

# SOUTHEAST MISSOURI STATE UNIVERSITY

College of Science and Mathematics

Course No. ST 603

Title of Course: Research Methods in Science Education

New: Fall 1999

- I. **Catalog Description and Credit Hours of the Course:** An overview of assumptions, limitations, and methods of research in science education with emphasis on classroom situations and application to published research; preparation of a proposal for classroom-based research. 3 credit hours.
  
- II. **Prerequisites:** Permission of instructor.
  
- III. **Purposes or Objectives of the Course:** This course will prepare students to conduct research in science education as teacher-inquirers conducting small-scale investigations of teaching and learning. Students will develop skills to analyze and evaluate published research in science education. Specifically the students will:
  - A. Critically analyze and use primary literature in science education as illustrations of a variety of methods and approaches.
  - B. Understand and be able to apply concepts of validity, reliability and generalizability to their own projects and those of others.
  - C. Know basic research designs used in both formal and classroom research in science education.
  - D. Know strengths and limitations of, and practice with a variety of data collection methods, including observations, interviews, surveys, tape transcripts, and artifact analysis.
  - E. Know how to organize and display data using Excel or other spreadsheet.
  - F. Be able to interpret descriptive statistics and results of commonly used tests of association and difference.
  - G. Develop, in consultation with peers and faculty, a proposal for a small-scale research project in their teaching setting on some aspect of teaching or learning science.
  
- IV. **Expectations of the students:**
  - A. Students will be expected to attend class and participate in all class activities.
  - B. Students will be expected to complete all homework assignments.
  - C. Each student will present a critical analysis of at least one research study from the primary science education.
  - D. Students will develop a proposal for a classroom research project in their own teaching setting.

- E. Students will participate actively as peer consultants on other students research proposals.

V. **Course Content or Outline**

<b>Week</b>	<b>Topic</b>	<b>Readings</b>	<b>Assignment</b>
1.	Course Overview Action research Teacher Research Methods Qualitative vs. Quantitative studies, Research for Improving Practice vs. theory-building research	Hubbard Intro and Ch. 1 (Opt.) Robson Ch. 1	Keep daily diaries about what is happening where you are teaching, see Hubbard p. 7, # 1 for ideas.
2.	Introduction to research design Case study methods and designs Methods for data collection I: Observing Notetaking	Hubbard Ch. 3 (Opt.) Robson, 3:38-54 Hubbard, 2:9-27 (Opt.) Robson, 8	<ul style="list-style-type: none"> <li>• Continue keeping diaries for another week.</li> <li>• Conduct a 5-10 minute observation and take notes.</li> </ul>
3.	Methods for data collection II: Interviews  Survey Methods and Designs	Hubbard, 2:28-33, 38-43 (Opt.) Robson, 9:227-243.	<ul style="list-style-type: none"> <li>• Using diaries, begin to identify interests and draft questions. See Hubbard pp1-53.</li> <li>• Develop and conduct a structured interview with three people.</li> </ul>
4.	Methods for data collection III: Surveys and questionnaires Present and discuss your preliminary research questions	Hubbard 2:33-38 (Opt.) Robson, 5:121-135, 9:243-260.	Prepare a four-question survey and administer it to a group.
5.	Methods for data collection IV: Classroom artifacts and student work Audio and video tape transcripts	Hubbard, 2:27-28, 43-47 (Opt.) Robson, 10: 269-279	Go through a set of student papers or other documents and identify the kinds of data you could collect from them. Bring samples.
6.	Research Designs in detail Experimental types Survey designs Case study designs Threats to internal and external validity.	Hubbard, 3:all (Opt.) Robson: 4,5,6:77-167	<ul style="list-style-type: none"> <li>• Analyze the methods section of the sample research paper supplied in class.</li> <li>• Bring in some statistics that “you like”</li> </ul>
7.	Analyzing Quantitative Data I: General principles Levels of measurement Descriptive statistics Charts and tables	Hubbard 4:65-67 (Opt.) Robson, 11:318 Selections from Statistics with Microsoft Excel	<ul style="list-style-type: none"> <li>• Continue to work on your preliminary proposal for next week.</li> <li>• Practice with Excel and sample data set.</li> </ul>

Week	Topic	Readings	Assignment
8.	Presentations of preliminary proposals with peer consulting.		Bring 5 copies of a draft of preliminary proposal
9.	Analyzing quantitative data II: Assumptions underlying parametric tests Measures of relationship Correlation, regression	(Opt.) Robson 11:331-350 Selections from Statistics with Microsoft Excel	Continue to practice with excel data analysis tools presented in class
10.	Analyzing quantitative data III Measures of difference t tests, F tests, ANOVA, regression analysis	(Opt.) Robson 11:350-end Selections from Statistics with Microsoft Excel	Continue to practice with excel data analysis tools presented in class
11.	Qualitative Data Analysis I: Preparing data for analysis Indexing <i>Analytical Critique Presentations</i>	Hubbard, 4:65-74 (Opt.) Robson, 12	
12.	Qualitative Data Analysis II: Working inductively: Finding patterns and categories <i>Analytical Critique Presentations</i>	Hubbard 4: 74-82	
13.	Qualitative Data Analysis III: Memos and narrowing Testing patterns <i>Analytical Critique Presentations</i>	Hubbard 4:82-86	
14.	Project Proposal Presentations		
15.	Project Proposal Presentations		
16.	Final exam		

## VI. Textbook and/or Other Materials or Equipment Required

Required:

Hubbard, R. and Power, B. *The Art of Classroom Inquiry*. Portsmouth, NH: Heinemann, 1993.

Dritzke, B.J. and K.A. Heilman. *Statistics with Microsoft Excel*. Upper Saddle River, NJ: Prentice Hall, 1998. (To be updated with newer editions)

Optional:

(Opt.) Robson, Colin. *Real World Research: A resource for Social Scientists and Practitioner-Researchers*. Cambridge, MA: Blackwell, 1993.

**VII. Basis of Student Evaluation (grades)**

- A. Participation in class activities (25%)
- B. Homework and Exams (35%)
- C. Student presentation and analysis of research articles (10%)
- D. Research Proposal and Presentation (30%)

**VIII. Programs Served by this Course**

- A. Required core course of the MNS in Science Education degree option.
- B. Students in the MNS in Biology, Chemistry, Geoscience or Mathematics with an interest in education.
- C. Students in the MA in Elementary or Secondary Education, with an interest in science education
- D. Students interested in teacher action research methods.