

## **The Scientific Endeavor Master Syllabus**

### **Cluster**

#### Quantitative and Scientific Reasoning

Courses in this cluster prepare King's graduates to be scientifically literate members of society. Over time, the quest for truth and understanding has led inquisitive people to ponder questions about the physical world and society and to discover – through the process of hypothesis, experiment, and observation – the rules, both simple and complex, that govern natural and social phenomena. In this vein, the overarching goals of the courses within this cluster are to inspire students to be curious about the world around them and to provide the mathematical and analytical tools necessary to draw sound conclusions from observations and evidence. From the study of the matter in the universe, the organization of matter into complex living organisms and ecosystems, and the effects of human behavior and organization on the physical world and each other, students will ultimately form connections between the governing principles of scientific inquiry and our human experience within the natural and social worlds. The foundational knowledge developed in the Quantitative and Scientific Reasoning cluster will enable students to identify scientific issues underlying national and local decisions and to utilize their skills of quantitative and scientific analysis to respond in meaningful and ethically responsible ways to issues of contemporary importance to society.

### **Core Goal Served in this Category**

Goal 5: To advance our students scientific reasoning and literacy.

### **Core Learning Outcomes**

A student successfully completing The Scientific Endeavor will be able to

1. Demonstrate familiarity with theories and research methods in the natural and social sciences, including qualitative and quantitative interpretations and analyses (Core Goal 5.1)
2. Critically assess sources and claims to test their validity from a scientific and quantitative perspective (Core Goal 5.2)
3. Evaluate the strengths and limits of the scientific method and articulate the relationship between science and other ways of seeking knowledge (Core Goal 5.3)
4. Design an experiment with a sound hypothesis or research question (Core Goal 5.4)
5. Demonstrate knowledge of the principles of ethically responsible research (Core Goal 5.5)

### **Catalog Description**

While every educated person may not be a scientist, he or she must have enough knowledge of the scientific method and of fundamental concepts of the natural sciences to understand and make informed decisions affecting both private and public issues of health and the environment.

In the Scientific Endeavor course, students will examine the empirical methods scientists use to gain knowledge about the world and how this knowledge shapes our human experience. The course offers a study of the scientific approach, its limitations, and what distinguishes science from other approaches to understanding the world. Students will learn how scientific observations and data become accepted scientific theories, how controversies are settled, and how science and scientists retain credibility and authority.

### **Intangibles / Aspirations / Other Category-Level Elements**

In addition to the outcomes assessed in this category, other Core outcomes might be developed and addressed. Skills, competencies, and dispositions relevant to the subject of science might also be cultivated in this category.

- To help students develop the foundational skills and competencies of written and oral communication, quantitative reasoning, and critical inquiry and analysis (Core Goal 1)
- Construct, evaluate, and defend moral arguments about matters of contemporary and perennial importance (Core Goal 3.4)
- Wonder, ponder, and ask thoughtful and insightful questions about the natural world (Core Goal 7.1)
- Seek out and give a fair and honest hearing to multiple and competing perspectives (Core Goal 7.2)

### **Teaching Methods and Assessment**

All students in this course will complete:

- A scientific design project (written, oral or both) in which students demonstrate proficiency with the scientific process. (Learning Outcome 1 and 4)
- An argument related to ethically responsible research (Learning Outcome 5)
- An assignment discussing the limits of scientific research (Learning Outcome 3)
- An evaluation of claim for scientific validity (Learning Outcome 2)

### **Texts**

Instructors should select a textbook that addresses the learning objectives of the course. Possible choices include:

1. *The Scientific Endeavor: A Primer on Scientific Principles and Practice* by Jeffrey Lee
2. *Just a Theory: Exploring the Nature of Science* by Moti Ben-Ari

## **Additional Information / Resources for Instructors**

### **Suggested Course Outline**

#### **Unit 1 –The Nature of Science (Goal 5.3)**

Questions: What is science? Why study science? What, if anything, is special about the way that scientists generate knowledge? Are there questions about the natural world that science can't answer?

#### **Unit 2 – The Empirical Process of Science (Goal 5.1, 5.4, 5.2)**

Questions: How can we formulate a testable hypothesis? How do we design experiments to test hypotheses? How are experimental variables identified and manipulated? What is the importance of establishing an experimental control? How can statistics and graphing help analyze data? Is there a difference between correlation and causation in a data set?

#### **Unit 3 – Beyond Scientific Experiments (Goal 5.5)**

Questions: What sort of biases should experimenters be aware of? Are there experiments that are unethical to conduct? Can science always tell us the right answers? Is all scientific data reliable? How should citizens judge scientific findings?

#### **Unit 4 – Science in Society**

Questions: What does science reveal about contemporary problems facing humanity and can science always offer solutions to those problems? Are all advancements in the natural sciences truly for the good of mankind?

## **Courses**

### **NSCI 100: The Scientific Endeavor (3)**

A study of the empirical methods scientists use to gain knowledge about the world and how this knowledge shapes our human experience. The course offers a study of the scientific approach, its limitations, and what distinguishes science from other approaches to understanding the world.

While examining contemporary issues in science, students will learn how scientific observations and data become accepted scientific theories, how controversies are settled, and how science and scientists retain credibility and authority.