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Dean's Office
College of Natural Science & Mathematics

FORMAT 1

Submit original with signatures + 1 copy + electronic copy to Faculty Senate (Box 7500).
See http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures-/ for a complete description of the rules governing curriculum & course changes.

TRIAL COURSE OR NEW COURSE PROPOSAL

SUBMITTED BY:

Department	Biology and Wildlife	College/School	CNSM
Prepared by	Denise Kind	Phone	474-6298
Email Contact	dmkind@alaska.edu	Faculty Contact	dmkind@alaska.edu

1. ACTION DESIRED (CHECK ONE): Trial Course [ ] New Course [X]

2. *COURSE IDENTIFICATION:* Dept: BIOL Course #: 679 No. of Credits: 2

Justify upper/lower division status & number of credits: This course meets for 2 hours each week and serves graduate students. Students are required to complete outside readings and assignments, including a project and paper. Active participation in class and regular preparation of materials to share is required.

3. *PROPOSED COURSE TITLE:* Scientific Teaching

4. *To be CROSS LISTED?* *YES/NO*: Yes If yes, Dept: CHEM/ GEOS Course #: 679

(Requires approval of both departments and deans involved. Add lines at end of form for such signatures.)

5. *To be STACKED?* *YES/NO*: NO If yes, Dept.: N/A Course #: N/A

6. *FREQUENCY OF OFFERING:*

Fall, Spring, Summer (Every, or Even-numbered Years, or Odd-numbered Years) — or As Demand Warrants

7. *SEMESTER & YEAR OF FIRST OFFERING* (if approved): Spring 2012

8. *COURSE FORMAT:*

NOTE: Course hours may not be compressed into fewer than three days per credit. Any course compressed into fewer than six weeks must be approved by the college or school's curriculum council. Furthermore, any core course compressed to less than six weeks must be approved by the core review committee.

COURSE FORMAT: (check all that apply): [ ] *1* [ ] *2* [ ] *3* [ ] *4* [ ] *5* [X] *6 weeks to full semester*

OTHER FORMAT (specify)

Mode of delivery (specify lecture, field trips, labs, etc): Seminar, discussion, workshop

9. *CONTACT HOURS PER WEEK:* 2 LECTURE hours/weeks; [ ] LAB hours /week; [ ] PRACTICUM hours /week

Note: # of credits are based on contact hours. 800 minutes of lecture=1 credit. 2400 minutes of lab in a science course=1 credit. 1600 minutes in non-science lab=1 credit. 2400-4800 minutes of practicum=1 credit. 2400-8000 minutes of internship=1 credit. This must match with the syllabus. See http://www.uaf.edu/uafgov/faculty/cd/credits.html for more information on number of credits.

OTHER HOURS (specify type): N/A

10. *COMPLETE CATALOG DESCRIPTION including dept., number, title and credits (50 words or less, if possible):*

BIOL 679 Scientific Teaching
2 credits Offered Spring
This course explores methods for teaching science at the university level. Emphasis is placed on methods of course design, instructional techniques, assessment and course management that have been shown by research to improve

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student learning. This course is intended for graduate students in the sciences who have an interest in improving their teaching skills. The course format will be a mixture of discussion, workshops and seminars. If the course is over-enrolled, priority will be given to teaching assistants who are assigned to teach large, introductory level (100 or 200 level) courses during the semester they are taking this course. *Prerequisites: Graduate standing or permission of instructor.* Cross-listed with GEOS 679 and CHEM 679. (2 + 0)

GEOS 679 **Scientific Teaching**
2 credits Offered Spring
This course explores methods for teaching science at the university level. Emphasis is placed on methods of course design, instructional techniques, assessment and course management that have been shown by research to improve student learning. This course is intended for graduate students in the sciences who have an interest in improving their teaching skills. The course format will be a mixture of discussion, workshops and seminars. If the course is over-enrolled, priority will be given to teaching assistants who are assigned to teach large, introductory level (100 or 200 level) courses during the semester they are taking this course. *Prerequisites: Graduate standing or permission of instructor.* Cross-listed with BIOL 679 and CHEM 679. (2 + 0)

CHEM 679 **Scientific Teaching**
2 credits Offered Spring
This course explores methods for teaching science at the university level. Emphasis is placed on methods of course design, instructional techniques, assessment and course management that have been shown by research to improve student learning. This course is intended for graduate students in the sciences who have an interest in improving their teaching skills. The course format will be a mixture of discussion, workshops and seminars. If the course is over-enrolled, priority will be given to teaching assistants who are assigned to teach large, introductory level (100 or 200 level) courses during the semester they are taking this course. *Prerequisites: Graduate standing or permission of instructor.* Cross-listed with GEOS 679 and BIOL 679. (2 + 0)

11. ***COURSE CLASSIFICATIONS:*** (undergraduate courses only. Use approved criteria found on Page 10 & 17 of the manual. If justification is needed, attach on separate sheet.)

H = Humanities [ ] S = Social Sciences [ ]

Will this course be used to fulfill a requirement for the baccalaureate core? **YES** [ ] **NO** [X]

IF YES, check which core requirements it could be used to fulfill:

O = Oral Intensive, Format 6 [ ] W = Writing Intensive, Format 7 [ ] Natural Science, Format 8 [ ]

12. ***COURSE REPEATABILITY:***

Is this course repeatable for credit? **YES** [ ] **NO** [X]

Justification: Indicate why the course can be repeated (for example, the course follows a different theme each time). [N/A]

How many times may the course be repeated for credit? [N/A] **TIMES**

If the course can be repeated with variable credit, what is the maximum number of credit hours that may be earned for this course? [N/A] **CREDITS**

13. ***GRADING SYSTEM:*** ***Specify only one.***

LETTER: [X] **PASS/FAIL:** [ ]

RESTRICTIONS ON ENROLLMENT (if any)

14. ***PREREQUISITES*** [Graduate student standing]

These will be *required* before the student is allowed to enroll in the course.

15. ***SPECIAL RESTRICTIONS, CONDITIONS*** [If the course is over-enrolled, preference will be given to students who are actively teaching or TAing at the same time they are taking the course.]

16. ***PROPOSED COURSE FEES*** [$0]

Has a memo been submitted through your dean to the Provost & VCAS for fee approval? **Yes/No** [N/A]

17. PREVIOUS HISTORY

Has the course been offered as special topics or trial course previously?
Yes/No

Yes

If yes, give semester, year, course #, etc.:

BIOL/GEOS/CHEM/PHYS 693: Spring 2010 and Spring 2011 This course was co-taught by 6 instructors when it was first offered in Spring 2010. In Spring 2011 instructors Kind and Fowell revised the course based on the trial offering and received excellent reviews from students.

18. ESTIMATED IMPACT

WHAT IMPACT, IF ANY, WILL THIS HAVE ON BUDGET, FACILITIES/SPACE, FACULTY, ETC.

This course will have minimal impact on budget and facilities. Instructors Kind and Fowell have included this as a regular part of their respective workloads. Few materials are required, and a room is required for only one evening per week, for 2 hours. Virtually any room that will accommodate group discussions for up to 20 students can be used.

19. LIBRARY COLLECTIONS

Have you contacted the library collection development officer (kljensen@alaska.edu, 474-6695) with regard to the adequacy of library/media collections, equipment, and services available for the proposed course? If so, give date of contact and resolution. If not, explain why not.

No		Yes		
	X			**The articles we are using are available through the library's website. We are sure of this, based on the Spring 2011 trial course.**

20. IMPACTS ON PROGRAMS/DEPTS

What programs/departments will be affected by this proposed action?
Include information on the Programs/Departments contacted (e.g., email, memo)

Whereas the course is cross-listed with GEOS and CHEM, we do not foresee any negative impacts on any of the departments involved. Other similar graduate courses on pedagogy are not available, so we do not expect to draw students away from alternative courses.

21. POSITIVE AND NEGATIVE IMPACTS

*Please specify **positive and negative** impacts on other courses, programs and departments resulting from the proposed action.*

The course an elective designed to improve the quality of instruction in undergraduate science labs and better prepare graduate students to enter the workforce as teachers, instructors or university faculty.

JUSTIFICATION FOR ACTION REQUESTED

The purpose of the department and campus-wide curriculum committees is to scrutinize course change and new course applications to make sure that the quality of UAF education is not lowered as a result of the proposed change. Please address this in your response. This section needs to be self-explanatory. Use as much space as needed to fully justify the proposed course.

Minimal formal training is available to graduate students regarding how to be effective instructors, even though they are responsible for a great deal of instruction in laboratory and discussion settings. This makes things unnecessarily difficult for them, and for their faculty supervisors. Providing graduate students with training in effective course design and methods of instruction improves the quality of undergraduate courses and strengthens the graduate students' CV, making them stronger applicants for positions that have a teaching component. By offering this course, we are improving undergraduate instruction, teaching graduate students valuable skills and creating a pool of trained applicants for positions that include teaching.

APPROVALS:

[signature]	Date	29 Sep 2011
Signature, Chair, Program/Department of:	Biology + Wildlife	
[signature]	Date	5 Oct 2011
Signature, Chair, College/School Curriculum Council for:	CNSM	
[signature]	Date	Oct 5, 2011
Signature, Dean, College/School of:	CNSM	
	Date	
Signature of Provost (if applicable)		

Offerings above the level of approved programs must be approved in advance by the Provost.

ALL SIGNATURES MUST BE OBTAINED PRIOR TO SUBMISSION TO THE GOVERNANCE OFFICE

	Date	
Signature, Chair, UAF Faculty Senate Curriculum Review Committee		

ADDITIONAL SIGNATURES: (As needed for cross-listing and/or stacking)

[signature]	Date	9/28/11
Signature, Chair, Program/Department of:	Geology + Geophysics	
	Date	
Signature, Chair, College/School Curriculum Council for:		
	Date	
Signature, Dean, College/School of:		

ADDITIONAL SIGNATURES: (As needed for cross-listing and/or stacking)

[signature] (William Simpson)	Date	29 Sep 2011
Signature, Chair, Program/Department of:	Chemistry + Biochem	
	Date	
Signature, Chair, College/School Curriculum Council for:		
	Date	
Signature, Dean, College/School of:		

Biology 679 / Chemistry 679 / Geosciences 679
Scientific Teaching

Instructors:

Denise Kind PhD, Biology and Wildlife	Sarah Fowell PhD, Geology and Geophysics
Email: dmkind@alaska.edu	**Email:** sjfowell@alaska.edu
Office: 309 Bunnell	**Office:** 326 REIC
Office phone: 474-6298	**Office phone:** 474-7810
Office hours: By appointment	**Office hours:** M 11:30-1:30, W 1:00-3:00

Credits: 2
Meeting Time and Location: 308 Bunnell, Monday, 6:00-8:00 pm

Course Materials:

- Handelsman, Jo, Sarah Miller and Christine Pfund. 2007. Scientific Teaching. New York: W.H. Freeman and Company.
- See the syllabus for additional reading assignments and citations.
- You will be expected to prepare and share materials for courses that you teach, particularly any course that you are currently working with.

Course Description:
This course explores methods for teaching science at the university level. Emphasis is placed on methods of course design, instructional techniques, assessment and course management that have been shown by research to improve student learning. This course is intended for graduate students in the sciences who have an interest in improving their teaching skills. This course will become a component of an instructor training program that is currently under development. The course format will be a mixture of discussions, workshops and seminars. If the course is over-enrolled, priority will be given to teaching assistants who are assigned to teach large, introductory level (100 or 200 level) courses during the semester they are taking this course.

Course Purpose:
Our goal is to prepare you to design your own quality undergraduate science courses and strengthen your professional resume. Quality instruction of undergraduate courses is essential to the development of skilled, highly-knowledgeable undergraduates. Good instructional skills, although they take time and effort to acquire, ultimately make an instructor a better and more efficient teacher. This course aims to develop instructional skills of graduate students who are currently teaching undergraduate-level courses and/or labs, and prepare them for careers that may have a strong teaching component to them. This includes not only tenure-track professorial positions, but any positions which require the ability to explain and teach things to others.

By the end of the semester, you will be able to:

1. Design a ***teachable unit***. This is an integrated, 2-3 week block of topics, activities, laboratory exercises and assessments, constructed around clearly stated learning goals (things students should know or be able to do upon completion of the unit). Teachable units are the building blocks of a well-designed undergraduate or graduate science course!

2. Present a 10-minute activity that employs ***active learning strategies*** and frame it in the context of your teachable unit.

3. Construct and maintain a ***learner-centered classroom***.

4. Draft a ***teaching philosophy*** that reflects understanding of current educational research and how students learn. Such philosophies are a standard part of a college or university faculty application. A philosophy that incorporates active learning strategies, student-centered outcomes and a variety of assessment tools is crucial for positions that involve aspects of teaching and curriculum design.

Course Goals

- to help students and instructors improve their ability to teach both course content and the analytical skills undergraduates need to carry out inquiry-based science
- to familiarize students with the best teaching practices, as established by research
- to provide students with the skills and support to implement active learning in their classrooms
- to provide students with the opportunity to experiment with new instructional and assessment techniques and discuss how well they worked
- to encourage students to reflect on instructional techniques they use and how well suited they are to the students in a particular class
- to familiarize students with resources available to support these goals

Specific Student Learning Outcomes

- apply backwards design to develop a teachable unit
- use active and inquiry-based learning in the classroom and the lab
- employ a variety of different teaching techniques to reach a diverse group of students and explain to students why they should take advantage of multiple approaches to learning
- effectively design and use both formative and summative assessments
- integrate a variety of assessment formats into courses
- clearly communicate course and assessment expectations and standards to students
- develop a classroom management strategy to enhance student learning
- use various tools to assess your own efficacy as an instructor and make adjustments

Grading: Teachable units, presentations, participation, reading assessments and teaching philosophies will be graded according to the following scale: 100-90% = A, 89% = A-, 88% = B+, 87-80% = B, 79% = B-, 78% = C+, 77-70% = C, 69% = C-, 68% = D+, 67-60% = D, 59% = D-, <59% = F.

Grading Scheme:

Item	**Portion of Final Grade**
active participation in and preparation for weekly discussions	20%
performance on weekly reading assessments	20%
presentation to group of a learning activity prepared as part of your teachable unit – focused on a particular objective of the unit, approximately 10 minutes in length *	20%
preparation of a teachable unit that includes active learning strategies, lab activities, and both formative and summative assessments with an explanation of how each of these will further the stated goals and objectives*	20%
a written, formal statement of personal teaching philosophy*	20%

***If this item is of substandard quality, additional revision and resubmission may be required.**

Schedule for BIOL 679 / CHEM 679 / GEOS 679: Scientific Teaching

Date	Topic	Due at start of class
Jan. 23	How People Learn; What Active Learning Is (and Isn't)	• Armbruster et al. 2009 • Knight & Wood 2005 • McConnell et al. 2003
Jan. 30	Bloom's Taxonomy – How to help students develop analytical skills and think "like a scientist"; designing formative and summative assessments to develop and evaluate these skills; when and how to grade assessments.	• Handelsman et al., Ch 1 & 3 • Harris 2002 • Kruger and Dunning 1999 • **Bring an exam from an undergraduate course to examine**
Feb. 6	Backward Design – using goals and objectives to drive course design; Goals and Objectives – writing useful ones; How to use concept inventories	• Stokes et al. 2007 • D'Avanzo 2008 • Libarkin & Anderson 2005
Feb. 13	Teaching in the Laboratory Setting – types of labs; Designing effective introductions for labs	• Casotti et al. 2008 • Apedoe et al. 2006 • **Bring a lab that you've done (not the supplies, but the *written* exercise)** • **Goals and objectives for a teachable unit**
Feb. 20	Teachable Unit – What is a teachable unit and how can an instructor develop a really good one? Examples and rubric Debunking learning styles	• Handelsman et al., Ch 5 • Gautier et al. 2006 • Pashler et al. 2009
Feb. 27	Active Learning I – active learning as a formative assessment tool; audience response systems (clickers), think-pair-share, case studies, and how to use them Work on rubric for grading class presentations; Formatting of the activity description - examples	• Handelsman et al., Ch. 2 • Greer & Heaney 2004 • Karpicke & Blunt 2011 • **Lesson plan for a teachable unit with revised goals and objectives**
Mar. 5	Active Learning II – other techniques to engage students: minute papers, strip sequences, concept maps and concept diagrams	• Hay et al. 2008 • Englebrecht et al. 2005 • **Description of an activity for your teachable unit, with goals, objectives, and assessment method**
Mar. 12	**Spring Break**	
Mar. 19	Active Learning III – engagement continued: kinesthetic activities and modeling processes Sample teaching philosophies and teaching philosophy rubric; 5-paragraph essay format and paper organization.	• Haak et al. 2011 • Moravec et al. 2010

Mar. 26	Writing a Teaching Philosophy – what a teaching philosophy is and how to write a great one	• O'Neal et al. 2007 • sample teaching philosophies • **Revised teachable unit + activity**
Apr. 2	Group Work I – Brainstorming, jigsaw exercises *Peer evaluation of teaching philosophies*	• McConnell et al. 2005 • Shimazoe & Aldrich 2010 • Felder & Brent 2001 • **Draft of teaching philosophy**
Apr. 9	Group Work II – Jigsaw wrap-up, peer instruction and collaborative thinking	• Crouch & Mazur 2001 • Yuretich et al. 2001 • **Your piece of the jigsaw** • **Revised teaching philosophy**
Apr. 16	Inquiry-Based Learning – the difference between investigative labs, guided inquiry and open inquiry learning	• Justice et al., 2007 • **Final teachable unit**
Apr. 23	Student Presentations of Teachable Unit, Outcomes, and One Complete Activity	• **teachable unit presentation** • **Final teaching philosophy**
Apr. 30	Student Presentations (continued)	• **teachable unit presentation**

Full citations for articles:

Apedoe, X., S. Walker and T. Reeves. 2006. Integrating inquiry-based learning into undergraduate geology. Journal of Geoscience Education 54(3):414-421.

Armbruster, P., M. Patel, E. Johnson and M. Weiss. 2009. Active learning and student-centered pedagogy improve student attitudes and performance in introductory biology. CBE – Life Sciences Education 8:203-213.

Casotti, G., L. Rieser-Danner and M. Knabb. 2008. Successful implementation of inquiry-based physiology laboratories in undergraduate major and nonmajor courses. Advances in Physiology Education 32:286-296.

Crouch, C., and E. Mazur. 2001. Peer instruction: Ten years of experience and results. American Journal of Physics 69(9):970-977.

D'Avanzo, C. 2008. Biology concept inventories: Overview, status and next steps. BioScience 58(11):1079-1085.

Englebrecht, A., J. Mintzes, L. Brown and P. Kelso. 2005. Probing understanding in physical geology using concept maps and clinical interviews. Journal of Geoscience Education 53(3):263-270.

Felder, R.M., and R. Brent. 2001. Effective strategies for cooperative learning. Journal of Cooperation & Collaboration in College Teaching 10(2): 69-75.

Gautier, C., K. Deutsch and S. Rebich. 2006. Misconceptions about the greenhouse effect. Journal of Geoscience Education 54(3):386-395.

Greer, L. and P. Heaney. 2004. Real-time analysis of student comprehension: An assessment of electronic student response technology in an introductory earth science course. Journal of Geoscience Education 52(4):345-351.

Haak, D.C., J. HilleRisLambers, E. Pitre and S. Freeman. 2011. Increased structure and active learning reduce the achievement gap in introductory biology. Science 332:1213-1213. (supplemental materials available at 10.1126/science.1204820)

Harris, M. 2002. Developing geosciences student-learning centered courses. Journal of Geoscience Education 50(5):515-523.

Hay, D., I. Kinchin and S. Lygo-Baker. 2008. Making learning visible: The role of concept mapping in higher education. Studies in Higher Education 33(3):295-311.

Justice, C., J. Rice, W. Warry, S. Inglis, S. Miller and S. Sammon. 2007. Inquiry in higher education: Reflections and directions on course design and teaching methods. Innovations in Higher Education 31:201-214.

Karpicke, J.D., and J.R. Blunt. 2011. Retrieval practice produces more learning than elaborative studying with concept mapping. Science 331:772-775.

Knight, J. and W. Wood. 2005. Teaching more by lecturing less. Cell Biology Education 4:298-310.

Kruger, J., and D. Dunning. 1999. Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. Journal of Personality and Social Psychology 77(6): 1121-1134.

Libarkin, J., and S. Anderson. 2005. Assessment of learning in entry-level geosciences courses: Results from the geosciences concept inventory. Journal of Geoscience Education 53(4):394-401.

McConnell, D., D. Steer, and K. Owens. 2003. Assessment and active learning strategies for introductory geology courses. Journal of Geoscience Education 51(2):205-216.

McConnell, D., D. Steer, K. Owens and C. Knight. 2005. How students think: Implications for learning in introductory geosciences courses. Journal of Geoscience Education 53(4):462-470.

Moravec, M., A. Williams, N. Aguilar-Roca and D.K. O'Dowd. 2010. Learn before lecture: A strategy that improves learning outcomes ina large introductory biology class. CBE-Life Science Education 9:473-481.

O'Neal, C., D. Meizlish and M. Kaplan. 2007. Writing a statement of teaching philosophy for the academic job search. CRLT Occasional Papers, Center for Research on Learning and Teaching, University of Michigan, No. 23. Available at http://www.crlt.umich.edu/publinks/occasional.php

Pashler, H., M. McDaniel, D. Rohrer and R. Bjork. 2009. Learning Styles: Concepts and Evidence. Psychological Science in the Public Interest 9:105-119.

Rushton, A. 2005. Formative assessment: A key to deep learning? Medical Teacher 27(6):509-513.

Shimazoe, J., and H. Aldrich. 2010. Group work can be gratifying: Understanding and overcoming resistance to cooperative learning. College Teaching 58:52-57.

Stokes, A., H. King and J. Libarkin. 2007. Research in science education: Threshold concepts. Journal of Geoscience Education 55(5):434-438.

Yuretich, R.F., S.A. Khan, R.M. Leckie, and J.J. Clement. 2001. Active-learning methods to improve student performance and scientific interest in a large introductory oceanography course. Journal of Geoscience Education 49 (2): 111-119.

Additional readings (not required, strictly for your own interest):

Anderson, D., K. Fisher and G. Norman. 2002. Development and evaluation of the conceptual inventory of natural selection. Journal of Research in Science Teaching 39(10):952-978.

Crowe, A., C. Dirks and M.P. Wenderoth. 2008. Biology in Bloom: Implementing Bloom's Taxonomy to enhance student learning in biology. CBE – Life Sciences Education 7:368-381.

Ehrlinger, J., K. Johnson, M. Banner, D. Dunning and J. Kruger. 2007. Why the unskilled are unaware: Further explorations of (absent) self-insight among the incompetent. Organizational Behavior and Human Decision Processes 105:98-121.

Kinchin, I. 2010. Solving Cordelia's Dilemma: Threshold concepts within a punctuated model of learning. Journal of Biological Education 44(2):53-57.

Klymkowsky, M., and K. Garvin-Doxas. 2008. Recognizing student misconceptions through Ed's Tools and the Biology Concept Inventory. PLOS Biology 6(1):14-17.

Musante, S. 2009. You're teaching, but how do you know they're learning? BioScience 79(7):557.

Roediger III, H., and J. Karpicke. 2006. The power of testing memory: basic research and implications for educational practice. Perspectives on Psychological Science 3:181-210.

Smith, M., W. Wood and J. Knight. 2008. The genetics concept assessment: A new concept inventory for gauging student understanding of genetics. CBE – Life Sciences Education 7:422-430.