APPENDIX F

Sample Instructional Units

The units that are described in this section represent the efforts of Bard College Master of Arts in Teaching Program faculty, drawing on their years of experience as classroom teachers and their expertise in particular subject areas. These units are only intended to provide examples of the kind of lesson sequences that will be typical in Paramount Bard Academy classrooms. All of these units work from a common planning model commonly known as "backwards planning" and defined by the work of Wiggins and McTighe in their book, ***Understanding by Design****, an award winning text on curriculum design and a standard text for teachers in teacher certification programs nationwide.*

APPENDIX F – SAMPLE INSTRUCTIONAL UNITS

F1. HISTORY AND LANGUAGE ARTS

This document briefly outlines how the principles and ideas described in the proposal – a disciplined approach to historical and literary inquiry—might look in two curricular cases. In both cases we describe an essential and productive curricular collaboration that brings together History and English Language Arts. Like many collaborations we recognize the benefits of working together on shared content. However, we are most interested in using such content to demonstrate the unique thinking skills and approaches our respective disciplines employ when interpreting text. All coursework is correlated with the standards set by the California Board of Regents.

F1a. History – Social Science – Grades 6 and 9

6th Grade
World History and Geography: Ancient Civilizations
Course Question: "Who am I, and where do I belong?"

Standard 6.2 Students analyze the geographic, political, economic, religious, and social structures of the early civilizations of Mesopotamia, Egypt, and Kush.
Standard 6.3 Students analyze the geographic, political, economic, religious, and social structures of the Ancient Hebrews.

How can a teacher connect the experience of 12-year-olds in 21st century California to the lives of men and women thousands of years ago? This curriculum begins in the students' own experiences coming to understand their own cultural identity.

Historians of the ancient world have long taken an interest in how the Egyptians, Hebrews, Indians, Chinese, Greeks, and Romans developed the social tools necessary to forge a life together with a shared identity. Indeed these "civilizations" are remarkable in

that they represent the first recorded cases of any large populace agreeing that they *belonged* to one another.

Most adolescents, like the ancients, discover that *belonging* to a group is a complicated process requiring individuals to continually re-negotiate their relationship with the cultural expectations of a larger society. Throughout the year, this curriculum returns to the student experience to ask: *Who am I, and where do I belong?* Ancient civilizations built elaborate expressions in politics, art, literature, history, mythology, philosophy, leisure, agriculture, language, and science to justify and reinforce a shared sense of belonging. Like the ancients, children today in the Central Valley adopt, co-opt, or reject such cultural expressions while determining their own identity--the degree to which they belong to or sense acceptance in a larger group.

The following unit, which uniquely bridges both Egyptian and Hebrew civilizations, offers students an opportunity to think through these questions of identity. Integrated closely with ELA coursework, this unit asks students to look closely at the exodus from Egypt to consider how literature and history can use a shared text for very different disciplinary purposes.

Essential Questions

- Can a desert wilderness sustain a civilization? [paralleling irrigation and agricultural patterns in California]
- Why was Pharaoh feared? What was Pharaoh himself afraid of?
- Does God care about me? What does God expect me to do? [Comparing Egyptian polytheism to Hebrew monotheistic covenants and ethics]
- Did slavery strengthen Hebrew identity and purpose? [Are feelings of belonging enhanced in the face of a common enemy?]
- How might a "promised land" encourage and inspire migration?
- What made Moses an effective leader? Why did Pharaoh take him seriously?
- How did the Ten Commandments contribute to Hebrew belonging?

Understandings

- The physical geography of the Nile, Sinai, and Canaan profoundly influenced how the Egyptians and Hebrews sustained life and developed culture
- Egyptian conceptions of the afterlife drove artistic, engineering, and political advances as well as the labor demands behind slavery
- The introduction of monotheism and covenant theology has altered the ways many humans understand their relationship to an all-powerful God and offered a foundational logic for ethical behavior that shapes Judaism, Christianity, and secularism in the West today.
- The written account of the Hebrew exodus from Egypt demonstrates how groups of individuals, driven by a shared sense of purpose, have overcome considerable odds in challenging a more powerful enemy.

- The written account of Moses offers important, descriptive lessons in leadership and a model, used in subsequent social movements, for "speaking truth to power."
- The Ten Commandments codified the ethical expectations necessary for a divergent and nomadic people to live together and share a sense of belonging

Sample Activities

Socratic Seminar: Using the ancient text of Moses' words and historically-grounded empathy, students reconstruct a possible discussion among the enslaved Hebrews deciding whether or not to flee from Egypt

Gallery Walk: Small groups of students are assigned one of the ten commandments to illustrate. Classmates then rotate to each illustration, marking examples of how each commandment has persisted in the ethical expectations of Western law, norms, or other values.

Free-Writing and Read-Around: Taking on the role and religious system of an Egyptian, the students write a letter (complete with a few hieroglyphics) expressing their shock at the ideas expounded in the Ten Commandments.

Mapping: Students investigate topography and climate conditions in contemporary Egypt, Sinai, and Israel prior to creating a map that makes a claim to a "promised land." Students then debate which map makes the best such case.

Dramatic Re-telling: Students create a drama, using ancient texts, to tell the story of Moses' negotiations with Pharaoh. This activity pays close attention to the conditions of slavery, the demographic change along the Nile, and the evolving identity of the Hebrew people.

Final Project: Working collaboratively with the ELA course, students create the script for a television documentary that describes how the ancient Hebrew experience offered a shared sense of identity. This script and accompanying visuals will include text from the Exodus story, map representations, archeological evidence of both the Egyptians and Hebrews, background on religious belief systems, and imagined, historically-empathetic dialogue between the leaders of both civilizations.

Texts

Assmann, Jan. *Moses the Egyptian: The Memory of Egypt in Western Monotheism*. Cambridge: Harvard University Press, 1997.
Baines, John and Jaromir Malek. *Atlas of Ancient Egypt*. New York: Facts on File Publication, 1988.
Buber, Martin. *Moses: The Revelation and the Covenant.* New York: Harper, 1958.
Hart, George. *Egyptian Myths*. Austin, TX: University of Texas Press, 1990.
Freed, Rita E. *Egypt's Golden Age, The Art of Living in the New Kingdom, 1558-1085*

B.C. Boston: Museum of Fine Arts, 1981.
Macauley, David. *Pyramid.* New York: Houghton, 1975.
Reeves, Nicholas. *The Complete Tutankhamen.* Thames and Hudson, 1990.

Wiese, Elie. "Moses: Portrait of a Leader." In *Messengers of God: Biblical Portraits & Legends*, 174–210. New York: Random House, 1976
Romano, James F. *Daily Life in Egypt of the Pharaohs.* New York: Henry Holt and Co., 1984.

F1b. English-Language Arts – Grades 6 and 9

Sixth Grade English Language Arts: Literature of the Ancient World
Course Question: "Who am I, and where do I belong?"

Let it be clear from the outset that this sample unit is non-secular and non-religious in its emphasis. The purpose for including this sample literature unit is to provide an example of an interdisciplinary unit that connects the CDE curriculum standards in History – Social Science to CDE standards in English – Language Arts. Emphasizing the use of primary documents in classrooms to engage in the construction of knowledge means that any treatment of the Exodus or Moses stories requires the use of the original literature from which these stories emerge. Key cultural understandings emerge from an understanding of the influence of the religious traditions and studying the story of Moses contributes to a fundamental understanding of important Islamic and Judeo-Christian traditions. It should be clear that the unit described below is a literary treatment of texts, leading to the development of critical reading skills that will build key intellectual competencies.

Similarly, the study of ancient Mesopotamia and Ancient Greece would be integrated with comparable units in English – Language Arts using primary texts and secondary sources as appropriate. For example, a comparable unit on Greece would focus on Greek mythology, age appropriate translations of The Iliad and the Odyssey, and literature that emerge from the Greek philosophers and tragedians. There is a vast resource of contemporary young adult fiction and historical fiction based on the Greek myths and Greek history which would serve the purposes of a similar unit. Certainly, the study of literature must acknowledge the sources for the many stories and allusions that derive from earlier sources in ancient texts, both secular and religious and origin.

The study of Mesopotamia might pursue a line of questioning that runs parallel to the unit described below using these texts:

- ***Gilgamesh the King (The Gilgamesh Trilogy), Ludmila Zeman***
- ***The Babylonians, Elaine Landau***
- ***The City of Rainbows: A Tale from Ancient Sumer, Karen Foster***
- ***Gilgamesh the Hero, Geraldine McCaughren***
- ***The Cultural Atlas of Mesopotamia and the Ancient Near East, Michael Ruaf***
- ***The Epic of Gilgamesh, Andrew George, Penguin Classics***

And, of course, a key element in any language arts classroom - reading for interpretation – is greatly enhanced by asking students to attend to the different treatments of a single story in the various translations that are available.

The curriculum for sixth-grade English is built on the essential question for year-long inquiry, "Who am I, and where do I belong?" This question is shared by sixth-grade social studies in its focus on ancient civilizations, and the two curricula are integrated in ways that enact the relationship between literature and history. Many of the primary historical sources for study of ancient civilization are literary, so an important component of sixth grade literature study will be such ancient texts as Genesis and Exodus, the Bhagavad Gita, and myths and histories from the Greeks and Romans. Choice of texts will be influenced by the grade six social studies standards. With support, sixth grade students will read translations of the originals of these texts, as well as modified versions designed specifically for young people.

Consistent with all English instruction at Paramount Bard Academy, sixth-grade English will combine shared and independent reading that follows the workshop model. Students will be encouraged to read children's and young adult fiction and nonfiction at their independent reading levels, as determined by teacher-administered reading inventories. They will also be encouraged to choose independent texts that deepen their understanding of topics from the curriculum. In writing workshop, students will compose examples from the range of genres outlined by the grade six ELA standards, with an emphasis on expository and creative writing that draws on information and models from the study of ancient civilizations.

Below is a description of a three-week unit on the Moses and exodus stories from the Hebrew Bible. Exodus raises an important set of questions about leadership, risks, and rules, all relevant to the essential question for the year, "Who am I, and where do I belong?" It follows a variation on the quest narrative structure that students will encounter in other ancient stories and myths. Because Exodus becomes critical in U.S. history, the unit ends with a brief glimpse at transformations of the story in the struggle against slavery and for civil rights.

Choice of topics, texts, and activities support the following CDE standards: History 6.3, Grade Six Reading 3.0, Writing 2.1 and 2.4, and Listening and Speaking 1.1-1.7.

Essential Questions

- Who is called to be a leader, and how do we know when to follow?
- Who makes the rules?
- What risks are worth taking?
- What is the relationship between faith or belief and action?
- What do the trials/responses of Pharaoh, Moses, and the Israelites suggest about human nature?

Understandings

- Some characteristics of the hero/leader are unique to Hebrew stories, but many generalize to other cultures.
- The story of Moses and the Israelites is a liberation narrative, which follows the ancient structure of the quest.
- Moses and the exodus became symbolic in the history of U.S. slavery and civil rights.
- The Bible is an ancient text—an oral narrative, written years after the events (which may or may not be historical); translated multiple times and for different purposes.
- Much of the story is implicit—related to oral form, story repeats language and pattern; detail is left to imagination or to the storyteller for embellishment.

Projects

Note: All activities, including independent research, will be carried out during the school day with the support of faculty and MAT graduate students.

- Daily writing to read: As in all courses at Paramount Bard, students will frequently use writing as a means to enter into and deepen their understanding of texts. During the Exodus unit, students will maintain a journal of responses to the following moments. Included are possible prompts for writing:
    - Baby in the bulrushes—Re-tell the scene from Miriam's perspective. Consider what we learn about her character through her clever actions.
    - Murderer in exile—What are we to make of Moses' temper? What is the relationship between anger and action?
    - The call—Why is Moses reluctant, and is reluctance typical of the ancient heroes we've encountered?
    - Plagues—How are the plagues a kind of trial for Pharaoh? What are we to learn from his response?
    - Exodus and escape—God is also a character in this tale. What examples of deus ex machina (discussed in class) have we seen? Why are they important?
    - Commandments and Golden calf—Re-tell the story, first from an Israelite's perspective, then from Moses'. Be sure to think about the differences suggested by the action of the scene we read for today.

    - Wilderness—Recall our discussion of metaphor. How is the wandering in the wilderness metaphoric?
    - Promised Land—Moses accepts the fact that he won't be allowed to enter the Promised Land. What's going through his mind? Write his thoughts.
- Comparing translations: Students will compare short passages from two major English translations of Exodus—the King James Version and the New Revised Standard Version—and write about how meaning shifts with choice of word and image.

- Creating a map—The quest myth is a narrative pattern that students will encounter repeatedly in their study of ancient civilizations. To learn about such essential literary patterns, or archetypes, groups of students will create a "map," using only geometric shapes, lines, and color, that represents the journey, character and conflicts in the quest archetype as it is depicted in the Moses story. They will write a rationale for their choices and present these maps in a gallery for grade six.

- Oral re-telling, with elaboration: Much of the action and most of the interior conflict is left implicit in Exodus. Using Reader's Theatre, groups of students will take responsibility for each of the story sections described above. They will read their portion of the story to the class, with elaboration and commentary. This work will support the final project, in which students work collaboratively with the social studies course to create a television documentary (see grade six World History sample unit for description.)

Texts
Exodus (RSV and KJV, for comparison)
"Go Down, Moses" (Negro spiritual)
Johnson, James Weldon. "Let My People Go" (poem) from *God's Trombones: Seven Negro Sermons in Verse* (1927)
King, Jr., Martin Luther. "I See the Promised Land" (transcript and video clip of speech from June 23, 1963)
Parson, Jayne and Brian Delf. "The Israelites in Egypt" and relevant sections of the Dorling-Kindersley *Bible Atlas*, a secular text with cultural information, timelines, and other contextualizing materials.

9th Grade
United States History and Geography: Continuity and Change in the Twentieth Century
Course Question: "Why do we seek the new?"

Americans have always been on the move—literally and figuratively. This curriculum takes a multi-perspective and layered look at mobility. Throughout the past century, why have Americans moved? What did these moves require? What explains the seemingly

endless quest to move? How have Americans been "pushed" to new places? How have they been "pulled" to new places?

Students hold basic theories about why people move. These theories are rooted in their own experiences. Similarly, students have theories about what kinds of adjustments a migrant must make to a new place and ideas about how citizens change or evolve to become "modern" (or conversely, how some migrants hold strongly to traditional values). These ideas form the starting point for a course that continually investigates cases of movement, migration, modernity, change, and continuity.

The 20th century American experience is especially useful for exploring how migration and changing demography introduced new ideas, spread cultural expressions, urbanized and industrialized the national landscape, created useful tensions, and otherwise shaped a modern America. This course looks at cases like: Eastern European migration in the early century, the African American migration from the rural south to the urban north, the migration of Mexicans to and within Southwestern states prior to WWII, postwar suburbanization, the jet-age immigrant experience, and the contemporary migration away from urban industrial cities to southern suburbs.

The themes of seeking, aspiring, fleeing, and adjusting are all evident in the largest inter-migration in U.S. Facing the hostility of Jim Crow in the South and attracted by industrial job opportunities in the North, millions of rural African American families caught trains for America's rapidly expanding cities between WWI and the 1950s. Collaborating with the ELA course, this unit uses an in-depth case study to understand the unique challenges and achievements of the Great Migration.

With three common texts, both ELA and History attempt to recreate the experience of an African American walking down Lenox Street in Harlem in July of 1927.

Subunit: Great Depression and New Deal

Standard 11.5 Students analyze the major political, social, economic, technological, and cultural developments of the 1920s.

Essential Questions

- Why might a Black man or woman in Florance, Alabama want to leave?
- What might be appealing to him/her about the city?
- What adjustments would she/he need to make after moving to Harlem?
- What would she/he miss about life "back home?"
- Can city-life change the kind of music someone likes?
- Did migrants see the North as an escape, an opportunity, a great unknown, or an inevitability?
- How did migrants make the city a more interesting place?

Understandings

1. African Americans in the 1920s faced oppressive discrimination in both law and tradition
2. The rise of industry created new opportunities for Blacks in the South
3. Daily life in cities differed drastically from the common sharecropping experience in the rural South
4. African Americans made complex adjustments when building new lives hundreds of miles from "home."
5. The sheer size and technological possibilities available in cities created the conditions by which rural traditions and art forms were modified and spread to gain widespread popularity in what became known as the Harlem Renaissance.
6. Art, music, and drama are usefully understood as products of a specific time and place.

Sample Activities

Final course project: As part of a larger, interdisciplinary end-of-course project ("My Migration Ain't Like Yours") students are creating a multi-media presentation that compares and contrasts a historical case of migration, such as the Great Migration, with a case from their own community.

Changing Lenses: Students create two sets of eye glasses labeled "History" and "Literature." Used throughout the unit, students will read shared documents while "switching lenses"--considering how an historian or literary analyst would view each text differently and for different purposes: James Weldon Johnson's essay on lynching, Langston Hughes' *Negro Speaks of Rivers*, and Bessie Smith's recording of "Gimme Pigfoot Blues."

Walk Down Lennox: Working in groups, students align their desks in the classroom or hallway to resemble Lennox Ave. in Harlem in July of 1927. Groups create and define the institutions for that time and place: a small church, a restaurant, an employment agency, a night club, a school, a clothing store, a domestic apartment dwelling, a recording studio, a public park, and a literary club. Using historically-grounded empathy, students consider perspectives on Johnson, Hughes, and Smith through these institutions.

Socratic Dialogue: In groups of three, students take on the characters of Johnson, Hughes, and Smith to discuss: 1) reasons why they might wish to return to the South and reasons why they wish to remain in Harlem; 2) reasons why their art forms would not have emerged as they did had they remained in the South.

Texts

Hughes, Langston
Johnson, James Weldon
Smith, Bessie
Lemann, Nicholas. *The Promised Land: The Great Black Migration and How it Changed America*. NY: Alfred A. Knopf, 1991.

Ninth Grade English Language Arts: The Quest for the New
Course Question: "Why do we seek the new?"

Ninth grade English is a course called "The Quest for the New," a survey of twentieth-century U.S. literature. Integrated with social studies, the course seeks to address the following questions:

- In what ways are restlessness and a quest for the new defining characteristics of being or becoming American in the 20th century?
- How does literature represent actual struggles for the new in 20th century U.S. life?
- What is new about American literature in the 20th century, and what is consistent with the past?

As with all English instruction at Paramount Bard Academy, "The Quest for the New" will combine shared reading in an array of genres and independent reading that follows the workshop model and supports the curriculum. For their independent reading, students will be matched with texts at their appropriate reading level, as determined by teacher-administered inventories; some, though not all, independent reading choices will support the "Quest for the New" curriculum. All students will read representative works from some of the key literary and social movements in the American twentieth century, including literature about the "New Woman" of the 1920's and from the second wave of feminism from the 1960's; work from the Harlem Renaissance and the later Black Arts movement; poetry from the modernists and the Beats; protest songs from the 1930's and 1960's; and memoirs of immigration and migration.

Below is a description of a three-week unit in the course, in which students are introduced to the Harlem Renaissance through collaborative work between English and social studies. In addition to examining a set of common works in both courses, students in English will focus intensely on one of the principal texts of the era, *The New Negro*, edited by Alain Locke. A combination of visual art, fiction, poetry, and essay created by many of the major African-American writers of the 1920's, this book was instrumental in shaping the claim that something new was taking place among black artists in Harlem: a re-birth of African arts in the new modes and voices of African-Americans.

Essential Questions

- Why was being perceived as "new" important to African-American writers in Harlem in the 1920's?
- How do the works in *The New Negro* build on traditional modes—African, African-American, and English? How do they break new ground?

Understandings

- *The New Negro* and Harlem Renaissance are cultural manifestations of the larger struggle of African-Americans for equal opportunity and representation.

- The Harlem Renaissance can be considered the first intentional artistic movement in black literary history.
- *The New Negro* challenged stereotype and promoted an ideal of Africa as culturally rich and of the "negro" as strong, beautiful, artistic, and intellectual.
- Contributors to *The New Negro* experimented with vernacular writing, archived Negro spirituals and folk tales, altered traditional English forms such as the sonnet, and worked in modes generally associated with metropolitan modernism. Presentation, as well as variety, was critical to the book's message.

Projects

Note: All activities, including independent research, will be carried out during the school day with the support of faculty and MAT graduate students.

- Daily writing to read: As in all courses at Paramount Bard, students will frequently use writing as a means to enter into and deepen their understanding of texts. During the *The New Negro* unit, particular attention will be given to differences across genres and the relationship between form and message (2.2; 3.1-3.2)
- A Walk Down Lenox Avenue, 1927: To reinforce the fact that the Harlem Renaissance was the result of a complex network of social, political, and artistic factors, students in grade nine English and social studies will reconstruct the scene on Lenox Avenue in 1927. In both courses, students will read Langston Hughes' "The Negro Speaks of Rivers," listen to Bessie Smith's "Gimme a Pigfoot Blues," and learn about the work of James Weldon Johnson.
- Independent research into the lives and work of one of the artists from *The New Negro*: This text is a veritable Who's Who of Harlem Renaissance figures, among them Zora Neale Hurston, Jean Toomer, Langston Hughes, Countee Cullen, W.E.B. DuBois, Aaron Douglas, and Arna Bontemps. Using print materials and internet resources, such as websites hosted by the Library of Congress and the Schomburg Center for Research in Black Culture, students will research and write about an artist from *The New Negro* and analyze her/his work in light of biographical and historical information (1.1-1.9; 2.4-2.6; 3.12)
- Book making: To emphasize the significance of choice and presentation in *The New Negro*, and to compare/contrast black arts movements in the 20th century U.S., students will begin creating a portfolio of materials that will culminate in a class book called "The New Negro, Then and Now." This project will continue during a unit on the Black Arts movement. It will include African American writing and art discovered by students through research, expository writing by students about these examples, and creative imitations of and responses to the work. (1.1-1.9, 2.1-2.3, 3.11-3.12)

Texts

Ferguson, Jeffrey Brown. *The Harlem Renaissance: A Brief History with Documents*

Harlem, 1900-1940, An African-American Community
(http://www.si.umich.edu/CHICO/Harlem/)

Huggins,Nathan, Ed. *Voices from the Harlem Renaissance*
Johnson, James Weldon. "The Dilemma of the Negro Author."
Library of Congress Digital Collections (http://www.loc.gov/library/libarch-digital.html)
Locke, Alain, Ed. *The New Negro*
Reuben, Paul, Ed. *PAL: Perspectives in American Literature, Ch. 9 The Harlem Renaissance* (http://www.csustan.edu/english/reuben/pal/chap9/CHAP9.HTML)
Smith, Bessie. "Gimme a Pigfoot Blues" (song)

F2. MATHEMATICS

Sixth Grade Mathematics: The Ideal School – Mathematics and Design

In the course of this unit sixth grade students will apply computation and measurement skills; develop geometric concepts related to area and perimeter; resolve problems having to do with percentages, construction costs, and design principles; learn to use available technologies, such as design software; and engage in collaborative planning to design an 'ideal school' of their own invention.

Students will begin by reflecting on their school experiences, including their experiences in the Paramount Bard Academy, to determine what elements of school life they think are important and/or satisfying. With these elements in mind, they will be asked to think about how school facilities might be designed that would best serve their ideas of an "ideal school". The goal of this unit is to develop and present a proposal for the construction of a middle school, serving 150 students in grades 6 through 8. The final report must include a scale drawing of the building floor plans, an estimate for the costs of building such a school, the physical layout and furniture needs of a typical classroom, and a rationale for the design itself. A particular focus on the construction and final energy use costs of a typical classroom in the ideal school will allow students to examine particular design issues more closely. Design teams of three to four students will carry out these projects. The teacher's role during the design process will be to provide mini-lessons that teach key concepts and offer useful questions to advance student thinking along the way. For example, the teacher will ask students to share floor plans for a typical classroom leading to a discussion of the relation of perimeter to area, how the shape of a room promotes or hinders various kinds of room use and activities, and how the volume of a room impacts heating/cooling costs.

Classroom presentations by a local architect and a building contractor will give the students an opportunity to learn how professionals think about similar problems and

guided visits to recently completed schools – such as the Robert F. Kennedy Jr. High School in Delano and the University Charter School, a middle school on the West Hills College Lemoore campus – will allow students to consider alternatives as they work on their own designs.

A rubric for grading final projects and a list of questions that must be answered during the design process will provide students with a clear set of expectations. The final designs will be presented to teachers, peers, and local professionals with related expertise in a closing symposium at school.

Essential Questions:

1. What is the most effective design for an "ideal school"?
2. How does mathematics help us answer this question?

(These are understood as essential questions because they defy simple solutions. The first question leads to questions of what effective means, which in turn requires students to begin defining terms and weighing various and often competing goals in planning a school building that satisfies a definition of effective. Are effective and efficient synonymous? The use of data and the application of mathematical methods and ideas provides the best way to balance competing demands and rationalize a final design that establishes priorities while offering design solutions that satisfy key principles satisfactorily. In the end, students will have developed a working knowledge of mathematics applications while coming to understand that there is no best solution, but rather a number of choices that can only be resolved through weighing alternatives.)

This unit will require students to understand and apply concepts and procedures related to many of the CDE Grade 6 Mathematics Content Standards, such as:

- **Number Sense - 2.0**: calculating and solving problems using addition, subtraction, multiplication, and division in various aspects of the design process.
- **Algebra and Functions - 1.0:** using and solving linear equations as well as graphing and interpreting results in solving problems related to the relationship of room volume to heating and cooling costs.
- **Algebra and Functions - 2.0:** constructing tables and graphs that compare building costs and conversion of measurements and the use of ratios in the preparation of floor plans.
- **Measurement and Geometry - 1.0:** using measurement of furniture to solve problems of classroom layout, calculating the volume of student lockers to determine the most appropriate shape and measurements for designated storage purposes.
- **Mathematical Reasoning - 1.0, 2.0, and 3.0:** all three areas of mathematical reasoning are necessary to success in this task and students will be asked to document aspects of their reasoning processes during the design sequence as a way of increasing reflection and building increasing self-awareness of student approaches to problem solving in mathematics.

Understandings to be developed:

- Relationships of perimeter to area and surface area to volume provide the basis for understanding how to maximize or reduce available space in relation to factors such as construction costs and heating/cooling demands.
- Recognizing patterns of relationship in design calculations leads to the construction of algebraic equations that provide functions for design decisions.
- Proportional diagrams, units of measurement, and scaled drawings serve various purposes in the design process for the effective communication of ideas and the realization and resolution of various design problems.
- Initial construction costs need to be balanced against long term maintenance and energy use costs in developing a financially sound plan for facilities or building development.
- Graphs, charts, and tables can be instrumental in understanding and comparing long term and short term costs in facilities design and planning.

F3. SCIENCE

9th Grade Biology – Ecology: Cycles Large and Small

This unit, and comparable units throughout grades 6 through 9 are designed to engage students in scientific thinking, which is exemplified in research processes. This serves a twofold purpose. It not only develops a more robust understanding of key scientific concepts and a fluency of knowledge in the scientific domain but also prepares students for research-based courses after 9th grade that demand increasingly independent work under the guidance of teachers. These courses will be modeled after the ***Authentic Science Research*** course developed by Dr. Robert Pavlica (http://www.nefsc.noaa.gov/press_release/2008/SciSpot/SS0811/index.html and http://eric.ed.gov:80/ERICWebPortal/custom/portlets/recordDetails/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=EJ682711&ERICExtSearch_SearchType_0=no&accno=EJ682711) as well as the ***Science Research in the High School*** program at the State University of New York at Albany (http://www.albany.edu/scienceresearch/). In these later courses, students engage in research projects and are connected to scientists at local colleges/universities as well as the private sector for additional guidance and real connections to the scientific community. For interested students, summer internship experiences in research laboratories will be part of their continuing education.

This unit of instruction addresses aspects of CDE Science Content Standards in Biology/Life Sciences, Standard Set 6. Ecology. In this unit, there is a particular emphasis on developing a working understanding of Standards 6.a., 6.b., 6.d., 6.e., and 6.f. through a comparative exploration of the flow of energy and elements through different ecosystems at the level of decomposition.

This unit follows the environmental inquiry unit ***Decay and Renewal*** developed by Nancy M. Trautmann and the Environmental Inquiry Team for the ***Cornell Scientific Inquiry Series***. Please refer to this source for a more detailed description of daily activities:

Trautmann, N.L.; Krasny, M.E.; Carlsen, W.S.; Cunningham, C.M. 2003. *Decay and Renewal*. Arlington, VA: National Science Teachers Association. (see also http://csip.cornell.edu/)

The goals of this unit, and the goals of science instruction generally at Paramount Bard Academy, are clearly defined in the text cited above and focus on engaging students in authentic science research as the context for developing scientific literacy.

"The goals of EI (Environmental Inquiry) are for students to:

1. Develop research skills
2. Use their newly acquired skills to conduct research projects of their own design focusing on topics relevant to their local communities
3. Participate in communities of peer student scientists
4. Enhance their understanding of scientific content and process"

(page 1, Trautman et al, 2003)

This unit was designed with the goals of developing scientific literacy, following the lead of the National Science Education Standards and the CDE standards for science learning. Students engage in data collection and sampling techniques leading to laboratory experiments that monitor decomposition activity associated with the activity of invertebrates and various microorganisms.

Students will engage in a variety of activities that position them as practicing scientists engaged with relevant questions and connected to local issues:

1. Students learn procedures for culturing bacteria and fungi, identification techniques, as well as assays for determining BOD (biochemical oxygen demand), carbon dioxide production, pH, dissolved oxygen, and dissolved carbon dioxide. Experiments with decomposition lead to an understanding of the biological mechanisms involved in composting and students are challenged to design composting systems that might satisfy present demands for solutions to problems of waste and recycling.

2. Students will engage with primary research literature, visit local agricultural field stations, and conduct investigations on line to understand current research and thinking in the field. Access to various databases will be one of many technological components in this unit, including use of the site developed as a connecting link to this unit. (http://www.scilinks.org/)

3. By drawing samples from local agricultural sites as well as from non-cultivated areas in the surrounding region and by talking with local agricultural and

environmental specialists, students will come to understand how the 'natural' and managed landscapes differ due to human use. Students will come to appreciate the issues of diversity and the complex problems associated with the monocultures that are typical of current farming techniques in the San Joaquin Valley.

By the end of this unit students will take on a research challenge that will require them to build on their understanding to answer a key question that is relevant to their own community. (In ***Decay and Renewal,*** students are challenged to design a solution to a hypothetical community's wastewater problem.) It's easy to imagine any number of problems associated with local agricultural practices. As a result of this research, students will develop key understandings that will allow them to answer these questions as a result of their investigations:

1. How do we explain the differences in biodiversity across different geographic areas in our local region? (CDE Standard 6.a.)
2. What are the effects of climate, human activity, and the introduction of nonnative species on the local landscape? What would happen if these changed in particular ways? (CDE Standard 6.b.)
3. How do water, carbon, and nitrogen cycle through the ecosystem and how is the role of biotic and abiotic factors different in natural versus managed settings? (CDE Standard 6.d.)
4. How are the populations of producers and decomposers regulated differently in different ecosystems and how does balance get defined? (CDE Standard 6.e.)

What determines energy inputs and outputs in a given ecosystem and how is the cycling of energy different in the cultivated versus the "natural" landscape? (CDE Standard 6.f.)