

Washington State University
MAJOR CURRICULAR CHANGE FORM -- COURSE
(Submit original signed form and ten copies to the Registrar's Office, zip 1035.)

Future Effective Date: 08/16/2013 New course Temporary course Drop service course
(effective date cannot be retroactive) There is a course fee associated with this course (see instructions)

Variable credit _____ Repeat credit (cumulative maximum _____ hours)
 Increase credit (former credit _____) Lecture-lab ratio (former ratio _____)
 Number (former number _____) Prefix (former prefix _____)
 Crosslisting (between WSU departments) Cooperative listing (UI prefix and number _____)
(Must have both departmental signatures) taught by: WSU UI jointly taught
 Conjoint listing (400/500) S, F grading
 Request to meet Writing in the Major [M] requirement (Must have All-University Writing Committee Approval)
 Request to meet GER in _____ (Must have GenEd Committee Approval) Fulfills GER lab (L) requirement
 Professional course (Pharmacy & Vet Med only) Graduate credit (professional programs only)
 Other (please list request) _____

T&L 584 Research in Teaching Mathematics and Science
course prefix course no. title

3

credit	lecture hrs per week	lab hrs per week	studio hrs per week	prerequisite
				None

Description (20 words or less) _____
The course will develop understandings of the research literature that are particularly related to mathematics and science teaching

Instructor: Andy Cavagnetto Phone number: (509) 335-6391 Email: andy.cavagnetto@wsu.edu
Contact: Julie Killinger Phone number: (509) 335-7296 Email: juliek@wsu.edu
Campus Zip Code: 3113

- Please attach rationale for your request, a current and complete syllabus, and explain how this impacts other units in Pullman and other branches (if applicable).
- Secure all required signatures and provide 10 copies to the Registrar's Office.

Doray Miller 10-28-12 Merden 11-5-12
Chair/date Dean/date General Education Com/date

Chair (if crosslisted/interdisciplinary)* Dean (if crosslisted/interdisciplinary)* Graduate Studies Com/date

All-University Writing Com/date Academic Affairs Com/date Senate/date

*If the proposed change impacts or involves collaboration with other units, use the additional signature lines provided for each impacted unit and college.

Course Rationale

T & L 584: Research in Teaching Mathematics and Science

T&L 584 is one of three required courses related to the foundational core of the degree. This is due to the emphasis of the course on the essential area of mathematics and science teaching, and the overview of research in this area that is explored.

This course is designed to provide an overview of the empirical evidence and frameworks related to mathematics and science teaching. Students will develop an understanding of the research literature, in particular central issues related to mathematics and science teaching. Specific student outcomes include:

- Understand influential areas of research in mathematics and science teaching.
- Gain proficiency with reading and analyzing research articles and reports.
- Identify potential areas of research in math and science education.

The course has no anticipated impacts on other units in Pullman. The course will be available to students at all campuses who are interested in mathematics and/or science educational research. The course will be taught on a rotating basis by faculty on the Pullman, Spokane, Tri-Cities and Vancouver campuses to ensure equitability in faculty load.

T&L 584: Research in Teaching Mathematics and Science

Monday 5:45pm-8:30pm
Location: AMS
Office Hours: Monday & Thursday 9-10
or by appointment

Professor: Andy Cavagnetto, PhD
Office: Cleveland 335
(509) 335-6391
andy.cavagnetto@wsu.edu

Course Description:

This course is designed to provide a look at the playing field related to research on mathematics and science teaching. Throughout the course you will develop an understanding of the research literature, in particular central issues related to mathematics and science teaching. Considering the likely influence of the Common Core State Standards in Mathematics and the Next Generation Science Standards, we will start with these documents to answer the following questions:

- What are the areas of research in math and science education that have influenced these documents?
- What are the recommendations outlined in these documents based upon? That is, what do we really know in these areas of research?
- What are unanswered questions that remain in these key areas of study?
- What questions are of interest to your future scholarship?

Readings:

Readings will be posted on Angel each week. You will also be responsible for identifying readings for the class.

Student Learning Outcomes:

- Understand influential areas of research in mathematics and science education.
- Gain proficiency with reading and analyzing research articles and reports.
- Identify potential areas of research in math and science education, with an emphasis on instructional issues.

Expectations:

It is expected that you show up on time, prepared for class by completing all assignments for the week. You are also expected to share your ideas and challenge other people's ideas. The intention is to create an intellectually stimulating, safe, and respectful class atmosphere. So while I expect you to critique and defend ideas, this should be accomplished in a manner that respects other opinions and positions.

Deliverables*

Literature Review

40%

This literature review should ground a vexation that you have related to science and/or math education. This work should build toward a future venture as evidenced by the identification of specific questions for exploration during your time at WSU and potentially beyond.

Presentation of your findings from the literature review 20%

You will be asked to give a presentation of your findings to the class. We will treat this as a very small conference. You will have 15-20 minutes to talk through your study. We will then have time to ask follow up questions and discussion.

Conference Proposal or Manuscript 25%

This assignment will require you to develop either a conference proposal (to either a state or national conference) or a manuscript for publication (likely for a practitioner journal given our time constraints). This will essentially be a summary of your findings from the literature review.

Collaborative Concept Map 15%

By the conclusion of the course we want to see the connections across the various literature bases that we choose to explore. In order to do this, you will be developing a concept map that integrates the various focus areas. We are going to try to develop this with the tool Inspiration.

*These are proposed deliverables. We will discuss these the first week to determine how they fit with the number and nature of students enrolled. Largely week one will be an opportunity for us to chart a course for the remainder of the semester.

Grading Scale:

90-100%	A
80-89%	B
70-79%	C
60-69%	D
Below 60%	F

Disability Accommodation: Reasonable accommodations are available for students with a documented disability. All accommodations must be approved through your WSU Disability Services office. If you have a disability and need accommodations, we recommend that you begin the process as soon as possible. All accommodations must be approved through Disability Services. For more information, contact a Disability Specialist on your home campus.

- **Spokane** /students/current/StudentAffairs/disability/index.html
- **Pullman** <http://accesscenter.wsu.edu>
- **Tri-Cities:** <http://www.tricity.wsu.edu/disability/index.html>
- **Vancouver:** <http://studentaffairs.vancouver.wsu.edu/student-resource-center/disability-services>

Academic Integrity: Academic integrity is the cornerstone of the university and will be strongly enforced in this course. Any student found in violation of the academic integrity policy will be given an "F" for the course and will be referred to the Office of Student Conduct. Read <http://academicintegrity.wsu.edu/>

For additional information about WSU's Academic Integrity policy, procedures, and definitions, please check online at <http://www.conduct.wsu.edu/default.asp?PageID=338> and <http://www.conduct.wsu.edu/>.

Note: Plagiarism is a violation of academic integrity. Students sometimes do not realize what constitutes plagiarism. Please read the information at <http://www.wsulibs.wsu.edu/plagiarism/what.html> and associated links.

Emergency Notification System: WSU has made an **emergency notification system** available for faculty, students and staff. Please register at myWSU with emergency contact information (cell, email, text, etc). You may have been prompted to complete emergency contact information when registering for classes on ROnet.

In the event of a **Building Evacuation**, a map at each classroom entrance shows the evacuation point for each building. Please refer to it.

Finally, in case of **class cancellation campus-wide**, please check local media, the appropriate WSU web page and/or <http://www.flashalert.net/>. Individual class cancellations may be made at the discretion of the instructor. Each individual is expected to make the best decision for their personal circumstances, taking safety into account.

Audio, video, digital, commercial note-taking and other recording during class: Copyright (insert year) (insert Faculty Name) as to this syllabus, all lectures, and course-related written materials. During this course students are prohibited from making audio, video, digital, or other recordings during class, or selling notes to or being paid for taking notes by any person or commercial firm without the express written permission of the faculty member teaching this course.

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- What are the areas of research in math and science education that have influenced these documents?
- What are the recommendations outlined in these documents based upon? That is, what do we really know in these areas of research?
 - *How do students learn mathematics and science?*
 - *How are practices of science and mathematics represented in classrooms?*
 - *How do we help teachers move from theory to practice?*
- What are unanswered questions that remain in these key areas of study?
- What questions are of interest to your future scholarship?

Readings:

Readings will be posted on Angel each week. You will also be responsible for identifying readings for the class.

Student Learning Outcomes:

- Understand influential areas of research in mathematics and science education.
- Gain proficiency with reading and analyzing research articles and reports.
- Identify potential areas of research in math and science education, with an emphasis on instructional issues.

Deliverables*

Vexation/Venture

20%

This assignment will require you to develop a tightly written vexation identifying a key problem in math or science education and a proposal for seeking an answer to the vexation.

Literature Review

35%

This literature review should ground a vexation that you have related to science and/or math education. This work should build toward a future venture as evidenced by the identification of

How do students learn in science and mathematics?

Week 4: *How do people learn?*

- Sawyer, K. R. (2006). *Introduction*. In K. R. Sawyer (Ed.). *The Cambridge Handbook of the Learning Sciences*. p. 1-18.
- Gadgil, S., Nokes-Malach, T. & Chi, M. (2012). Effectiveness of Holistic Mental Model Confrontation in Driving Conceptual Change. *Learning & Instruction, 22*, 47-61.
- Bransford, J. D., & Schwartz, D. L. (1999). Rethinking transfer: A simple proposal with multiple implications. *Review of Educational Research, 24*, 61-100.

Week 5: *What are key areas of concern in science and mathematics education? How can we effectively yet efficiently navigate the university library system?*

- Students bring in initial vexations that are linked to previous weeks' readings. Vexations are clarified.
- Collectively the class will identify key areas to explore with class readings over the course of the class.
- Familiarization with the university library system.

Week 6: *How can we explore and answer our vexations and effectively communicate our findings?*

- **Vexations/Ventures Due**
 - Students will present their vexations and ventures.
 - Franke, M. L., Webb, N. M., Chan, A. G., Ing, M., Freund, D., & Battey, D. (2009). Teacher questioning to elicit students' mathematical thinking in elementary school classrooms. *Journal of Teacher Education, 60*, 380.
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How are practices of science and mathematics represented in classrooms?

Week 7: *What is the role of language in the science and mathematics classroom?*

- Cavagnetto (2010). Argument to foster scientific literacy: A review of argument interventions in K–12 science contexts. *Review of Educational Research, 80*, 336-371.
- Students also provide articles related to topic and lead discussion.

Week 8: *What is explanation and how should it be represented in science classrooms?*

- Braaten, M. & Windschitl, M. (2011). Working toward a stronger conceptualization of scientific explanation for science education. *Science Education, 95*, 639-669.
- Students also provide articles related to topic and lead discussion.

Week 9: *What is the role of models in mathematics classrooms and how does that compare with science classrooms?*

- Noss, R., & Hoyles, C. (2006). *Exploring mathematics through construction and collaboration*. In R. Sawyer (Ed.). *Cambridge Handbook of the Learning Sciences*. New York: Cambridge University Press.
- Students also provide articles related to topic and lead discussion.

Week 10: *How do we really determine students' perceptions of science as a discipline?*

- Sandoval, W. (2005). Understanding students' practical epistemologies and their influence on learning through inquiry. *Science Education*, 89, 634-656.
 - Students also provide articles related to topic and lead discussion.
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How do we help teachers move from theory to practice?

Week 11: *How do teachers conceptualize instruction?*

- Schneider, R. M., & Plasman, K. (2011). Science teacher learning progressions: A review of science teachers' pedagogical content knowledge development. *Review of Educational Research*, 81, 530-565.
- Peer review of literature review drafts.

Week 12: *What do we know about teacher learning and professional development?*

- Webster-Wright, A. (2009). Reframing professional development through understanding authentic professional learning. *Review of Educational Research*, 79, 702-739.
- Opfer, V. D. & Pedder, D. (2011). Conceptualizing teacher professional learning. *Review of Educational Research*, 81, 376-407.
- **Literature Reviews Due**

Week 13: *What theories can guide our work with school reform?*

- Wenger, E. (1999). *Communities of Practice: Learning, Meaning, and Identity (Learning in Doing: Social, Cognitive and Computational Perspectives (p3-134; 214-229))*. New York: Cambridge University Press.

Week 14: *What theories can guide our work with school reform (continued)?*

- Mesoudi, A. (2011). *Cultural Evolution: How Darwinian Theory Can Explain Human Culture and Synthesize the Social Sciences (p1-134)*. London: University of Chicago Press.

Week 15: Student presentations of literature review findings

- **Student Presentations Due** and follow up discussions

Week 16: Review of where we have been

- Collaborative concept mapping