Application to the Interdisciplinary Teaching Grant Program

Attached is an application to the Interdisciplinary Teaching Grant Program for a course called "*Introduction to Climate Change*" to be offered for the first time in the spring of 2015. This course would be team-supervised by Dr. Brent Williams in the Department of Energy, Environmental, and Chemical Engineering in the School of Engineering and Dr. Tristram Kidder in the Department of Anthropology in Arts & Sciences. This will be a freshman-level introductory course that focuses on 1) **the physical basis for climate change**; 2) **how climates are changing and how we know and assess that climates are changing**; and 3) **the effects of climate change on natural and human systems**. Our present enrollment target is 50-75 students drawn from all undergraduate schools. We envision that this course could be scaled to a larger audience in the future.

Because the subject matter is vast, and as a way of exposing students to a breadth of material and giving them a perspective in the various disciplinary perspectives on the topic, we will organize the course around a series of guest lectures by faculty from most of the schools at Washington University (and possibly several guest lectures from faculty at nearby schools and colleges). The two instructors will serve as course masters, organizing topics and lectures, introducing lectures and connecting intellectual and subject matter threads across lectures, and administering quizzes and exams. Each course master will also give at least one lecture. While we intend to draw on faculty from most of the schools at the university, the two course masters approach the discipline from different but complementary perspectives. Dr. Williams comes out of a STEM field and his emphasis is on the physical processes involved. Dr. Kidder comes out of a Social Science field and his work is especially concerned with how climate change affects human social, economic, and political systems. By drawing on experts across multiple disciplines and schools students will be engaged by varying intellectual perspectives, and will be exposed to multiple ways of presentation and thinking. By the very nature of the course students will have to confront the challenges of different approaches to data, different levels of data evaluation, different methods, inferences, and assessments, and highly dissimilar political and social viewpoints. All students will have to wrestle with numerical data and all students will have to confront ambiguous issues that do not have hard-and-fast answers. The course masters will also have to grapple with these challenges and we anticipate that the varied nature of the course will stimulate engaged learning by all participants.

In the attached syllabus we outline the course and its objectives and provide a tentative course schedule. The topics have been selected because we feel that these are ones that are critical for a basic student understanding of the subject. The topics have been vetted by the WU Climate Change Initiative committee and have also been discussed by the ICARES Steering Committee. In addition, we have tried to have topics that can be covered by experts here at Washington

University or by colleagues at nearby universities (if necessary). In most instances students interested in further study of a given topic can pursue these in higher-level courses at the university. In the attached syllabus we have tentatively identified individuals who could give a lecture on the topic (none have been formally approached at this time). The topic structure, organization, and lecturers may change slightly as we secure commitments from designated lecturers and work around their schedules.

We provide a budget for the course that requests funds for Graduate and Undergraduate TA support, monies for a small honorarium for guest lecturers, and a budget for course planning to be supervised by Dr. Kidder in fall 2014. We also provide an Assessment plan that outlines the formal course assessment measures and includes a review of the course with feedback for improvement. Letters documenting support by the chair/dean of the relevant school are included as are the CVs of the course masters.

Assessment Plan

An effective assessment of an introductory climate change course should evaluate course management, technical knowledge attained, and development of student values, perspectives and language. Technical knowledge will be assessed through the administration of 7 quizzes over the course of the semester (roughly one every four class periods, or once every two weeks). These will be graded by TAs using a standardized rubric and reviewed by instructors. Frequent quizzes help students monitor their own work and allow rapid assessment of understanding by the instructors and TAs. Two research assignments will also be included. One will use climate modeling exercises as a way of assessing understanding of climate feedback processes and a second will involve calculating individual carbon footprints as a means to explore the capacity to understand the behavior and interaction of human and natural systems. A final, cumulative exam at the end of the course will be used to assess the overall academic progress, and to understand both retention of course materials and student ability to synthesize these materials across different subjects.

To assess changes in student values and acceptance of the shared terminology of climate change the course masters will use a formal pre/post questionnaire to gather basic information about students (prior training, major, etc.) and specific understanding and attitudes related to climate change. The post-course questionnaire will provide a way to measure whether student's beliefs have changed through expressed priorities for future coursework, political goals, and understanding of the coupled human/natural environmental challenges. At the end of the course the quizzes, final exam, and pre/post-course questionnaires will be reviewed by the course masters to gauge overall growth in the use and application of the shared terminology developed in the course; we expect that shared terminology will be used more frequently and naturally over time.

Finally, the course masters will track attendance of students, student engagement and participation, and guest lecture interactions. We are exploring ways to best achieve this monitoring and are considering multiple processes, including Blackboard discussion groups and/or Twitter or other social media interactions. This information will tie course management to student feedback to determine, for example, how much time should be spent with guest lecturers planning course discussions. Within this framework the course masters will be able to assess formal learning, informal growth and the formal course management requirements. Additionally, the assessment of the course will be discussed with the Washington University Climate Change Initiative's steering committee and revisions will be incorporated in future course offerings as indicated by issues and/or deficiencies.

I50-101
Earth's Future: Causes and Consequences of Global Climate Change

Spring 2015
Time: T/Th 1:00-2:30
Place:

T.R. Kidder
120 McMillan Hall
Office Hours: Date, time, or by appointment
935-5242
trkidder@wustl.edu

Brent J. Williams
Brauer Hall
Office Hours: Date, Time, or by appointment
(314) 935-9279
brentw@wustl.edu

Graduate TA:
Office No.
Office Hours: Date, time
e-mail address

Description: Climate change is said by many to be one of the most important issues of our time. Nine of the ten warmest years in the modern meteorological record (which goes back to the 19th century) have occurred since the year 2000. Today, the major political debates on the subject focus on whether climate is changing naturally, or if humans are causing climate change. The scientific reality, however, is that climates have changed through geological time, are changing now, and will continue to change in the future.

Introduction to Climate Change examines 1) **the physical basis for climate change**; 2) **how climates are changing and how we know and assess that climates are changing**; and 3) **the effects of climate change on natural and human systems**. The course is team-taught and will involve participation by scholars across the university with expertise in specific subjects. *Introduction to Climate Change* is a broad, introductory course for first year students. This course presumes no special subject matter knowledge on the part of the student.

Goals: Knowledge about climate change processes and its effects on human and natural systems can be used to shed light on the complex and contested political, economic, and social concerns of contemporary global warming and climate change issues. Students who understand the physical processes of climate change and who understand how we know about these issues should be able to reason well about climate change events and to understand their causes and consequences. By understanding how climate change influences human and natural systems students are expected to make connections between climate change and a multitude of contemporary issues in the 21st Century. A primary objective is to allow us to think about why climates change, what causes climates to change, how we know climates change, and how humans and natural systems respond (or perhaps do not respond) to changes in the earth's climate and climate systems.

Because climate change affects all humans and natural systems, every student is capable of gaining

insight about his/her present day circumstances and future life by careful and critical study of climate change. Through lectures, readings, in-class assessments (assessments/short written responses), and written presentations we expect students should be able to undertake a critical analysis of arguments (including assessment of data sources and analytical methods) and that each student will finish the class with improved skills in critical thinking and analysis of complex arguments.

Requirements: The class will have regular lectures; student participation is required. Students are expected to regularly attend all classes, complete the assigned readings in advance of class, and come ready to discuss readings or topics.

In addition to consistent classroom attendance and active participation, each student must complete all of the following:

1. 7 in-class assessments (assessments/short written responses)
2. Two research assignments
3. Final cumulative exam

Grades: The class will not be graded on a curve. It is theoretically possible for the whole class to get an A or an F.

- 7 in-class assessments: 35%; each assessment=5%
- Two research assignments: 40%; 20% for each assignment
  - Climate feedbacks (climate modeling exercise)
  - Carbon footprint
- Final cumulative exam: 25%

Readings: There are 2 course texts: *Introduction to Modern Climate Change* (A. Dessler, Cambridge, 2011), and *Climate Change Science and Policy* (Schneider et al., Island Press, 2009). These required textbook(s) are available in the campus bookstore. Further readings assigned by each presenter will be posted on Blackboard. You are expected to complete them before the class to which they apply. In class we will highlight important concepts from the readings and expand on the material; to follow the discussion it will be important for you to be familiar with the readings that have been assigned.

Student Educational Services

Wash U provides academic resources for students at Cornerstone: The Center for Advanced Learning. Located on the South 40 at Gregg Hall, the Center offers academic resources such as study groups, peer mentors, academic mentoring, help desks, and course workshops. The Center also offers technological resources such as programs for web design and learning style assessments.

Students seeking disability information should contact Disability Resources at 935-5970 or link to Disability Resources from the Cornerstone website. Contact information for Cornerstone is 935-5970 or http://cornerstone.wustl.edu. Please let Professor Kidder know in advance of any learning accommodations that have been suggested by the Disability Resources office.

Class Etiquette

This course is based on a simple principle of mutual respect and politeness. Just as it is important for us to act in a courteous and respectful way toward you, it is equally important for you to extend the same courtesy to your fellow students and instructors. To make the classroom experience enjoyable for all, you're expected to comply with the following guidelines.

- **Students talking with their neighbor after the instructor has begun lecturing**. When surveyed, students rate this as extremely annoying because it interferes with their ability to take notes. It is also distracting to instructors. We will not repeat portions of the lecture because of others talking or because of other similar disruptions. Thus, when you talk to your neighbor you may well be hurting the grades of others around you (and your grade, too). Once we start class please stop talking.
- **Use of laptops/tablets in class.** Laptop computers or tablet devices are not permitted in class. Several research studies have found that (a) students report laptop use by their peers, as well as their own laptop use, as the most distracting aspects of class; and (b) there is a negative relationship between laptop use and course grade, student attentiveness, lecture clarity, and understanding of course material. (For further information on these studies see here and here and here.)
- **Ringing/using cell phones.** Please turn off or silence all phones before class begins.
- **Coming in late**. Class starts promptly 10 minutes after the hour. If you come to class late, please select a seat in the back; do not clamber over other students to find your usual favorite seat.
- **Audio/video/photo recording of class**. Please get our permission as well as the permission of the current guest lecturer if you would like to record any portion of a lecture.

Academic Integrity

As a member of the Wash U academic community you are bound by honor regarding your academic work. Academic dishonesty includes, but is not limited to, cheating on tests, fabricating information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of or distributing examinations or examination questions, submitting work of another person or work previously used as your own, or tampering with the academic work of other students.

Plagiarism is another unacceptable practice. Plagiarism occurs when an individual uses the thoughts or words of another person as if they were their own. For example, we have borrowed much of the language for this section from the syllabus for the course: *When I'm Sixty-Four: Transforming Your Future: Interdisciplinary Studies 123*. We are thus bound to acknowledge this and give credit to the original authors, Dr. Brian Carpenter, Dr. Nancy Morrow-Howell, and Dr. Suzy Stark.

In your written work, you must provide adequate citation of other people's work. Identify where your ideas have come from when they are not your own. On examinations, answer questions for yourself rather than relying on information from other students.

Academic dishonesty on any assignment will result in written notification of the charge, a score of 0 on the assignment, and referral to the Dean. If you have questions about what might constitute academic dishonesty, please talk with one of the instructors or an administrator at the University. Additional information can be found in the University Student Judicial Code or from the Academic Integrity Committee of the College of Arts and Sciences , https://acadinfo.wustl.edu/WUCRSLFrontMatter/WebWUCRSLInfo_AcadIntegrity.htm

***Introduction to Climate Change*: Class Schedule Spring 2015**

Disclaimer: *The Instructors reserve the right to make adjustments or changes to this syllabus throughout the semester*.

Part 1: **The physical basis for climate change**

1 [Tues., Jan. 13] Introduction to class; weather vs. climate – T.R. Kidder and Brent Williams
2 Atmospheric Origins, Composition, and Dynamics – Ben DeFoy (SLU)
3 Energy balance of the Climate System – Brent Williams
4 Solar radiation (**assessment 1**) – Mark Alford
5 Greenhouse gases – Jay Turner
6 Clouds, aerosols, and albedo – Rajan Chakrabarty
7 Sources, Sinks, and Lifetimes of Atmospheric Gases and Aerosols – Rudy Husar
8 Ocean systems and cycles (**assessment 2**) – John Fortner and Dan Giammar
9 Water – Michael Wysession
10 The carbon cycle; sources and sinks – David Fike

Part 2: **How climates are changing and how we know and assess that climates are changing**

11 Ice ages; Milankovitch cycles; pacing and forcing climate change – Jen Smith
12 Abrupt climate change (**assessment 3**) – Norman Schofield
13 Proxies and measures of climate change – Alex Bradley
14 Climate modeling; predictions – Kenneth Chilton (now at Lindenwood)

Part 3: **The effects of climate change on natural and human systems**

15 Environmental consequences of climate change 1: ice sheet melting; sea level changes – Doug Wiens
16 Environmental consequences of climate change 2: habitat change; ocean acidification; food chain disruptions (**assessment 4**) – Tiffany Knight
17 Climate change and human history (*Assignment 1 Due*) – T.R. Kidder
18 Energy, fossil fuel use and consumption; global energy infrastructure –Pratim Biswas
19 GHG emissions – Michael Compton
20 Economics of climate change (**assessment 5**) – Bill Lowry
21 Conservation and biodiversity – Peter Raven
22 Food production; food security – Glenn Stone
23 Water rights; ocean access; coastal vulnerability – Beth Martin
24 Politics, law and climate change (**assessment 6**) – Maxine Lipeles
25 Religion, ethics, human rights, environmental justice –Gautam Yadama
26 Impact of climate change on human health – Bill Powderly
27 Green and Future technologies; sequestration, biofuels, sustainable energy; geo-engineering – Himadri Pakrasi and Young-Shin Jun
28 [April 23] Built environment; resilient engineering and architecture(*Assignment 2 Due*) –John Hoal (**assessment 7**)