Oats, Kings, Proofs, and Climate Change: How Do You Know?

Led by Paul A. Heiney

Preface

This seminar examined the ways in which scholars acquire knowledge in various disciplines. The focus in the course was on the nature of evidence, and how a case is made for a particular claim. Penn faculty members from multiple disciplines presented “modules” on topics relevant to their fields, using primarily original source materials to illustrate the process of discovery, confirmation, and change. The underlying question in each case was "How do you know? (HDYK)" For example, how do you know whether a mathematical statement is true or just plausible? How do you know whether a popular dietary recommendation is a good idea?

The first module was led by Dennis DeTurck (Mathematics and Dean of the College of Arts and Sciences), and examined the nature of mathematical knowledge. Participants worked through a collection of puzzles in mathematical arenas as diverse as probability and graph theory to gain an appreciation of the ways in which mathematicians decide what is “true” and “not true”, and the surprising ways in which apparently unrelated questions can be connected to each other. The second module was led by Robert Giegengack (Geology), and examined the now commonly accepted assertion that human activity has been responsible for the warming trend now underway. We gained a critical understanding of the scientific and political basis of the current climate-change debate, an appreciation of the probability that widely publicized projections of future climate will be realized, and some insights into actions that society should or should not be taking to mitigate these changes. The third model was led by Paul Rozin (Psychology), and examined the medical studies that led to the rise and fall of oat bran as an effective way to lower blood cholesterol. The focus was on medical science and its interaction with the media and the public, and on how the same results can be described (framed) in different ways in terms of the motivation of the individuals presenting the results. Finally, Phyllis Rackin (English) led a module examining the historical basis of Shakespeare's Henry V. What would Shakespeare have known about Henry V from the historical sources available to him, how does that information compare to what he put in the play, and more generally how do we know the past? We found that the play could actually be read in very different ways, leading to apparently equal valid interpretations of the king as a noble hero or a dishonorable villain.

Paul Heiney, in addition to his role as seminar organizer, led “integrative” discussions of probability and randomness, the nature of good and bad science, Kuhn’s theory of scientific revolutions, and the HDYK questions posed by the 1985 reports of cold fusion.

The Fellows in this seminar went quite different directions with their curriculum units. Cara Crosby, a middle school math teacher, wrote a curriculum unit designed to lead students towards the concepts of logic and proof in mathematics. Students will examine
how the rules of childhood games are related to axiomatic systems, work on the four-color map problem, and solve logical puzzles. Anne Cherian, a high school math teacher, developed a unit organized around the binomial and normal probability distributions. Relevant examples were taken from situations familiar to the students, such as their placement on a percentile scale after taking a standardized exam.

Alexander Leed, a high school physics teacher, developed a unit that explored the HDYK aspect of the universal law of gravitation. How do we know that the same laws that govern the motions of objects on earth also govern the heavens? Rita Sorrentino, an elementary computer teacher, wrote a curriculum unit exploring truth and falsehood in photography. This unit extended previous experiences that her fifth grade students have had with digital photography to help them answer the question, “How do we know what is true in this digital age?”

Meagan McGowan, a high school history teacher, explored the HDYK aspects of the American Civil war. Her unit examined the role that bias in source material plays in deciding how history is written and learned. Students will work with primary sources from both ends of the conflict to discover how politicians, authors, filmmakers, and historians have painted the message behind the Civil War to their advantage. Kate Reber, a high school English teacher, also explored bias in research, and specifically bias in survey methodologies. After reading and interpreting WPA interviews with Ex-Slaves, and examining the so-called Bradley Effect in election polls, her students will design their own interview and survey protocols.

Collectively, these units will provide a valuable resource for teachers wishing to present these topics in their own schools. In addition to detailed lesson plans, the Fellows were also in many cases able to identify valuable teacher and student resources, both in printed form and on the web, which could be used both in development of new curricular units or in enhancing existing units.