

Designing Effective Science Experiences: Examples of upper Level Courses for

Non-science Majors

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At Keene State College, our new Integrative Studies Program (ISP) requires that students complete at least two courses at the 300 or 400-level. All courses in the program are required to address three sets of outcomes - those that focus on skills development, those that reflected the Perspectives area, and Integrative Outcomes that reflect Keene State College's values. Our integrative Outcomes combined with the Skills Outcomes and program breadth align with the LEAP Essential Outcomes (http://www.aacu.org/leap/documents/EssentialOutcomes_Chart.pdf), and this poster is presented as a LEAP Camps Action Network exemplar. This presentation focuses on the science outcomes expected of all Keene State graduates. Most of our students are not science majors, and many enter with a negative attitude towards science and an inability to distinguish between science and pseudo-science.

Integrative Studies Program

Students at Keene State College complete two programs of study to earn a degree - the College's Integrative Studies Program and their major program of study. Keene State College's Integrative Studies Program purposefully and intentionally helps students engage ethical issues, approach global issues from multiple perspectives, apply diverse perspectives to their thinking and their actions, and analyze key social and environmental issues confronting us all. The program provides students with the opportunity to develop the skills necessary for success in academics and careers and preserves the breadth of a liberal arts education that enables students to succeed in a global environment. The integrative teaching and learning process approaches teaching and learning in intentionally connected ways. Integrative learning is a process by which students will connect knowledge and skills from multiple sources and experiences, apply knowledge and skills in varied settings, utilize diverse points of view, and understand issues contextually. Knowledge in both individual and multiple disciplines is the foundation upon which integrative learning builds. Integrative learning often occurs as students put theory into practice, "making meaning" as students apply abstract concepts in practical settings. As students participate in this integrative learning experience they will: see connections in seemingly disparate information and connect skills and knowledge from multiple sources and experiences; apply skills learned in one situation to problems encountered in another; become aware of complex interdependencies; be able to utilize diverse and contradictory points of view in their discussions and decision-making; and be able to understand contextual frames and take into account different dimensions of an issue, seeing it from different perspectives, making conceptual links. Though they are not required as part of the Integrative Studies Program, students should also consider as part of their learning, developing competence in a second language, participating in a study abroad program, and participating in experiential learning in which disciplinary, interdisciplinary, and multi disciplinary knowledge can be applied.

Requirements

(minimum) 44 credits

Students will complete a total of 44 credits as follows, including a minimum of two courses (8 credits) at the 300 or 400-level. Students may enroll in the upper-level courses once they have completed a minimum of 24 credits of lower-level (100 and 200 level) courses including ITW 101 and IQL 101 in the Integrative Studies Program. The upper-level requirement must be completed at Keene State College. Students should complete ITW 101 within their first two semesters and IQL 101 within their first three semesters.

I. Foundations

8 credits

Essential question: How do critical and creative thinking, researching, writing, and evaluating quantitative information inform scholarly endeavors?

Thinking and Writing (ITW course prefix)

Quantitative Literacy (IQL course prefix)

II. Developing Perspectives and Breadth of Knowledge

32 credits

Essential questions: How are the arts and humanities constructed and defined, and how do they change, shape, provoke, and represent our perceptions and our world? What assumptions, methodologies, and theoretical constructs define today's sciences, and how are they used to understand our world?

Modes of Inquiry

Perspectives Distribution

Four courses in the Arts and Humanities (IA and IH course prefixes) 16 credits

Two courses in the Humanities (IH)

One course in the Fine and Performing Arts (IA)

Two courses in the natural sciences (IN)

Two courses in the social sciences (IS)

II. Making Connections

4 credits

Essential question: How are the skills, concepts, and values developed across disciplines applied to questions fundamental to today's interdependent world?

Integrating Modes of Inquiry

One course in Interdisciplinary Studies (II course prefix)

THE NATURAL SCIENCE COMPONENT

Introductory (100 and 200-level) ISP courses are offered in virtually all of the natural science areas. Many of these courses are designed as a gateway to the major in the hope that a student who signed up for the course to satisfy a General Education requirement might be enticed to major in that discipline. As such these courses are often information dense and not 'friendly' to the non-science major.

Many non-science majors delay the Natural Science component of their General Education requirement until their junior or senior year. Prior to the implementation of the ISP, these students usually enrolled in introductory-level, content-dense science courses (often an introduction to the major course) and often put in an effort just good enough for a 'passing grade'. At best, their attitude about science remained unchanged, at worst they left with an even more negative attitude about science.

Under the new program, these students take courses designed to challenge upper-level students. Students at the upper-level bring higher-level skills in many areas, including reading, writing, critical thinking and information literacy. For upper-level non-science majors we have developed a number of courses that integrate science with other areas of knowledge (e.g., social sciences, public policy, history, philosophy, literature, and art) to advance the understanding of the place of science in all aspects of life.

The core paradigm of the discipline offering the course is introduced and the specific topics that lie at the intersection of science and society comprise the bulk of the content. Students often work with primary sources in lieu of an introductory text in the process of researching a paper on a topic or issue that is of interest to them and that is part of the larger topic of the course. Two courses from Geology (Geoscience Issues & Society and Earth Climate - Past & Future), one from Biology (Evolution and Genetics of Sex) and a course from Psychology (Mercury and Power) have been or are being offered, and as the number of students required to take the ISP increases, additional courses will be phased in. Early indications include increased participation in class discussions, increased use of primary sources in written work and a greater awareness of science related items that students ask about during or after class. Although we have not conducted a rigorous survey yet, anecdotal evidence suggests the students completing these courses have a much greater appreciation of the role of science in their lives.

COURSE DESCRIPTIONS

INBIO-300 EVOLUTION AND GENETICS OF SEX - Ken Bergman, Biology Department

Topics in the biological sciences such as genetics, health, ecology, and others will be explored at an in-depth level. Socially relevant and ethical issues such as AIDS, genetic engineering, embryo research, environmental crises and other issues will be emphasized. Prerequisites: 24 credits in ISP including ITW 101 and IQL 101.

INGEOL-300 GEOSCIENCE ISSUES AND SOCIETY - Charlie Kerwin, Geology Department

A course focusing on the cause and effect of geologic processes that impact society. Content may vary, but includes earthquakes, tsunamis, floods, volcanic activity, resource issues, and the geologic record of climate change. Students are expected to closely monitor popular media to document current geologic events and their effects. Prerequisites: 24 credits in ISP, including ITW 101, IQL 101 and one course from the IS category.

Geoscience issues and society is a course that will focus on the impact that geologic processes have had, are having and will have on the existence of society. We will discuss how we believe the Earth formed and what has transpired on this planet since the beginning. How do geologic processes affect the weather, climate, oceans, atmosphere and ultimately, life on this planet. What (if anything) can we do to predict and possibly alter the natural course of events? What does the past tell us about the future. We will use the media to discuss current events and bring them into context.

INGEOL-399 EARTH CLIMATE - PAST AND FUTURE - David Obolewicz, Geology Department

The tools of climatic science are used to investigate the evidence and mechanisms for earth's climatic change events throughout geologic time. Orbital and plate tectonic scale mechanisms will be surveyed including deglaciation. Focus will be on climatic change cycles from 5 million years ago to the present with emphasis on civilization's pre and post-Industrial Age influence on climate modifications. Students will be challenged to assess issues and propose solutions to earth's current climatic transition. Integrated lecture-lab. Prerequisites: 24 credits in ISP, including ITW 101 and IQL 101

Description and Goals

Geol 399 is divided into 3 distinct areas of study:

1. Evolution of the atmosphere, atmosphere dynamics. Climate classification.
2. Climatology as a science. Climate change at tectonic and orbital scales. Deglacial climate change.
3. Global Warming. Global warming remedies... alternative energy, energy conservation. Future Climates

This course will challenge you to think about WHY earth's systems interact the way they do, how the interactions evolved over geologic time and accelerated during historic times. As your intellectual base broadens you will find yourself growing in confidence. Confidence and knowledge will enable you to communicate, discuss and debate with great credibility the issues at hand related to the current Global Warming crisis.

ISPSYC-399 MERCURY AND POWER - Karen Jennings, Psychology Department

This course will explore the complex topic of mercury in our environment and its impact on society. Students will engage with faculty to understand the health and environmental consequences of emissions of this toxin and will be challenged develop recommendations that limit adverse societal impacts by working in multi-disciplinary teams. Prerequisites: 24 credits in ISP, including ITW 101 and IQL 101

As an Interdisciplinary offering in Keene State College's Integrative Studies program, this course will engage students in a challenging learning environment that will develop the skills necessary to effectively participate as a member of society when faced with complex multi-disciplinary challenges.

Course Outcomes:

This course will apply a multi-disciplinary teaching method. Upon completion of this course, student will be expected to be able to:

1. identify emission sources for mercury in our environment;
2. identify the environmental fate and transport and exposure pathways for this toxic metal;
3. describe the toxicological impacts of mercury in the developing brain;
4. describe the complex policy challenges and societal impacts of mercury and its compounds; and
5. apply critical thinking, information literacy, and effective and respectful communication skills to engage with members of our society regarding this topic.