in world history. Ibn Battuta is also the subject of numerous children's books and innovative Web sites.

Christine Elmore's unit, "An African Pilgrim-King and a World Traveler: Mansa Musa and Ibn Battuta," aims to strengthen students' reading skills by focusing on two Africans: Ibn Battuta and the king Mansa Musa. Her unit ends with a play that grammar school students can perform to improve their fluency in reading. Paula Ranciato's unit, "Ibn Battuta's Journey by Land and by Sea: Investigating Cultural Landscapes" seeks to broaden her students' personal landscapes by encouraging them to read, to make beads, and to learn in multiple ways about Ibn Battuta and Africa. Christopher Bostock's unit, "The Expansion of Maps and Minds Before 1500: Ibn Battuta, Christopher Columbus, and Google Earth," harnesses technology— the downloadable program Google Earth—to the study of history and geography. His unit asks middle school

students to follow the routes of two travelers in order to learn about the geography of the entire world as well as the study of history. It offers an ideal introduction to social studies. Marialuisa Sapienza's unit, "Who First Reached America: the Vikings, the Chinese admiral Zheng He, or Columbus?" focuses on maritime travel (and does not examine Ibn Battuta). Her unit pushes language arts students in high school to read primary source accounts carefully in order to answer the question posed by the title of her unit. (Warning: the answer to the question is not what you expect!) Mary Lou Narowski's unit, "The Voyages of Kennewick Man, Gilgamesh, Ashoka, Leif Eriksson, Li Qingzhao, and Ibn Battuta," embraces world history with her characteristic enthusiasm: her unit asks her middle-school students to make journals so that they can personally experience the thrill of doing their own research in both language arts and social studies. Brad Magrey's unit, "Traveling with Ibn Battuta and the Plague through the Islamic World, China, Europe and Mexico, 1325-1350," seeks to expose seventh and eighth-graders to the entire world in the 1300s by focusing on four different places in the 1300s and learning about these same places today.

As a group, these units eloquently demonstrate how many people traveled in the centuries before Columbus's voyage.

Valerie Hansen

Synopses of the Curriculum Units

07.02.01
Teaching the *Epic of Gilgamesh*, by Kristen Grandfield

The ideas of the journey and the epic as well as the hero itself are the basis for this curriculum unit. The unit will begin with basics of the epic, the epic hero, and the epic cycle. Then, we will look at the *Epic of Gilgamesh* and its historical and literary impact. Time spent with the *Epic of Gilgamesh* will also allow students to study Mesopotamia as an early civilization. In the end, the students will not only read and learn about Mesopotamia and *Gilgamesh* but will also have a chance to write and act out their own epic adventures. Reading *Gilgamesh* allows for discussion of larger issues in literature and life: roles of women, the use and abuse of power, friendship, and the importance of the epic in a particular society or culture.

(Developed for World Literature, grade 12; recommended for World Literature, grades 11-12)

07.02.02
China: Soldiers, Sudoku and Stories, by Barbara Natale

This unit will provide students in grade four with an exciting opportunity to visit China without leaving their classroom! During the lessons, students will come to the realization that China has a very interesting past. Reading about the Qin Emperor and his Terracotta Warriors will engage learning and curiosity. Students will experience the exciting discovery of the Terracotta Warriors through books, pictures and computer research. A creative art lesson will allow students to envision what it was like to make the real Terracotta Warriors.

Students will become excited that they will also learn to read and speak Mandarin. A fun Sudoku math game will be the culminating activity that students will really enjoy. At Davis Street Interdistrict Magnet School, we embrace multiculturalism, and my class will not only embrace the activities, but they will want to visit China upon completion of this unit. Any teacher, regular or special education, can utilize any or all of this unit. Because of the hands-on activities, students will enjoy this unit and hopefully add some creativity when making the replica Warriors. These lessons allow teachers and students the opportunity to work together to better understand the Chinese culture, and way of life. Fourth-graders are at a very pressionable age, and maybe one of the lessons in this unit will inspire them to travel to China and view the Great Wall or amazing Terracotta Warriors.

(Developed for Language Arts, Mathematics, and Social Studies, grade 4; recommended for Language Arts, Mathematics, and Social Studies, grade 4)

07.02.03
Fact versus Film: How Hollywood Depicts the Crusades in the *Kingdom of Heaven*, by Sarah Black

The goal of this unit is to use my students' love of film to teach them how to distinguish between historical facts and inaccuracies that plague "historically representative" films. Specifically, this unit will help my students develop a critical eye when viewing historical films by strengthening their background knowledge and understanding of historical context so they can discern historical fact from fiction.

This unit will analyze how the Medieval European Crusades were portrayed in the film *Kingdom of Heaven* (2005). The film portrays the events leading up to the Battle of Hattin in

1187. In the course of this unit, my students will analyze primary sources and read secondary sources to provide background information and survey a range of historical perspectives on the Crusades. We will then view *Kingdom of Heaven* and draw comparisons between the primary source accounts as well as the film's portrayal of those same events. For the culminating activity, my students will choose between acting as either a film critic, writing a review for *Kingdom of Heaven* for its historical accuracy; or as screenwriter, rewriting the script for a chosen scene in order to make the scene more historically accurate.

(Developed for World History, grades 9-12; recommended for World History, grades 9-12)

07.02.04
The 1183-1185 Hajj of Ibn Jubayr and Teaching Islam, by Justin Boucher

The goal of this unit is to guide high school history students in a study of the early Islamic world through the eyes of a 12th century Spanish pilgrim, Abul- Husayn Muhammad ibn Ahmed ibn Jubayr. Ibn Jubayr undertook the Hajj in 1183 and traveled extensively throughout the Islamic world before his return to Spain, meticulously documenting his travels. This unit follows his travels through his writing while exploring such major themes in history as the movement of ideas, religious experience, and changing perspectives on historical data all through primary source reading. This use of one excellent primary source will allow the teacher to stress the importance of primary sources in historical study, while allowing the students to identify deeply with an historical figure.

Approaching the early Islamic world in this way gives teachers, particularly teachers of world history, the chance to expose their students to the Islamic world, before the Mongol invasion, and in only three weeks of classroom time.

(Developed for World History, grade 9; recommended for World History, grades 9-12)

07.02.05
Two Twelfth-Century Couples: Heloise and Abelard of France and Li Qingzhao and Zhao Mingcheng of China, by Niki LaMontagne

Relationships are an integral part of high school. Working in a large magnet high school, whose student body is populated by 20 surrounding school districts, I have witnessed the creation and demise of many student relationships. In history, there too have been many relationships built and destroyed.

The purpose of this unit is to take advantage of the historical figures Heloise and Peter Abelard, as well as Li Qingzhao and her husband Zhao Mingcheng to illustrate the variance of relationships amongst historical figures. These historical figures will also be used to teach the students about the culture of Medieval China and Europe.

Students will engage in classroom activities such as making predictions about Medieval Europe and China based on images and facts. The students will also participate in a variety of class activities that analyze primary sources from Heloise, Peter Abelard, and Li Qingzhao. Through the activities of the unit, stu- dents will critically examine the relationships presented in the literature of these figures in order to create a cross-cultural identification with the historical figures, as well as making a connection to the types of relationships that exist in the students' lives.

(Developed for World History, grade 9; recommended for World History, grade 9)

07.02.06
An African Pilgrim-King and A World-Traveler: Mansa Musa and Ibn Battuta, by Christine Elmore

In this unit I plan to take a unique approach and teach world history by using the travel narrative of the famous 14th century Muslim globe-trotter, Ibn Battuta, who set off in 1325 to make a pilgrimage to Mecca and didn't return home until 29 years later. We will focus on his final journey in 1353 from Morocco to the kingdom of Mali, West Africa and see history unfold before his eyes. Along the way we will gain valuable insights into African and Muslim beliefs of that time and a special focus will be placed on studying the Hajj in all its detail. His travels will provide the larger context for exploring a variety of related topics of particular interest to my young learners including caravan travel by camel, the Tuareg, the hazards of desert travel, and the founder of Mali, Sundiata. Of particular appeal to third-grade students will be the additional unit focus on the very colorful historical figure, Mansa Musa, the great ruler of the flourishing Mali empire (from 1312 to 1337) who was often referred to as 'the Black Moses.' His legendary pilgrimage in 1324 to Mecca by way of Egypt, accompanied by a lavish African entourage, will provide a marvelous opportunity to stimulate student interest in further reading and research. At the unit's end is a Readers Theater play on Sundiata, the founder of the Mali empire.

(Developed for Reading, grade 3; recommended for Reading, grades 3 and up)

07.02.07
Ibn Battuta's Journey by Land and by Sea: Investigating Cultural Landscapes, by Paula Ranciato

This unit is designed to be incorporated into a World History course. The unit is written with a wide range of abilities in mind and would meet the needs of students from grades six to twelve. Some sections will need to be modified for use with middle school students. People travel for a variety of reasons. Today travel is by car, boat, or plane and we can reach our destination within a reasonable period of time. By walking in Ibn Battuta's shoes students can imagine what Muslim travelers during the 1300s encountered on their pilgrimages to Mecca. Ibn Battuta's journey, for the most part, followed important trade routes linking the continent of Africa to Eurasia. By reading his writings students can experience the hospitality, companionship, customs and the dangers of travel by land and sea during the 12th century. Investigating travelers allows our students to understand, study and analyze the expansion of Islam.

The unit can be completed in three to four weeks. The unit is designed to motivate students and provide excitement in the classroom through activities involving map skills, development of written narratives, journal entries and analyzing visual arts such as illustrations and paintings. The main goal of this unit is reading and interpreting primary sources. The most important of these is the rihla (travel account) written by individuals on their pilgrimages. By investigating journeys the students discover how the world of the 1300s was interconnected rather than disconnected.

(Developed for World History, grades 9-12; recommended for Ancient History, grades 6-8 with modifications, and World History, grade 9-Adult)

07.02.08

The Expansion of Maps and Minds before 1500: Christopher Columbus, Ibn Battuta, and Google Earth, by Christopher Bostock

This unit is designed to help middle school students acclimate themselves with world geography. By examining the writings of Ibn Battuta (a Moroccan Muslim traveler from the 1300s) and Christopher Columbus (one of the most well-known explorers in history), students will compare ancient geography with that of the modern world. In this unit, students will also practice their ability to judge the merit of primary sources, draw connections between themselves and the text, and practice using evidence to support arguments in their writing.

Another crucial component of this unit involves the use of technology to map out the routes traveled by the explorers during their journeys. Google Earth, a program developed by the software company Google that is available freely on the Internet, is a virtual globe. Students will use the software to trace the routes made by their explorers and create short animated films, which they will use to educate their classmates on world geography. The goal is to make students active participants in learning geography and to become critical historians who understand historical bias and the importance of different forms of sources.

(Developed for Social Studies, grade 8; recommended for Social Studies, grades 7-8)

07.02.09

Who First Reached America: The Vikings, the Chinese Admiral Zheng He, or Columbus? by Marialuisa Sapienza

My unit is primarily focused on the reading for information skills and on the connected writing skills which are required by the English curriculum. The unit will start with the following essential questions: Who reached America first: the Vikings in 1000, the Chinese Admiral Zheng He in the 1420s, or Columbus in 1492? What were these travelers looking for? What did they actually find and what benefits did they get? The students will be authentic 'researchers' whose primary goal is to determine whether the Vikings, Zheng He, or Columbus reached North America first. We may use the word 'discover' but the students will learn that the Amerindians, of course, knew that America existed. They will use primary sources—the travelers' writings—and a few secondary sources. The unit will analyze visual materials and written texts in order to understand, to compare and contrast, to synthesize, and to evaluate causes and effects. It will also require various writing activities—quick writes, analytical essays, written responses, summaries, peer's revisions and editing activities—and a final project that will be in the form of a documented essay with a visual presentation, or a simpler documented visual for those students who have special needs.

(Developed for College English and Pre-AP Language/Honors, grade 11; recommended for Language Arts, College English, AP Language and Composition, grades 11-12)

07.02.10

The Voyages of Kennewick Man, Gilgamesh, Ashoka, Leif Eriksson, Li Qingzhao, and Ibn Battuta, by Mary Lou Narowski

This unit was crafted to address several curriculum needs of my seventh and eighth-grade Language Arts students, namely reading for information using primary and secondary sources,

research-based writing with instruction on avoiding plagiarism, and reflective journal writing eliciting personal insights into each traveler's journey. A journey or trip holds expectations of excitement, adventure, thrill, obstacle, and final success or defeat. This unit will carry my students on an interdisciplinary exploration with travelers such as the Kennewick Man (8400 years ago), Gilgamesh (ca. 2650 B.C.), Ashoka (ca. 273-232 B.C.), Leif Erickson, (ca.960-1020), Li Qingzhao (ca.1084-1150), and finally Ibn Battuta (1304-1369), each of whom moved through different regions and times.

Beginning with the hands-on creation of personal journals, my students will have a "diary" of their own to record questions they may want answered or insights they may gain as they read about each adventurer. They will look at the many "forms" that writing and journaling took along the way. They will develop "traveler boards" as a graphic organizing tool, pulling important facts out of our selected readings, as well as an artistic creation. Finally they will write and present a final project designed to incorporate their individual understandings of our selected travelers.

(Developed for Language Arts, grades 7-8; recommended for Language Arts, grades 7-8, and Social Studies, Middle and High school grades)

07.02.11
Traveling with Ibn Battuta and the Plague through the Islamic World, China, Europe, and Mexico, 1325-1350, by Brad Magrey

This is a unit designed for seventh- or eighth-grade students of mixed ability levels. It will appeal to the students' interests and challenge their perceptions of religions and other cultures. It meets many standards of both the Language Arts and Social Studies curriculums. The unit examines four civilizations in the world within a brief time period, 1325 to 1350. It is set up like a travel adventure, complete with maps, itineraries, pirates, and hardships. It will begin with the travels of Ibn Battuta, the Muslim scholar from Tangier, and then it will explore other areas of the world that he did not visit. I have designed it for a Language Arts class, heavy on writing requirements, but it could easily be used in Social Studies. The major travel stops are as follows: Ibn Battuta at Mecca in 1326 and in Guangzhou (China) in 1346, the plague in London in 1349, and the founding of Tenochtitlan by the Aztecs in 1350. What the students learn will be tied to contemporary issues, such as crowd control at Mecca, the possibilities of a mod- ern plague, and environmental degradation.

Along the journey, students will keep a journal; create maps and illustrations; deal with the travel problems of the period; learn about religions, governments, and social structures of the time; learn what food and accommodations were available; and deal with the hygiene and difficulties of life during this period.

They will write and learn about history, geography, and themselves.

(Developed for Language Arts, grade 7; recommended for Social Studies, Language Arts, Reading, and Writing, grades 7-8)

III. The Physics, Astronomy and Mathematics of the Solar System

Introduction

Astronomy is a subject that excites everybody. It is one of the few physical sciences that seems to interest even those school students who are normally bored by the mere mention of the word science. As a result, astronomy is a great teaching tool, and it can be used to teach mathematics and physics, in addition of course, to teaching astronomy.

The purpose of this seminar was to develop different types of curriculum units, some to teach astronomy, others to use astronomy as a tool to teach the physical laws that control the solar system and other planetary systems, and yet others to teach the mathematical principles used to describe these systems. The seminar itself dealt with many different aspects of astronomy from the Sun, to planets, to how stars evolve and die, though the units are focused mainly on the solar system. Nine units were developed as a result of this seminar and they have been grouped according to subject matter.

The first set consists of units to teach astronomy. Larissa Giordano developed a unit to teach second-graders about the Moon. The emphasis is on learning to read through reading mythology about the Moon, and on science through learning the phases of the Moon and eclipses. Students will also learn about the Apollo missions and what it is like to train to be an astronaut. Huwerl Thornton's unit is about moons, not just Earth's Moon, but also Europa which is one of Jupiter's moons and Titan, one of Saturn's moons. The idea is to compare and contrast the different moons. The third unit in this series is that by Nicholas Perrone. Although nominally for fourth- to-sixth-grade students, it can be used in other grades too. The unit is very different from others in that the basis is a Web-based tool at http://www.spomonie.com/mrp/voyage/title.htm that will be used by students to "explore" the solar system. The unit itself contains all the background information a teacher would need to help the students.

Next come two units about teaching physics. Julia Biagiarelli's unit aims to teach the basic laws of physics to eighth-graders. They will first start by learning about Brahe, Kepler and Newton, the three people who observed, characterised and explained motions in the solar system. Then they will go on to learn the basic laws that can be used to explain the motion of the planets. Jennifer Esty's unit is for a higher grade and aims to teach students the nature of light, and the different processes by which astronomical bodies emit light.

The last group consists of units meant to teach mathematics. The first unit is by Maria Stockmal; she aims to use solar-system data to teach students how to graph and compare data, how to calculate slopes, how to use trigonometry to estimate distances and also about arc lengths and sections. Sam Jones' unit deals with teaching conic sections (both their history and what they are) using data solar-system data. The orbits of planets and comets around the Sun can be described by conic sections. Hermine Smikle's unit is meant for AP classes and has multiple aims, one of which is to introduce students to astronomy, and the other to com- pare topics in mathematics with those in astronomy. She starts with describing how early astronomers observed and described the solar system, and then goes on to connect mathematics to astronomy through the formulae used to describe the basic laws of physics. The last unit of this series, by Kenneth Spinka, is quite different; it aims to use the principles of astro-navigation to teach algebra, geometry, calculus and trigonometry.

Synopses of the Curriculum Units

07.03.01
Shoot for the Moon, by Larissa Giordano

The topic for this curriculum unit is the Earth-Moon system. My goal is to give students an overview of this system and describe different aspects, such as the physical characteristics of the Earth and the Moon as well as how they interact. We discuss the mythology of the Moon as well as examine the Moon as young scientists. We discuss phases of the Moon, solar and lunar eclipses and how the Moon affects the tides of the oceans, etc. A historical glimpse at how astronomers began to study the Moon and NASA's Apollo Missions is also included to inspire and motivate young scientists who may want to become astronomers or astronauts. This unit is designed to help teachers integrate astronomy within their own classroom by providing the necessary background knowledge about the Earth, its place in the solar system and the Moon. It has been designed such that it can be integrated into literacy, mathematics, science and technology classes, giving teachers the ability to integrate the subject matter within their own daily lesson plans to meet the needs of all learners while satisfying the curriculum standards of the school district. This unit is aimed at helping students think critically and solve problems, while simultaneously giving them a perspective about their place in a universe that is in constant motion.

(Developed for Science and Language Arts, grade 2; recommended for Science and Language Arts, grade 2)

07.03.02
Astronomy and Me: Moons Over New Haven, by Huwerl Thornton, Jr.

This unit will look at three moons in our solar system and do a comparison as to how the composition of each moon is similar as well as how they are different. The three moons to be compared are our very own Moon, Jupiter's moon Europa, and Saturn's moon Titan. The unit begins with an overall look at the make-up of our solar system. It introduces the eight planets and three dwarf planets. The unit touches upon the Asteroid Belt, Kuiper Belt, as well as the Sun. The unit also briefly examines the life of Galileo Galilei, as he was one of the first astronomers to use a telescope to view the stars and the Moon.

After the overall look at the solar system and Galileo, the unit takes a much more in-depth look at our Moon, Europa, and Titan. It takes a closer look at the composition of each moon, i.e. the size, surface, and atmosphere. The overall purpose of the unit is to examine each moon closely and build moon rovers out of K'NEX™ based on the surface structure of each moon. The lessons described in the unit are based on the introduction of the solar system.

(Developed for Elementary Earth Science, grade 4; recommended for Elementary Science and Earth Science, grades 3-6)

07.03.03
Voyage to the Planets, by Nicholas R. Perrone

This unit gives students an opportunity to research the eight common planets, dwarf planets, and the Sun in our solar system. The unit is an inquiry-based WebQuest requiring students to work in teams to research one celestial object. They use their research to create a computer slide show presentation as well as a model of a planetary probe to further explore their object. The WebQuest may be found at the following Internet address:

<http://www.spomonie.com/mrp/voyage/title.htm>.

In the Voyage to the Planets WebQuest, student groups will take on real-life roles to research properties of celestial objects using computers connected to the Internet. They will use their research and create a computer slide show presentation to give to the rest of the class at the end of the project. Each student will take on the role of astronomer in their research during the unit; in this role he will imagine what an astronomer would need to know about his topic. Other individual roles include the planetary scientist, who will become an expert in the physical properties of the celestial object; the aerospace engineer, who will design and build the probe model that will investigate the celestial object; and the expert in celestial mechanics, who will research the movements and gravitational forces of the object.

(Developed for Science Class, grade 5; recommended for Astronomy and Solar System, grades 4-6)

07.03.04
The Physics of the Planets: How 16th and 17th Century Physicists Helped Us Understand Our Solar System, by Julia Biagiarelli

This unit is designed for an eighth-grade Earth Science class. It can be adapted for grades five through seven as well. The concepts related to the movement of the planets are covered. Among topics discussed are: force, gravity, inertia, escape velocity, Newton's laws of motion and gravity, and Kepler's laws of planetary motion. In addition there are brief biographies and brief descriptions of the contributions to the field of astronomy of Tycho Brahe, Johannes Kepler and Isaac Newton. Also included in the unit is a brief overview of the ancient astronomical discoveries of China, Egypt and the Mayans. Drawing ellipses, measuring speed and creating a computer-based slide show with information on the objects in our solar system are some of the activities and lessons in this unit.

The following Connecticut State Education Standards for eighth-grade science are covered:
8.1 *Forces and Motion - What makes objects move the way they do?*
8.3 *Earth in the solar system - How does the position of Earth in the solar system affect conditions on our planet?*

(Developed for Earth Science, grade 8; recommended for Earth Science, Physical Science, and Astronomy, grades 5-8)

07.03.05
The Space Cadet's Laboratory: Using Electromagnetic Energy to Study Astronomy, by Jennifer B. Esty

The electromagnetic spectrum is a basic science topic that is covered in many different ways in many different classes in school. This unit will look at how the electromagnetic spectrum is used to study astronomy. This curriculum unit is written to be taught in a high school physics class; however, most of the ideas could be adapted for use in a middle school or a general science class. Many of the students for whom this unit is intended struggle with basic algebra and read, write and think at about an eighth- or ninth-grade level. Most of these students have had very little background in science of any kind, so there is a fair amount of basic and introductory information covered in this unit as well as some of the more advanced topics in the study of astronomy and energy.

This unit includes several hands-on activities intended to make the study of the electromagnetic

spectrum more interesting. These activities include building and using a simple spectrophotometer, and a new way to think about electron energy levels. All of the activities are suitable for high school level students and are probably adaptable for younger students as well as older ones.

(Developed for Physics, grades 9-12; recommended for Physics, General Science, and Astronomy, High School grades)

07.03.06
Astronomy: The Mathematician's Perspective, by Maria Stockmal

This curriculum unit offers a way to teach mathematics through astronomy. Sometimes teaching mathematics becomes a matter of routine. Keeping students engaged is a challenge in today's world with competition from electronics.

Since astronomy is a fascinating subject and captures the attention of everyone it is no wonder that there is a desire to write an astronomical unit to be used in the classroom to teach secondary school mathematics. Instruction of astronomy does not have to be confined to use in only the science classes but may be used in mathematics classes to teach mathematical concepts in a captivating manner.

The unit proposed is to instruct about graphs, slope, the Pythagorean Theorem, trigonometric ratios, measure of an arc length, and area of a sector. It contains all the astronomical information and data necessary for students to construct graphs and an idea on how to introduce finding the slope of a line.

The astronomy ideas used to teach geometric concepts are more involved and so astronomical information, data, and sample lesson plans are included.

(Developed for Algebra I, grade 9, and Geometry, grade 10; recommended for Algebra I, grades 8-9, and Geometry, grade 10)

07.03.07
Discovering Conic Sections in the Motion of Heavenly Bodies, by Sam H. Jones

The development of mathematics, from its very beginnings, has been about problem solving. The study of the heavens, in addition to the quest for knowledge about the world around us, was required in order for human beings to be able to better navigate, and map, the vast world around them. Rather than focus on the abstract and procedural nature of mathematics we will attempt to put a human face on what is a very human endeavor. Additionally, we will emphasize the problem solving and practical aspects of the whole enterprise. By having students "discover" ways to solve problems in a historical context we hope to facilitate a deeper and better understanding.

The unit will specifically investigate the origins of conic sections and the possible role of the sun dial in that discovery. The circle will be used to describe Ptolemy's universe. Kepler's First Law, in particular, will be used to model the path of orbits. Parabolas will be used to describe the trajectory of rockets and other Earth launched projectiles. Hyperbolas will be used to describe the paths of unbound objects in space. This is an introductory unit in conic sections suitable for high school Algebra II or Precalculus courses.

(Developed for Pre-Calculus, grade 11; recommended for Algebra II, grades 10-11, and Pre-Calculus, grade 11)

07.03.08
Mathematics at the Frontier of Astronomy, by Hermine Smikle

Early astronomers investigated the phenomena in the heavens through observations. The data collected from these observations were carefully documented. The application of mathematics and physics helped in the explanation and under- standing of those observations. Physics helped to explain and interpret the physical phenomena, while mathematics attempts to provide a quantitative model for the events.

The subject of astronomy, if taught at the middle and high school levels, is concerned mostly with the physical features of the solar system, the planets, and their orbits. The mathematics involved is usually not taught because it is considered to be too difficult for the students at those levels. This curriculum unit is written with the purpose to present some of the concepts of mathematics that are applied to selected topics in astronomy.

The Main Focus of the Curriculum Unit

Section 1: This section is written to stimulate students' interest in the topic and provide the historical setting for the development of the study of astronomy. In this section the contribution of early Greek and Arab observers is discussed.
Contributions of early astronomers Copernicus, Brahe, Kepler, Galileo, and Newton are discussed. This historical time line is designed to give students a look back at how these discoveries and inventions of the earliest astronomers have laid the foundation of present day astronomy.

Section II: An attempt is made to make some connection to mathematics. The topics discussed include escape velocity, gravity, orbital motion, cosmic distances and stellar parallax. These concepts are not usually included in regular school curricula. These are chosen to given students the opportunity to discuss these mathematical concepts since these are usually heard in the context of space programs.

Section III: The focus of this section is to use the mathematical models to solve problems. Efforts are made to present topics to occupy students in an AP calculus course after they have completed the AP examinations. The challenge is to find challenging but interesting topics that can be used to compliment the regular curriculum. The goal therefore, is to use this unit to engage students. The unit will minimize teacher talk, but will have students working together or individually to do research, make presentations, and solve problems. The concepts in most cases will be introduced with a significant task. This will require students to do some investigation on their own. To facilitate discussion of concepts in the unit, students will be asked to visit the NASA Web site and view the information. Selected Web sites will be visited in class to present the concept.

(Developed for AP Calculus, grade 12; recommended for Mathematics and Science, grades 11-12)

07.03.09
The Mathematical Dynamics of Celestial Navigation and Astronavigation, by Kenneth William Spinka

This unit introduces and integrates astronomy as a study subject relative to the math curriculum for high school grade levels within the New Haven Public School system. Specific goals and objectives are cited that will enable students to respond to a series of sequential assignments, culminating in one or more definitions of astronavigation and the mathematical dynamics in astronomy that are navigation-implicit. Astronomical reference points have prevailed as universal reference points for position-fixing derived with a variety of mathematical methods to determine the position of a ship, aircraft or person on the surface of the Earth until quite recently, with the advent of inexpensive and highly accurate satellite navigation receivers or GPS. The Algebra, Calculus, Geometry, and Trigonometry processes of Astronavigation are the subject of this presentation of math curriculum.

The first curriculum unit lesson plan constructs a sextant with which the other curriculum unit lesson plans are completed. The other curriculum lesson plans address one of three well known methods for calculating a navigator's position on earth using the astronomical references of celestial navigation: the Intercept Method, or Marc St. Hilaire Method; the Longitude by Chronometer Method; and the Ex-Meridian Method. Each of these three methods demonstrates the four New Haven math curricula: Algebra, Calculus, Geometry, or Trigonometry.

These lesson plans assist teaching navigational mathematics in the classroom with the astronomical content from the "Frontiers of Astronomy" seminar, referencing common celestial objects: the Sun; Moon; other planets; and 57 "navigational stars" described in nautical almanacs. The unit identifies goals, objectives, vocabulary, and assessments.

(Developed for Geometry, grade 10; recommended for Algebra, Calculus, Geometry, and Trigonometry, grades 9-12)

IV. The Science of Natural Disasters

Introduction

Earth is a highly active, mobile and, at times, hazardous planet. Earth's violent activity arises not only from its oceans and atmosphere, but also from its deep interior as well its orbital journey through a debris-filled solar system.

The Earth's deep interior is continuously turning itself inside out through the action of convection (hot material rises, cold material falls), leading to plate tectonics, and hence earthquakes and volcanoes. Such phenomena are powered by heat flow from the planet's interior. In contrast, the power received from outside the planet, from the Sun, is tens of thousands times greater and drives more frequent disasters in the atmosphere and oceans in the form of hurricanes, mid-latitude cyclones (i.e., nor'easters), thunderstorms, and tornadoes. Finally, huge quantities of energy are released upon the rare but catastrophic collisions with space objects such as Earth-crossing asteroids.

This seminar was designed to study the science of some of the most prevalent and/or catastrophic natural disasters. Such natural hazards are not only of enormous societal importance, but the variety of scientific processes acting during disasters provides a profound window into the both the origins and workings of our planet. Seminar meetings covered a wide range of topics, including the following:

1. The energy sources that power natural disasters
2. Plate tectonics
3. Earthquakes: principles and events around the globe
4. Volcanoes: volcanism at plate boundaries and volcanic eruptions
5. Climate change
6. Weather and atmospheric circulation
7. Tropical cyclones: Hurricanes, Cyclones and Typhoons
8. Storms, Tornadoes and Lightning
9. Space objects, impact disasters and extinctions
10. History of life, human impact, population growth

The seminar focused primarily on elucidating the common scientific themes that thread through our understanding of all disasters, primarily relating to both the Earth's solid interior and its atmospheric envelope. This approach is required for using disasters as a vehicle for employing basic physics, chemistry and math in learning how the Earth works. Resources for this seminar were largely derived from standard college texts (e.g., *Natural Disasters* by Patrick Abbott). Internet sources were made available on the seminar Web page and were drawn from government science agencies such as the U.S, Geological Survey (USGS), National Oceanic and Atmospheric Administration (NOAA), National Science Foundation (NSF) and National Aeronautics and Space Administration (NASA).

The seminar was designed for any level of K-12 course, and the 2007 seminar Fellows were from the full range of grades in subjects ranging from non-fiction literature and social-

studies (history, geography) to upper-level math and science. For elementary and middle-school classes, the material may be used for basic earth/environmental science class work and any other related subject. For high school classes, the topic of natural disasters can be used for showing how math, physics, chemistry and biology are employed in studying topics of enormous societal, ecological and environmental impact.

The seminar units that were developed could be roughly categorized as (1) themes com- mon to all disasters (e.g., convection, energy sources, and disaster cycles); (2) extreme weather, global warming and the effect of global warming on extreme weather; (3) earthquakes and tsunami; and (4) the application of natural disasters in core disciplines such as mathematics, geography, literature (non-fiction), and social studies. These units provide a broad sampling of the many themes covered by this field and give fine examples of how the material can be applied across different grades and classes.

David Bercovici

Synopses of the Curriculum Units

07.04.01
How Heating and Convection Contributes to Natural Disasters, by Roberta Mazzucco

This unit is written for a third-grade science class but can also be used by teachers in grades two to five. The premise of the unit was to choose some science concept that young students could grasp as the guiding principle in studying natural disasters. The seminar dealt with disasters of all kinds with a lot of attention given to earthquakes, volcanoes, and weather. This unit concerns convection— the heating and rising of material or fluid and the eventual falling or cooling of that fluid as a source of earthquakes, volcanoes, and weather events such as thunderstorms, hurricanes and tornadoes. Convection can be found deep in the Earth where it drives plate tectonics and drives magma which finds it way up to the surface through volcanic activity. Convection is also an integral part of the oceans as they help spread the sun's warmth around the globe. Likewise, it is convection which powers the weather and causes our winds. The unit includes a teacher bibliography as well as one for children which lists both fiction and non- fiction selections. There are three lesson plans and a few demonstrations through- out the unit. There is also a list of pertinent Web sites.

(Developed for Science, grade 3; recommended for Science, grades 2-5)

07.04.02
Disaster Cycles, by Erica M. Mentone

The science topics presented in this unit are intended to fascinate second-graders! I have chosen content within the topic of natural disasters that can be studied as cycles in order to build upon students' prior knowledge from a second-grade curriculum unit on life cycles. The content of this unit includes: the hydrologic cycle, hurricane seasons, the tectonic cycle, and the recovery cycle. This unit requires students to use higher order thinking skills. Students must think critically in order to compare and contrast, analyze, and synthesize information.

The concepts and lessons in this unit can easily be adapted for use in grades one through four. It is meant to provide teachers with the content area knowledge necessary to teach a unit on natural disasters, and some practical resources for conveying that knowledge to elementary school students.

The resources in this unit include: content area reading for teachers, a suggested scope and sequence for implementation of a unit, four lesson plans designed for students in grade two, experiments, demonstrations, reading lessons, writing lessons, ideas for extensions and differentiation, relation of this unit to district standards, and a recommended reading/technology list for students and teachers.

(Developed for Science and Nonfiction Reading and Writing, grade 2; recommended for Science and Nonfiction Reading and Writing, grades 1-4)

07.04.03
Fueling Extreme Weather, by Catherine Baker

This is an integrative unit which addresses the scientific topics of space, energy, typical weather, the hydrologic cycle and extreme weather. It is designed for lower elementary grades as I teach first-grade but can very easily be used through eighth-grade. This unit teaches the

scientific method in preparation for science fair and also directly covers district science strands for first-grade. The unit is organized more broadly into three parts. The first section will focus on broader concepts so as to create the necessary background knowledge of the Sun, Earth, heat, energy, water and using the scientific process as a model for learning about nature. Next, we will focus on how the heat from the Sun interacts with water in the air to create weather. We will explore the range of typical weather conditions for this section and make observations daily. Lastly, we will focus on extreme weather conditions in a series of four in-depth case studies. The first case study will be on thunderstorms and it will be followed by hurricanes, tornadoes and heat waves. Each case study will be a complete cycle of the scientific process and will involve making models and performing experiments.

(Developed for Science, grade 1; recommended for Science, grades 1-3)

07.04.04
Severe Weather Trackers, by Kacey Jackson

I am currently a first-grade teacher at John C. Daniels School in New Haven, Connecticut. John C. Daniels was the first dual language program implemented in the city. As a dual language school, we teach every child English as well as Spanish. For the first two years, grades kindergarten and first, children learn their academic foundational skills in their dominant language of English or Spanish.

They are exposed to the opposite language as a second language, where they begin to learn the very basics of that language. Beginning in the second-grade, children learn all of their academic skills in both languages. There is only one other school like ours in New Haven, which makes our programs distinctive.

With these children in mind, I developed a science unit for my classroom. Through this five-week unit, the children will learn about different types of severe weather. The children also will learn about choosing meteorology as a career and what it takes to get there. Bringing the idea of a career to children in this community would be beneficial because they may never realize this could be an option for their future. This unit will help them get excited about science and weather and possibly a future career to consider.

This unit will fulfill the weather portion of the district's first-grade science curriculum. Relevant standards include:

- Children will address, describe, question, classify and experiment (1.2s)
- Children will understand that tools help scientists make better observations, measurements and are the equipment for investigations (5.2s).

Overall, my goals for this unit are to get the children excited and engaged in scientific inquiry. The children will be learning about severe weather through hands-on experiments, video clips and pictures. The more children are able to do and see, the greater the impact of their learning. I also want the children to learn how meteorologists contribute to science and our society. I want them to see what an interesting job they have, but also how difficult it can be. Most of all, I want the children to gain an interest in weather and have fun! Severe weather is a very interesting topic with plenty of excitement to keep the children's attention and participation.

(Developed for Elementary Education, grade 1; recommended for Elementary Education Science, grade 1)

07.04.05
Greenhouse Gases: The Chemistry Behind the Culprits, by Zakia D. Parrish, Ph.D.

This curriculum unit will explore the climate change and global warming segments of the Global Interdependence content strand (9.8) of the Connecticut State Science Standards. The makeup of the Earth's atmosphere, differentiation between climate and weather, the transfer of solar energy, and the greenhouse effect are provided as introductory information within this unit.

The foci of this unit are the major gases responsible for the greenhouse effect: water vapor, fluorinated gases, methane, and carbon dioxide. Additionally the sources of these gases, the history of their release, their global warming potential, and contribution to the greenhouse effect are included. This unit includes the methods of global warming measurement, global warming trends and ecological changes that have been observed in addition to the potential changes scientists believe can occur. Alternative energy sources including solar cells, hydroelectricity, wind turbines, nuclear energy, and geothermal energy are discussed as possible solutions to global warming.

Students are required to utilize technology and apply it to content-based activities, which parallel the Science, Technology, and Society component of the Connecticut Academic Performance Test. Students will need to evaluate the credibility of Web sites in order to conduct Internet research, in addition utilizing Microsoft Excel to construct graphs.

(Developed for Physical Chemistry and Science, grade 9; recommended for Physical Chemistry and Science, grade 9, Chemistry, grade 11, and Environmental Science and Science, grades 10-12)

07.04.06
Does Global Warming Increase the Intensity of Atmospheric Natural Disasters? by Jacqueline Porter-Clinton

I am a special education / hearing impaired teacher. Currently I work with ninth- grade hearing-impaired students at Hill Regional Career High School in the resource room along with three other teachers with students of their own.

Resource is a credit class for special education students. I will be teaching my unit to the students who have a resource period next school year.

Tenth-grade students are given the Connecticut Academic Performance Test (CAPT), and are expected to pass in order to receive a high school diploma. It is an unfortunate fact that many of our students fail the test and have to take the test a second time in the 11th grade, often this test is also failed and eventually they are required to take a CAPT class in the specific area they failed and than pass an exam at the end of the class. Writing (persuasive essay) as well as Science (weather) are areas on the CAPT. This unit will assist in both of these areas.

Climate changes, global warming and a rising sea level appear to have serious adverse impacts on human and animal life on our planet and are the cause of great concern. The effect of global warming on weather patterns is frequently blamed for an apparent increase in intensity of weather—related disasters such as windstorms and hurricanes, among others. The responsible climate changes result from natural and human factors.

There is evidence supporting and arguing against linking human-induced climate change and

extreme weather conditions. After learning about the above natural disasters, the students will choose a disaster and read different views. The students will take a stance and write a persuasive essay to convince others to their way of thinking.

(Developed for Resource/Science, grades 9-11; recommended for Science, grades 8-10)

07.04.07
Global Warming and Hurricanes: Is an Increase in the Number of Stronger Hurricanes an Indicator of Global Warming? by Nicole D. Primeau

This unit will be taught in conjunction with a larger theme in the ninth-grade integrated science curriculum which focuses on Global Interdependence and the impacts of humans on their natural environment. This unit will be designed to have students enhancing their critical thinking skills, as they will explore the controversies surrounding global warming and the lasting effects of global warming on the environment. The unit will take approximately six weeks and will be taught in three parts. The first part will focus on learning about what Global Warming is and understanding our role as humans in global warming, the second will focus on understanding the science behind the formation of hurricanes/tropical cyclones; and finally the third part will focus on integrating the two concepts focusing on the question: Is an increase in the number of stronger hurricanes an indicator of global warming? We are at the leading edge of this research, and scientists don't have conclusive evidence yet. There is a lot of misleading information out there for both sides of the argument, so the more important questions that the students will also be keeping in mind are: What do you believe (about the idea of global warming and its effect on the Earth)? How far are you willing to go if all of the evidence is still not in; do you act without sufficient evidence and risk a major economic crisis or wait until it's too late? Some guiding questions that the students will focus their research on include: Is global warming really happening? Is Carbon Dioxide (CO2) causing the global temperature to change? Are natural disasters affected?

(Developed for Integrated Science, grade 9; recommended for Earth Science, Environmental Science, Biology, and Integrated Science, grades 7-12)

07.04.08
Making Waves: A Study of Earthquakes and Tsunami, by Chrissy Bieler

This unit is designed for a twelfth-grade environmental studies curriculum. The goal of the unit is to provide students with a comprehensive understanding of plate tectonics and how they affect the occurrence of earthquakes and tsunami around the world. Students will be made aware of how the Earth is divided into tectonic plates and how the plates move in different directions and at different speeds. They will familiarize themselves with the locations of plate boundaries and the effects that the different movements of these plates have on the occurrence of earthquakes and tsunami. Students will become familiar with both seismic and ocean waves and how they are measured. Students will differentiate between the types of waves that cause earthquakes and tsunami. In addition, they will examine why these waves travel at different speeds. Students will also investigate how the measurement and detection of waves are used to understand and mitigate disasters. To compare the severity of specific disasters that have occurred during our lifetime, students will perform case studies on a number of the earthquakes and tsunami that have occurred around the world, examining the causes and effects of each.

(Developed for Environmental Science, grade 12; recommended for Environmental Science, grade 12)

07.04.09
The New Madrid Earthquakes of 1811-1812: Shaking Our Misconceptions about Earthquakes in United States History, by Ralph Russo

This unit will use the historical example of the New Madrid Earthquakes of 1811-1812 to expose students of high school history to the causes and effects of earthquakes. It should at the very least displace some common misconceptions about the nature of earthquakes in the United States.

The frequency of earthquake activity on the West Coast reinforces the misconception that earthquake events in United States history occur only at places like the famous San Andreas Fault. However, a closer look at the geological pro- file of the United States and the history of seismic activity in the United States reveals that earthquakes are a realistic natural disaster on the eastern seaboard as well as in the nation's interior. My unit will examine the New Madrid Earthquakes of 1811-1812 as historical and geological events that will lead to a more comprehensive understanding of the geological profile of the United States. Subsequently, the unit will explore the history of earthquakes across the continental United States, basic earthquake concepts and terminology, the potential for future seismic events, and the implications for specific communities in areas subject to earthquakes.

(Developed for U.S. History I, grade 10; recommended for U.S. History and Earth Science, grades 7-12)

07.04.10
Modeling Natural Disasters with Mathematical Functions, by Jonathan Knickerbocker

This unit is designed for New Haven high school math students in an Algebra 1, Algebra 2, or Precalculus course. The intention is to increase the relevance of the topics of applications of mathematical functions and models through incorporating the spectacular scientific topic of natural disasters.

By relating these mathematical topics with such things as tsunami, volcanoes, earthquakes, tornadoes, and population growth, teachers may spark the interest of students otherwise uninterested in the subject of mathematics. By applying mathematical topics to problems outside the traditional applications problems, and by unifying these applications problems with a common theme that can be carried between one lesson and another, students may have a much greater appreciation of the power of both mathematics to model and describe nature, as well as the raw power of nature itself.

The lessons of this unit have been designed so that they are independent of one another and may be used in the context of another unit covering similar objectives and having covered the same prerequisite skills and concepts. Also, they need not be taught in any particular sequence. Two themes or major concepts embedded in this unit are dimensional analysis and mathematical models.

(Developed for Algebra I, grade 9; recommended for Mathematics, Algebra I, grade 9; Algebra 2, grade 11; and Pre-Calculus, grades 11-12)

07.04.11
Natural Disasters and the Five Themes of Geography, by Matthew A. Dooley

This curriculum unit was developed with inner-city middle school students in mind. It is intended to be implemented in either a survey of world cultures or world geography course. The five themes of geography (location, place, region, movement and human-environment interaction) are applied to different natural disasters including volcanoes, earthquakes, hurricanes and tsunamis. In this way students are exposed to different cultures from around the world utilizing natural disasters as a vehicle of learning. While this curriculum unit can stand alone to be used by a social studies teacher, it can also be used in tandem with lessons taught by the science teacher. This curriculum unit contains a list of teacher and student resources that both a science or social studies teacher would find useful. It also contains several lessons that involve teacher-directed research and the possible use of technology for student slide presentations. This curriculum unit can be modified according to the age and ability of the student population. Listed are several useful Web sites, including one that will allow students to manipulate variables to create different natural disasters.

(Developed for World Cultures, grade 7; recommended for World Geography and World Cultures, Middle grades)

07.04.12
Natural Disasters: An Adventure in Non-Fiction, by Carol Boynton

Many teachers in primary grades are teaching in self-contained classrooms, generally focusing on literacy and math. I would like to build background knowledge for teachers to feel comfortable teaching about our Earth and its natural disasters, and performing experiments to build understanding. Often as teachers we do not have specific training or knowledge of a content area. My goal with this unit is to bring science into classroom reading.

First-grade students come to school in the fall ready to learn to read. During their young lives they have heard stories read to them or told to them. This type of literature, fiction, is their first introduction to reading, through modeled story-telling. I would like students to be introduced and aware of the genre of non-fiction. Through the excitement of learning about earthquakes, volcanoes, hurricanes, and tornadoes, the students can transfer that excitement to the reading, consequently learning. Non-fiction surrounds us in daily life—newspapers, maps, assembly instructions, recipes, signs. Teaching students to read non-fiction is essential as we teach them to develop as readers.

My hope is that this curriculum will excite students about the natural world and spark some curiosity to learn more. It is important for children to see that science and reading are connected.

(Developed for Reading and Science, grade 1; recommended for Reading and Science, grades 1-2)

07.04.13
Myths and Legends on Natural Disasters: Making Sense of Our World, by Pedro Mendia-Landa

What is the definition of a natural disaster? What is the relationship between Earth's workings and natural disasters? What are the direct and indirect environmental, economic, and human impacts of these severe weather and dynamic pat- terns on habitats and ecosystems? How have

we explained through the ages the effects that natural disasters have on communities and society? These are some of the central questions that frame this curricular unit.

This unit provides the classroom teacher with some model activities that integrate the TESOL and content standards in the four language domains of listening, speaking, reading and writing, as the students explore the theme of natural disasters and related myths. Students then are asked to explore some first- and second- hand accounts of major natural disasters affecting the New England states such as the hurricane of 1938, the blizzard of 1888, or the year without a summer (1816).

A list of student, teacher, and electronic resources, evaluation rubrics, extension activities and standards is provided for the implementation of the unit.

(Developed for Integrated Language Arts, Mathematics, Social Studies, and Art, grade 5; recommended for Language Arts, Social Studies, Science, ESL, grades 4-6)

V. Health and the Human Machine

Introduction

Humans eat, drink, and breathe to bring into their bodies the raw materials for growth, repair, and generation of the energy necessary for life and the actions that bring pleasure to life. This seminar provided an overview of human nutrition and the operation of the human body from the perspective of biomedical engineering. From a simple mechanical viewpoint, the human body is an elegant machine that requires inputs for sustained operation. What are the processes responsible for input of nutrients and raw materials? How are molecular nutrients extracted from ingested materials? How are these processes controlled?

The human machine requires food and water for continued operation. But the relationship between the food intake and human health is complex and poorly understood. Some things are clear: whole foods that we ingest get broken down to components such as amino acids and sugars, which the body uses to synthesize new proteins and to generate or store energy. Protein synthesis, energy generation, and metabolic processes occur in cells throughout the body; hence all of these processes are related to the circulation of molecules in the body. This seminar discussed these issues and attempted to establish some general descriptions of the ways our bodies are changed by what we allow to enter them.

The issues of food intake, nutrition, and human health are becoming increasingly important in the U.S. The Centers for Disease Control and Prevention (CDC) report a dramatic increase in obesity in the U.S. over the period from 1985 to 2005. In addition, diseases related to environmental exposure to toxins and pollutants are widespread and still rising. For example, asthma among children has increased to epidemic proportions, accounting for one in six of all visits to pediatric emergency rooms in the U.S. And disorders of metabolism, such as diabetes, create tremendous challenges for many individuals in the U.S. and other nations.

Specifically, the seminar covered the following topics:

1. Introduction to Human Physiology—viewing the human body as a complex, and sometimes fragile, machine
2. Respiratory Physiology—structure of the lungs, anatomy of breathing, and oxygen uptake
3. Heart Physiology—structure of the heart and vessels
4. Nutrition—body mechanisms for control of weight, obesity, vitamins (and diseases caused by deficiencies)
5. Diabetes—the chemical and anatomical changes that result from this disease, as well as ways to treat the disease
6. Infectious disease—a discussion of communicable diseases including STDs that focused on the anatomical routes of infection
7. Biomechanics—how the human body performs in the physical world.

The discussions were supplemented with drafts of chapters from a book in progress, *Biomedical Engineering: Bridging Medicine and Technology*, by myself and Veronique Tran. The textbook is scheduled for publication soon.

The Fellows prepared curriculum units that covered the breadth of human physiology. The range of material was impressive, as well as the range of grade levels that the seminar produced units to satisfy.

This volume includes units from a team of four teachers working together at the same middle school to bring valuable health information into their classrooms. Two of these projects focused on nutrition: Amy Migliore-Dest prepared a unit on the use of pop art techniques to teach about human nutrition called "Using Pop Art Imagery to Inspire Healthy Eating" and Crecia C. Swaim prepared a unit for French students that teaches about nutritional content of foods called "À Votre Santé: A French-Language Unit on Nutrition." These nutrition units are paired with two units on cardiovascular health and obesity; Grace Malangone prepared a unit on "Adolescent Obesity and Susceptibility to Disease" and Marisa Ferrarese prepared a unit on maintaining good cardiovascular health called "Fit for Our Future."

Nutrition was a subject of two of the other units in this volume. Shannon E. Oneto prepared a unit on nutritional information for elementary school students, which also includes an important primer on the sources of nutrients in foods, called "Eating the Rainbow: A Student's Guide to Healthy Foods That Grow." Karen A. Beitler prepared a unit for high school students on the timely issue of genetic modification of foods called "Genetically Engineered Food: Altering the Blueprint."

Sara E. Thomas prepared a unit on the use of graphic design techniques to teach high school students about nutrition, smoking, and body image called "Advertising for Healthy Habits." Wendy Decter prepared a unit for high school students that capitalizes on interest in crime scene analysis to teach about cardiovascular physiology called "Cardiac Arrest! Using Forensics to Investigate Cardiovascular Anatomy and Function."

Three of the units focused on infectious diseases, discussing mechanisms of infection and how they influence physiology and the progress of disease. Heidi A. Everett prepared a unit called "Human Papillomavirus: Investigating the Prevention, Transmission, and Treatments of a Viral Infection." Melanie Laputka prepared a unit for world language students called "HIV/AIDS in Our Spanish-Speaking Community and the World." Rosey Rawle-Pitter pre- pared a unit on "Infectious Diseases: Hepatitis B and Tuberculosis." These units were all pre- pared for high school students.

Finally, this volume includes a unit for elementary school students that provides information to help students understand the impact of disabilities on students in their classrooms. Melanie Wolf prepared this unit, called "Understanding and Supporting Our Peers with Cognitive Challenges."

W. Mark Saltzman

Synopses of the Curriculum Units

07.05.01
Advertising for Healthy Habits, by Sara E. Thomas

Information about smoking, body image and nutrition is important to the students in my digital art class, and to the students throughout my entire school. But health is an area where my students are lacking information. They receive some information regarding health during their freshman year, but after that unless they have a health class they are not exposed to it for the rest of their high school careers. As an educator this worries me greatly. Students need to be made aware that the decisions and the lifestyle choices they make now can have a drastic effect on their health in the future. This unit will have students assume the role of a Graphic Designer who has been given a project by a client who is very concerned with the health of high school students. The client would like to create three different public service announcements, in the form of posters, regarding three different issues: smoking, body image and nutrition. Students will go through the processes used by a graphic designer—first researching and collecting as much information as they can about each of these health concerns. Then students will brainstorm, do thumbnail sketches, roughs, and finally will create eye-catching posters to alert their peers of these health issues, which will be hung around the entire school.

(Developed for Digital Art, grades 9-12; recommended for Digital Art, High School grades, and Health, Middle and High School grades)

07.05.02
À Votre Santé: A French-Language Unit on Nutrition, by Crecia C. Swaim

What middle school world language teacher *hasn't* taught that stale old café les- son, with its myriad variations on how to politely order a meal of *un steak-frites et un coca, s'il vous plaît*? Food units in many textbooks generally serve several purposes: They supply a ready-made, structured opportunity for student-student interaction in terms of asking for and providing information; they tap into the students' universal interest in food as well as their curiosity about basic cultural similarities and differences; and lastly, they provide an arena to practice the concept of gender and gender identification with indefinite articles. In the following unit, I will attempt to breathe some vitality into what can easily become that lesson during which we find ourselves sacrificing creativity for ease and familiarity. Although I understand the appeal of and value in tasks like creating a menu and acting out a restaurant scenario, I find myself (and my students) growing tired of the same ten menu items! By exploring new facets of food and health in this unit, I hope to increase the communicative options available to my students in a restaurant-based unit.

(Developed for Middle School French, grade 7; recommended for Middle School French, grade 7)

07.05.03
Using Pop Art Imagery to Inspire Healthy Eating, by Amy Migliore-Dest

This is a sculpture-based Visual Art unit on healthy eating and good habits. This unit will describe how to create sculptural mobiles based on the food pyramid. Students will do research on attributes of healthy foods and the importance of physical activity. Each student will construct a

mobile, consisting of several food items, each from different food categories and each of a different color. The finished sculptures will hang in the school cafeteria to inspire good eating habits and a healthy lifestyle.

(Developed for Visual Art, grade 8; recommended for Visual Art, Middle and High School grades 8-10)

07.05.04
Genetically Engineered Food: Altering the Blueprint, by Karen A. Beitler

The issue of genetic modification remains controversial for numerous reasons. The methods and knowledge of the processes of genetic modification have been with us for many years and the possibilities with this new technology are continuing to evolve. The most controversial issue is whether or not genetic modification should be allowed at all. The 1997 film *Gattaca* portrays a world where genetic imperfection, or natural births of humans are not the norm. Is that what people are afraid of? Will humans seek to eliminate diversity and make everyone alike? This is not likely; there are far too many minds that would oppose such an attempt at making a "master race." Diversity is desired and although we still have our prejudices and preferences, the majority of people would not seek to make everything identical. This unit looks at genetic modification of food and the issue of labeling. Students in high school are required to write a persuasive pamphlet about this issue. The aim of the unit is to provide teachers with background and some lesson plans that will help them give their students a good background in subject. The unit integrates portions of the high school biology curriculum to create a comprehensive lesson on this controversial subject. Upon completion of the unit students will be able to form an educated opinion regarding the labeling of genetically modified foods and have gained important background information about biotechnology and biomedical engineering.

(Developed for Biology, grade 10; recommended for High School Biology, grades 9-11, and Middle School grades 7-8)

07.05.05
Eating the Rainbow: A Student's Guide to Healthy Foods That Grow, by Shannon E. Oneto

Many children in our nation are in a health crisis. Childhood obesity is on the rise, as is the number of children developing diabetes and other health issues. We can choose to point fingers—fast food, school lunches, busy parents, disappearing recess. The better option might be to start to do something. Education is a powerful tool, and teaching our children to be more aware of their own health may help to slow down this crisis.

This unit strives to begin to do just that. Created for a group of third-graders with mixed English language abilities and varying levels of background knowledge, this unit will help students begin to take charge of their own eating habits by first learning more about what they eat. Students will use literature and class discussions to find out which foods are healthy (or not healthy) for them, and why. They will take a close look at their own diet and reflect on how they can improve their own eating habits. Students will also examine the idea that we should "eat the rainbow," by examining the nutritional components of fruits and vegetables, and finding similarities in health benefits of plants in the same color group. Overall, this unit should help to make students aware that they have the power to make good choices when it comes to their health.

(Developed for Elementary, grade 2; recommended for Elementary/ESL and Science, grades 3-4)

07.05.06
Adolescent Obesity and Susceptibility to Disease, by Grace Malangone

This unit is part of a health initiative designed to be incorporated into the language arts curriculum. This unit will educate students on the importance of making healthy food choices and incorporating daily exercise into their lives for optimal adolescent and adult health. This unit will also educate the students on the future effects of not maintaining a healthy lifestyle. This unit is divided into four sections. The first section consists of the general functions of the cardiovascular sys- tem. This overview of the cardiovascular system will include vocabulary, how the heart functions, and a healthy heart rate. The second section focuses on weight gain: How do we gain weight and what is body mass index (BMI), what role do physical activity and good eating habits play in obesity? The third section will educate the students on over-the-counter pills and what role surgery plays in the treatment of obesity. The fourth section will focus on the susceptibility to dis- ease/health risks that stem from obesity and adolescent obesity. The students will participate in small-group, whole-group activities. The students will be asked to keep and maintain vocabulary/note taking journals and create public service announcement posters. The comprehensive goal is for students to create pamphlets that are to be distributed to their classmates at a school-wide health fair, but the ultimate goal is for students is to learn lifelong skills to live a healthy lifestyle.

(Developed for Language Arts, grade 5; recommended for Middle School, grades 5-8)

07.05.07
Fit for Our Future, by Marisa Ferrarese

This unit is part of a health initiative designed for a fifth-grade science curriculum to educate students on the importance of physical fitness for a person's overall health. The goal for the students is to be one of four classes that participate in educating their peers at a school-wide health fair. Through this unit students will discover the importance of physical activity, adequate forms of physical activity, and how physical activity supports the mind, skeletal system, respiratory system, and muscular system. Students will also learn how to improve the physical activity of students, how to get family involved in physical activity, and the consequences of physical inactivity. Independent work, small-group work, and whole-group activities will be carried out while students participate in classroom daily exercise, maintain daily nutrition and exercise journals, create pictorial representations of the human body systems, and work in small groups to develop and carry out final project ideas for the school health fair. The ultimate goal for this unit is for students to become knowledgeable about their own health and learn lifelong skills to live a healthy lifestyle.

(Developed for Science, grade 5; recommended for Science and Health, grades 4-6)

07.05.08
Cardiac Arrest! Using Forensics to Investigate Cardiovascular Anatomy and Function, by Wendy Decter, M.D.

Forensic Science has become the darling of high schools, colleges, and graduate schools around the country in the last few years. A myriad of television shows have popularized forensic science, and it even has its own cable channel: Court TV. High school and middle school teachers can capitalize on this fascination by incorporating crime scenarios into their lessons in biology, chemistry, physics, environmental science, or just about any discipline to generate interest and relevancy. For those of us privileged to teach Forensic Science introductory courses in high school it is an opportunity to have students use scientific inquiry constantly in the classroom. Forensic science is the essential applied science. Students use the scientific method to gather data and use the data to support or refute a hypothesis of "what happened?"

This unit is written to incorporate the study of the anatomy and physiology of the cardiovascular system into a Forensic Science class. It is a very versatile unit that can be adapted to any high school biology, anatomy and physiology, forensic science, or health class and parts can be used in middle or elementary school to study the heart. It is multidisciplinary in that it makes use of reading, writing, scientific investigative, artistic, and presentation skills. It is inquiry-based in that the students must decide what kind of information they need and form their own questions to solve the mystery. The lessons are based on a scenario in which a body is found and an inexperienced coroner can only say that "cardiac arrest" has taken place. Students must determine the various mechanisms of cardiac arrest and try to determine a more specific cause of death and whether or not a crime has been com- mitted. The highlight of the unit is the "Heart Game." Students actually "become" the parts of the heart and the circulating red blood cells and act out the path of circulation. The heart game can be played at any grade level by including or excluding anatomical parts and varying the complexity of the path of circulation.

The unit is written for a 12th grade Forensic Science class but can be modified for biology, anatomy and physiology or health or used for the study of the cardiovascular system in middle school. The "Heart Game" can be played by any grade level.

(Developed for Forensic Science, grades 11-12; recommended for Middle School Biology, grades 6-8; Anatomy and Physiology, Forensic Science, Health, and Biology, High School grades 9-12)

07.05.09
Human Papillomavirus: Investigating the Prevention, Transmission, and Treatments of a Viral Infection, by Heidi A. Everett

This unit provides the framework to investigate the role of viruses in human populations with a brief overview of the production of vaccines. The virus that is the focal point of this unit is the Human Papillomavirus (HPV). HPV is part of a family of viruses that are linked to causing cancer in their hosts. Recently, the FDA approved a vaccine for HPV providing immunity against four strains of HPV known to lead to cervical cancer in women. There is great debate among health officials and the government whether or not to mandate that preadolescent females receive the vaccine. This unit serves to educate general biology students as to what a virus is composed of and the way in which it infiltrates the cells of its host. This knowledge provides the foundation for students to investigate how science, technology, and society are

working together to come to a conclusion concerning a topic that directly involves their physical health.

(Developed for Biology, grade 10; recommended for Biology and AP Biology, grades 9-10 and 12)

07.05.10
HIV/AIDS in Our Spanish-Speaking Community and the World, by Melanie Laputka

The purpose of this unit is to educate students about one of the most pressing current global pandemics. Today, about 40 million people in the world live with HIV and AIDS. The number of people affected, including the family members and friends of those living with these diseases, is even larger. The global HIV/AIDS pandemic is growing, and the effects of HIV and AIDS on those people living in higher needs communities and impoverished countries are even larger than on those that have access to treatment in wealthier communities. This topic is pertinent to my students, considering the demographic makeup of my school. My students fall into two main groups, Black and Hispanic. Research from the Centers for Disease Control and Prevention shows that these two groups share a large percentage of the new recent diagnoses of HIV and AIDS in the U.S. In this unit, students will learn about the HIV/AIDS epidemic in the Spanish-speaking population of New Haven, and also of the United States, especially Puerto Rico, and a variety of Spanish-speaking countries around the world.

(Developed for Spanish 1, grade 9, Spanish 2, grade 10, and Native Speaker, grades 9-10; recommended for Spanish, High School grades)

07.05.11
Infectious Diseases: Hepatitis B and Tuberculosis, by Rosey Rawle-Pitter

The issue of infectious diseases in our society is of great concern to our well being. The control and prevention of the spread of infectious diseases have improved over the years with the development of vaccines and working knowledge of how infectious diseases are spread. The main focus of the unit is to compare and contrast the infectious diseases of hepatitis b and tuberculosis. Hepatitis b is caused by a virus, and tuberculosis is caused by bacteria. Not all infectious diseases are the same depending on the type of pathogen that causes the disease. Most infectious diseases are caused by either a virus or bacteria. This unit covers the topics of pathogens, immune system, antibodies, vaccines, antibiotics, tuberculosis, and hepatitis b. There are different types of pathogens such as a virus, bacterium, fungus, and protozoan. The immune system is the body's defense against pathogens that invade the body. Humans have created ways to protect themselves against infectious diseases by development of vaccines and antibiotics, which are used on various diseases.

The lessons in this unit are designed to explore how infectious diseases are spread through an interactive lab. The students will have the opportunity to figure out how antibiotics are used and for what type of infection. The students will use the knowledge about vaccines to create a pamphlet about childhood vaccinations. At the end of this unit the students will explore different types of infectious diseases.

(Developed for Biology, grade 10; recommended for Biology, grade 10, Human Physiology, grades 11-12, and Health, grades 9-12)

07.05.12
Understanding and Supporting Our Peers with Cognitive Challenges, by Melanie Wolf

All schools in New Haven enroll students with some cognitive disabilities. In fact, most classrooms have at least one member who has a disability, whether it be physical like hearing impairment or cognitive like an intellectual disability. All of our students must learn about the needs and feelings of their peers because students who are sensitive to the needs of their fellow students can better learn in a cooperative setting. Thus, any teacher in our school system could benefit from using this unit with his/her students.

The goal of this curriculum is to prepare students to meet the challenge of living and learning with *all* of their peers. Students will study the attributes of students with intellectual disabilities, specifically Down Syndrome and will gain knowledge and become aware of the perspective of some of these peers. They will compare and contrast challenges of students who live with intellectual disabilities, such as Down Syndrome.

Both federal and state law mandate educating our students who have disabilities alongside students who do not. Teachers who use this unit will learn about how and why all teachers are required to teach students with disabilities. Students will learn about their peers' challenges, and during reading and writing assignments, increase their proficiency on Connecticut's Mastery Test literacy strands.

(Developed for Literacy, grade 5; recommended for Literacy, grades 3-6, and Social Science, grades 5-6)