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MEMORANDUM

ATTENTION Senate
FROM Rolf Mathewes, Acting Chair
Senate Committee on Undergraduate Studies
RE: Faculty of Education (SCUS 10-27)

DATE May 7, 2010
PAGES 1/1

For information:

Acting under delegated authority at its meeting of May 6, 2010, SCUS approved the following curriculum revisions:

- (i) New Course Proposal: EDUC 484, Exploring Students' Scientific Misconceptions

Senators wishing to consult a more detailed report of curriculum revisions may do so on the Web at http://www.sfu.ca/senate/Senate_agenda.html following the posting of the agenda. If you are unable to access the information, please call 778-782-3168 or email mlg7@sfu.ca.

SIMON FRASER UNIVERSITY
Senate Committee for Undergraduate Studies
NEW COURSE PROPOSAL

Course Number: EDUC 484~~X~~ - 4
Course Title: Exploring Students' Scientific Misconceptions

AND

Short - for registration/transcript no more than 30 characters including spaces/punctuation
Scientific Misconceptions

State number of hours for Lect () Sem (4) Tut () Lab ()

Course Description (for Calendar). Attach a course outline to this proposal.

Examines scientific misconceptions on two levels. ~~Initial focus is on understanding the nature and origins of a selection of learners' common misconceptions about the physical, material and living world. Second is~~ A critical examination of what it means to have a "misconception" and an exploration of different models and strategies for helping learners ~~change problematic ideas.~~ *Quantitative, to evaluate and modify*

Prerequisite: EDUC 401/402 or corequisite EDUC 403

Corequisite: None

Special Instructions: None

Course(s) to be dropped if this course is approved:

None.

Rationale for Introduction of this Course:

The Faculty of Education currently has a very limited number of undergraduate offerings in the area of science education. In particular there is no course that addresses the issue of scientific misconceptions. Scientific misconceptions are persistent and stubborn student ideas about the natural world (physical, chemical, biological) that differ from those accepted by domain experts. These ideas are generally developed through students' interactions with the everyday world (e.g. Clement, 1982; McCloskey, 1983) before students ever set foot in a science classroom and instruction will not change these ideas unless they are specifically drawn out and addressed (e.g. Guzzetti, Synder, Glass & Gamas, 1993; Metioui, Brassard, Lavoie, & Lavoie, 1996). Due to their remarkable prevalence and intractability, understanding

the origins of misconceptions and supporting students in the process of conceptual change is perhaps *the* most critical challenge for science educators.

There is a well-established body of literature empirically examining student misconceptions and their origins (e.g. Carey, 1985, Gentner & Steven, 1983). In addition, the research goes beyond simply identifying misconceptions to study the processes by which these ideas can be changed (e.g. Posner, Striker, Hewson & Gertzog, 1982; Smith, diSessa, & Roschelle, 1994; Slotta & Chi, 2006). In a landmark book synthesizing thirty years of research on how people learn and its implications for teaching, the U.S. National Research Council (2000) proclaimed:

“Schools of education must provide beginning teachers with opportunities to learn (a) to recognize predictable preconceptions of students that make the mastery of particular subject matter challenging, (b) to draw out preconceptions that are not predictable, and (c) to work with preconceptions so that children build on them, challenge them and when appropriate, replace them.” (p 20)

This course aims to fulfill these goals in a way that is appropriate for science teachers of all levels: elementary teachers who integrate the study of the living and physical world into their classroom; middle-school teachers who teach integrated or dedicated science classes; and high school teachers who teach in a particular science domain. This is possible because scientific misconceptions are related to fundamental concepts used at all levels and misconceptions related to these fundamental concepts often persist (despite instruction to the contrary) throughout a student's K-12 experience.

References

- Carey, S. (1985). *Conceptual change in childhood*. Cambridge: MA: MIT Press/Bradford Books
- Clement, J. (1982). Students' preconceptions in introductory mechanics. *American Journal of Physics*, 50, 66-71.
- Gentner, D. & Stevens, A. L. (Eds.) (1983). *Mental models*. Hillsdale, NJ: Lawrence Erlbaum.
- McCloskey, M. (1983). Naïve theories of motion. In D. Gentner and A. L. Stevens (Eds.) *Mental models*. Hillsdale, NJ: Lawrence Erlbaum.
- Metioui, A., Brassard, C., Lévassieur, J. & Lavoie, M. (1996). The persistence of students' unfounded beliefs about electrical circuits: The case of Ohm's law. *International Journal of Science Education*, 18(2), 193-212.
- Guzzetti, B., Snyder, T., Glass, G., & Gamas, W. (1993). Promoting conceptual change in science: A comparative meta-analysis of instructional interventions from reading education and science education. *Reading Research Quarterly*, 28, 117-159.

- National Research Council. (2000). *How people learn: Brain, mind, experience, and school*. Washington, D.C.: National Academy Press.
- Posner, G. J., Striker, K. A., Hewson, P.W., & Gertzog, W.A. (1982) Accommodation of a scientific conception: Toward a theory of conceptual change. *Science Education* 66(2), 211-227.
- Slotta J., & Chi, M. T. H. (2006). Helping students understand challenging topics in science through ontology training. *Cognition and Instruction*, 24(2), 261-289.
- Smith, J. P., diSessa, A.A., & Roschelle, J. (1994). Misconceptions reconceived: A constructivist analysis of knowledge in transition. *Journal of the Learning Sciences*, 3(2) 115-163.

Scheduling and Registration Information:

Annual offering in the summer semester beginning in Summer 2010.

There is a two-semester wait for implementation of any new course.

Waiver required _____

Will this be a required or elective course in the curriculum?
Elective

What is the probable enrolment when offered?
30 (course filled max capacity of 30 students when offered as a special topics course in Summer 2009)

Which of your present CFL faculty have the expertise to offer this course?
Dr. Alyssa Wise

Are there any proposed student fees associated with this course other than tuition fees? (if so, attach mandatory supplementary fee approval form)
No

Resource Implications:

Note: Senate has approved (S.93-11) that no new course should be approved by Senate until funding has been committed for necessary library materials. Each new course proposal must be accompanied by a library report and, if appropriate, confirmation that funding arrangements have been addressed.

Campus where course will be taught: Surrey

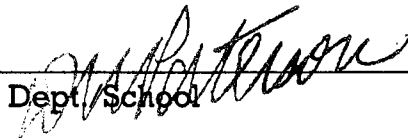
Library report status No additional library resources are required for this course

Provide details on how existing instructional resources will be redistributed to accommodate this new course: Course is already being offered as a Special Topics course, regularizing the offering will not require additional instructional resources.

Any outstanding resource issues to be addressed prior to implementation:
None


Approvals

1. **Departmental approval** indicates that the Department has approved the content of the course, and has consulted with other Departments and Faculties regarding proposed course content and overlap issues.

_____  _____
Chair, Dept. School Date

_____ _____
Chair, Faculty Curriculum Committee Date

2. **Faculty approval** indicates that all the necessary course content and overlap concerns have been resolved, and that the Faculty/Department commits to providing the required Library funds.

_____  _____ Date: _____
Dean or Designate

List which other Departments and Faculties have been consulted regarding the proposed course content including overlap issues. *Attach documentary evidence of responses.*

_____ See attached. _____

Other Faculties approval indicates that the Dean(s) or designate of other Faculties affected by the proposed new course support(s) the approval of the new course.

_____ Date: _____

_____ Date: _____