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MATH 691.01: Research Methods in Mathematics Education

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Math 691 Research Methods in Mathematics Education
Fall Semester, 2000 Wednesday 4:10-7:00; 3 credits (graduate only)
Math Building Rm. 305
Johnny W. Lott

Description: Prerequisite: Consent of Instructor. Resources for learning of reported research, critical reviews of research, quantitative and qualitative processes.

Rationale: Mathematics Education requires research involving institutions, classrooms, and students at all levels, from early childhood to graduate education. A variety of research paradigms are used with different demands on data collection and analysis. This course would complement student needs in statistics, but is not intended to replace any preparation in statistics for the Ph. D. candidates. The exploration of research paradigms is a critical step in a student's selection of appropriate methodology for a research proposal.

Text: Kelly, A., and R. Lesh (eds.). *Research Design in Mathematics and Science Education*. Mahwah, NJ: Lawrence Earlbaum Associates Publishing, 2000.

Note: Text is available from Lott at a cost of \$80.00. It was ordered by the Department through convention rates to save money. Make checks payable to Department of Mathematical Sciences.

Outline: The course will be taught by examining research of the following types:

- Weeks 1-2: Traditional research paradigms to include design and analysis of experiments, and quantitative studies. Handout of Campbell and Stanley will be used for the first two weeks.
- Weeks 3-4: Problems, Instruments, Methods, Kelly and Lesh—pgs. 9-190
Qualitative versus Quantitative Research; supplemental readings
Wang pgs. 103-117.
- Weeks 5-6: Teaching Experiments, Kelly and Lesh—pgs. 191-360
Supplemental readings to include systemic research projects
- Weeks 7-8: Classroom Based Research, Kelly and Lesh—pgs. 361-512
Supplemental reading include classroom interactions and ethnography
- Weeks 9-10: Clinical Methods, Kelly and Lesh—pgs. 513-732
Supplemental readings include clinical interviews
- Weeks 11-12: Curriculum Design as Research, Kelly and Lesh—pgs. 733-814
Supplemental readings from SIMMS as an example
- Weeks 13-15: Assessment Design, Kelly and Lesh—pgs. 815-926

Evaluation:

1. Class contributions—discussions in class (10%)
2. Written assignments—Short paragraphs about research reviewed and submitted by email. (20%)
3. Research presentations—Made in class to exemplify a design or a research issue (20%)
4. Mini-research proposal—Required for each on an area of interest. For doctoral students, this may be either a preliminary proposal for a dissertation, or the actual proposal. For others, this is negotiable as to what it covers. (30%)
5. Take-home final examination—The plan is to give you a research project or article and to have you critique it exemplifying what you have learned in the semester. (20%)

Sources:

Adelman, C., D. Jenkins, and S. Kemmis. "Re-thinking Case Study: Notes from the Second Cambridge Conference, *Cambridge Journal of Education*, 6(3, 1976): 139-150.

Agar, M. *The Professional Stranger: An Informal Introduction to Ethnography*. New York: Academic Press, 1980.

Altheide, D. L., and J. M. Johnson. "Criteria for Assessing Interpretive Validity in Qualitative Research." In N. K. Denzin and Y. S. Lincoln (Eds.) *Handbook of Qualitative Research* (pp. 485-499), Thousand Oaks, CA: Sage.

Boyer, E. L. *Scholarship Reconsidered: Priorities of the Professoriate*. Princeton University Press, 1990.

Campbell, D. T., and J. C. Stanley. *Experimental and Quasi-Experimental Designs for Research*. Chicago: Rand McNally & Company, 1971.(Reprinted from Gage, N. L. (ed). *Handbook of Research on Teaching* by American Educational Research Associates, Chicago: Rand McNally & Company, 1963, under the title "Experimental and Quasi-Experimental Designs for Research on Teaching."

Cheney, L. V. *Tyrannical machines: A Report on Educational Practices Gone Wrong and Our Best Hopes for Setting Them Right*. Washington, DC: National Endowment for the Humanities, 1990.

Denzin, N. K. *The Research Act: A Theoretical Introduction to Sociological Methods* (2n edition). New York: McGraw-Hill, 1978.

Donald, J. G. and A. M. Sullivan, Eds. *Using Research to Improve Teaching*. San Francisco: Jossey-Bass, 1985.

Elliott, J. *Action Research for Educational Change*. Bristol, PA: Open University Press, 1991.

Ewell, P. T. "Outcomes, Assessment, and Academic Improvement: In Search of Usable Knowledge," In John C. Smart, ed., *Higher Education" Handbook of Theory and Research* 17 (1991) 75-125.

Fisher, R. A. *The Design of Experiments*. New York: Hafner Press, 1971.

Grouws, D. A. (Ed.) *NCTM Handbook of Research on Mathematics Teaching and Learning*. Macmillan, 1992.

Keith, S. "Interest Inventories and Mathematics," Unpublished article, Department of Mathematics, St. Cloud State University, MN 56301, 1991.

Malone, J., B. Atweh, and J. Northfield. *Research and Supervision in Mathematics and Science Education*. Mahwah, NJ: Lawrence Earlbaum Associates Publishing, 1998.

Novak, J. D., & Gowin, D. B. "The Vee Heuristic..."; Chapter 8, "Improving Educational Research" Chapter 3, *Learning How to Learn*. Cambridge University Press, 1984.

Patton, M. Q. *Qualitative Evaluation and Research Methods*, 2nd ed. Thousand Oaks, CA: Sage, 1990.

Selden, A. and J. Selden. "Collegiate Mathematics Education Research: What Would that Be Like?" *The College Mathematics Journal* (November 1993): 431-445.

Senechal, L. (Ed.) *Models for Undergraduate Research in Mathematics*. MAA Notes No. 18, 1990.

Wang, C. *Sense and Nonsense of Statistical Inference: Controversy, Misuse, and Subtlety*. New York: Marcel Dekker, Inc., 1993.

A major portion of the course will be devoted to analyzing research in the following journals.

Educational Researcher

Educational Studies in Mathematics

International Journal of Mathematical Education in Science and Technology

Investigations in Mathematics

Journal for Research in Mathematics Education.

Journal of Mathematical Behavior

For the Learning of Mathematics

Selected articles from the following journals will also be examined.

Cognition and Instruction

Cognitive Science

Educational Psychologist

Instructional Science

Review of Educational Research