

SIMON FRASER UNIVERSITY
Office of the Vice-President, Academic

MEMORANDUM

To: Senate

From: J.M. Munro, Chair
Senate Committee on Academic Planning

Subject: Master's Programs in Mathematics Education and
changes to M.Sc. Program in Secondary Mathematics
Education - SCAP Reference: SCAP 94-37, SCAP 94-40

Date: September 15, 1994

Action undertaken by the Senate Committee on Academic Planning and the Senate Graduate Studies Committee, gives rise to the following motion:

Motion: "that Senate approve and recommend approval to the Board of Governors, as set forth in S.94-61 the proposed Master's Programs in Mathematics Education, including new courses EDUC 844, EDUC 845, MATH 601, MATH 602; and revisions to the M.Sc. Program in Secondary Mathematics Education"

The attached documentation was prepared earlier and held up because the Math courses were still going through the approval stages. As a result some of the events written in the future tense have now take place. The following changes should be read in the documentation:

- Page 1, paragraph 2. The third intake into the Secondary Mathematics Education program took place in fall 1993.
- Page 1, paragraph 7. The first intake into the Mathematics Education program is projected to take place in 1995-2.
- Page 2, Note *** This course [EDUC 844] was offered as a special topics course during the 1993-2 semester.



JUL 23 1989

Master's Programs in Mathematics Education

In the following we propose

1. A change in the current M.Sc. Program in Secondary Mathematics Education
2. Establishment of the new M.A./M.Ed. emphasis in mathematics education

Justification

The program in Secondary Mathematics Education (offered jointly by the Faculty of Education and the Department of Mathematics and Statistics) which was instituted in 1989 has been very successful in attracting qualified secondary mathematics teachers. The second cohort is currently completing its program, and we are looking forward to the third intake in the fall of 1993. This program addresses the interests and needs of a very specific group, secondary mathematics teachers, in that one-half of the course work is taken in the department of mathematics.

Over the years, we have encountered strong candidates who are interested in mathematics education at the elementary and intermediate levels, that is, up to grade 10. However, the advanced level of mathematics content in the existing program did not meet their needs and interests in pedagogical matters of mathematics. Until now such students were enrolled in the Computers in Education, General Curriculum, or Individual Programs and took part of their course work with the cohort in secondary mathematics education.

The Faculty of Education and the Department of Mathematics and Statistics wish to respond to this small but growing number of students by institutionalizing a program in mathematics education with two routes: M. Sc. in Secondary Mathematics Education and a new route of M.A./M.Ed in Mathematics education. The new, M.A./M.Ed. program will keep the spirit of collaboration between the Faculty of Education and the Department of Mathematics and Statistics. Thus, the mathematics content courses will be designed such as to address the background of the candidates.

Characteristics

Recent documents on the nature of teaching and learning of mathematics (Year 2000; NCTM Standards 1989) emphasized the need for new approaches in mathematical pedagogy. This program incorporates recent developments in theory (such as constructivism) as well as new emphases in curriculum and pedagogy (problem solving, the use of technology).

Potential Students

The appropriate target group would be teachers with assignments at the elementary and intermediate grade levels that include the instruction of mathematics.

A bi-annual intake of 10 - 15 students is anticipated. This intake alternates with the bi-annual intake of students in the Secondary Mathematics Education. The first intake is projected for the 1994-2 semester.

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Course Requirements

M.Sc. in Secondary Mathematics Education*

The requirements for the M.Sc. in Secondary Mathematics Education include course work with a minimum of 25 credit hours in education and mathematics and masters thesis.

Core courses

Math 603-4 Foundations of Mathematics

Math 604-4 Geometry

Math 605-4 Mathematical Modeling

Educ 846-4 Foundations of Mathematics Education

Educ 847/S-4 Teaching and Learning Mathematics

Educ 844-5 The Research Basis of Mathematics Education**,***

M.A./ M.Ed. in Mathematics Education

The requirements for the MA in Mathematics Education include course work with a minimum of 25 credit hours in education and mathematics and a masters thesis. The requirements for a M.Ed. in Mathematics Education include a required course work of 25 credit hours in education and mathematics, a minimum of 15 hours of electives in education and/or mathematics, and a comprehensive examination. After the first 4 courses in the program, the students in consultation with faculty members will choose either the MA or M.Ed. option. At this point, the M.Ed. candidates will be provided with a list of critical readings which will serve as the basis for the comprehensive examination to be taken after all the course work (required and elective) has been completed. The core courses will be completed together by the MA and M.Ed. candidates.

Core courses

Math 6xx-4 Discovering Mathematics I**

Math 6xx-4 Discovering Mathematics II**

Educ 846-4 Foundations of Mathematics Education

Educ 847/G-4 Teaching and Learning Mathematics

Educ 844-5 The Research Basis of Mathematics Education**,***

Educ 845-4 Learning Mathematics with Computers**, ****

Electives

Graduate level courses in the Faculty of Education or in the Department of Mathematics and Statistics.

Notes

- * The M.Sc in Secondary Math Education has been approved. We propose an amendment by adding the course Educ 844-5, The Research Basis of Mathematics Education.
- ** New courses are printed in bold-face type. Course descriptions are enclosed.
- *** This course is offered as a special topics course during the 1993-2 semester
- **** This course was offered as a special topics course during the 1991-2 and 1992-2 semesters

Staffing

The courses Educ 846-4 Foundations of Mathematics Education, and Educ 844-5 The Research Basis of Mathematics Education will be taught jointly to students in both M.Sc and M.A./M.Ed routes. However, the course Educ 847-4 Teaching and Learning Mathematics will be taught separately.

The proposed change in the M.Sc. route of the program involves one new course taught every second year. The proposed M.A./M.Ed route involves three new courses, taught every second year, one in education, and two in mathematics. Members of the Department of Mathematics and Statistics will continue the tradition to serve on thesis committees which has been established for the program in secondary mathematics education over the past four years.

The total additional commitment in terms of faculty teaching time for both programs will be $\frac{3}{8}$ FTE (3 courses over 2 years) in the Faculty of Education and $\frac{1}{4}$ FTE (1 course/year) in the Department of Mathematics and Statistics.

SIMON FRASER UNIVERSITY
New Graduate Course Proposal Form

Calendar Information:

Department: FACULTY OF EDUCATION Course Number: Educ. 844-5

Title: The Research Basis of Mathematics Education

Description:

An examination of critical issues, current research and research practices in mathematics education.

Credit Hours: 5 Vector: 3-0-2 Prerequisite(s) if any: EDUC 847

Enrollment and Scheduling:

Estimated Enrollment: 15-20 When will the course first be offered: 95-2

How often will the course be offered: once every 2 years

Justification:

This course builds on the theoretical foundations of mathematics education acquired in the prerequisite course EDUC 847, Foundations of Mathematics Education

Resources:

Which Faculty member will normally teach the course: Dr. Wolff-Michael Roth

What are the budgetary implications of mounting the course: 1/8 FTE

Are there sufficient Library resources (append details): Appended literature resources locally available

- Appended: a) Outline of the Course.
- b) An indication of the competence of the Faculty member to give the course.
- c) Library and faculty resources

Approved:

Faculty Graduate Studies Committee: [Signature] Date: Oct 18th 1993

Faculty: [Signature] Date: 18 Oct '93

Senate Graduate Studies Committee: [Signature] Date: June 28, 1994

Senate: _____ Date: _____

THE RESEARCH BASIS OF MATHEMATICS EDUCATION (844-5)

This course was developed for graduate students in the program(s) of mathematics education. It builds on the theoretical foundations of mathematics acquired by the students in the prerequisite course EDUC 847, Teaching and Learning of Mathematics. Students will examine the highlights of contemporary research and research practices in mathematics education as they pertain to teaching, learning, and knowing of mathematics.

The course will deal with current and critical issues in the area of mathematics education such as situated cognition, social constructivism, communities of practice/socio-cultural issues, collaborative problem solving, technology in mathematics education, gender and mathematics, constructivism, sociology of knowledge, ethnomathematics and cultural issues, mathematical cognition/problem solving, and students' beliefs. The course will examine the influence of these issues on the specific research methods used by researchers.

The topics of the course are circumscribed by, but not limited to the major readings listed below with each topic. The specific selections may change depending on the participants in the course. That is, the specific research articles to be read in the offering for elementary teachers would focus on the research done by researchers in the elementary classrooms such as by Paul Cobb and colleagues, Maggie Lampert, and Gaea Leinhardt. For secondary education majors, the research done at Cornell by Jere Confrey or by Allan Schoenfeld at Berkeley would be more central. In the context of published research and original data sources, the student will be introduced to the relevant research methods in mathematics education.

Textbook

Grouws, D.A. (Ed.) (1992). *Handbook of research on mathematics teaching and learning*. New York: MacMillan Company.

Competence of a Faculty Member

Dr. Wolff-Michael Roth completed a Ph.D. in Science Education with a secondary emphasis in research methods. In addition to science, he taught mathematics and computer science in middle and high schools. Over the past five years, he investigated problem solving, ratio reasoning, and the learning of mathematics in the context of science classrooms using both quantitative and qualitative methods. His current research includes the construction/acquisition of mathematics knowledge in settings which focus on situated learning and communities of mathematical practice.

Sociology of Knowledge/ Social Constructivism

Cobb, P. (1989). Experiential, cognitive, and anthropological perspectives in mathematics education. *For the Learning of Mathematics*, 9, 32-42.

Cobb, P., Wood, T., & Yackel, E. (1991). Analogies from the philosophy and sociology of science for understanding classroom life. *Science Education*, 75(1), 23-44.

Cobb, P., Wood, T., Yackel, E., Nicholls, J., Wheatley, G., Trigatti, B., & Perlwitz, M. (1991). Problem-centered mathematics projects. *Journal of Research in Mathematics Education*, 22(1), 3-29.

Cobb, Paul; And Others (1991). Assessment of a Problem-Centered Second-Grade Mathematics Project. *Journal for Research in Mathematics Education*, 22, 3-29.

Livingston, E. (1986). *The ethnomethodological foundations of mathematics*. London and New York: Routledge and Kegan Paul.

- Lynch, M. (1990). The externalized retina: Selection and mathematization in the visual documentation of objects in the life sciences. In M. Lynch & S. Woolgar (Eds.), *Representation in scientific practice* (pp. 153-186). Cambridge, MA: The MIT Press.
- Lynch, M. (1990). The externalized retina: Selection and mathematization in the visual documentation of objects in the life sciences. In M. Lynch & S. Woolgar (Eds.), *Representation in scientific practice* (pp. 153-186). Cambridge, MA: The MIT Press.
- Lynch, M. (1991). Method: measurement--ordinary and scientific measurement as ethnomethodological phenomena. In G. Button (ed.), *Ethnomethodology and the human sciences* (pp. 77-108). Cambridge: Cambridge University Press.

Ethnomathematics/Cultural Issues

- Crump, T. (1990). *The anthropology of numbers*. Cambridge, UK: Cambridge University Press
- Lave, J. (1988). *Cognition in practice: Mind, mathematics and culture in everyday life*. Cambridge: Cambridge University Press.
- Lave, J., Murtaugh, M., & de la Rocha, O. (1984). The dialectic of arithmetic in grocery shopping. In B. Rogoff & J. Lave (Eds.), *Everyday cognition: Its development in social context* (pp. 67-94). Cambridge, MA: Harvard University Press.
- Saxe, G. B. (1991). *Culture and cognitive development: Studies in mathematical understanding*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Schliemann, A.D. & Acioly, N.M. (1989). Mathematical knowledge developed at work: The contribution of practice versus the contribution of schooling *Cognition and Instruction*, 6(3), 185-221.
- Scribner, S. (1986). Thinking in action: some characteristics of practical thought. In R.J. Sternberg & R.K. Wagner (Eds.), *Practical intelligence: Nature and origins of competence in the everyday world* (pp.13-30). Cambridge: Cambridge University Press.

Situated Cognition

- Brown, J.S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42.
- Collins, A., Brown, J. S., & Newman, S. (1989). Cognitive apprenticeship: Teaching the craft of reading, writing, and mathematics. In L. Resnick (ed.), *Cognition and instruction: Issues and agendas* (pp. 453-494). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Greeno, J.G. (1988). Situated activities of learning and knowing in mathematics. In M. Behr, C. Lacampagne, M.M. Wheeler (Eds.), *Proceedings of the 10th Annual Meeting of the PME-NA*. DeKalb, IL
- Greeno, J.G. (1991). Number sense as situated knowing in a conceptual domain. *Journal for Research in Mathematics Teaching*, 22, 170-218.
- Greeno, J.G. (1991). Number sense as situated knowing in a conceptual domain. *Journal for Research in Mathematics Teaching*, 22, 170-218.
- Kaput, J.J. (1987). Towards a theory of symbol use in mathematics. In C. Janvier (Ed.), *Problems of representation in the teaching and learning of mathematics* (pp. 159-195). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Kilpatrick, J. (1987). Problem formulating: Where do good problems come from? In A. Schoenfeld (ed.), *Cognitive science and mathematics education* (pp. 123-147). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Roth, W.-M. (in press). Bridging the gap between school and real-life: Toward an integration of science, mathematics, and technology in the context of authentic practice. *School Science and Mathematics*.
- Roth, W.-M. (in press). Problem-centered learning or the integration of mathematics and science in a constructivist laboratory: A case study. *School Science and Mathematics*.
- Saxe, G.B. (1992). Studying children's learning in context: Problems and prospects. *The Journal of the Learning Sciences*, 2, 215-234.

Communities of Practice/Socio-Cultural Issues

- Brown, J.S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42.
- Cazden, C.B. (1986). Classroom discourse. In M. C. Wittrock (Ed.), *Handbook for research on teaching* (3rd ed.), (pp. 432-463). New York: Macmillan.
- Eisenhart, M.A. (1988). The ethnographic research tradition and mathematics education research. *Journal for Research in Mathematics Education*, 19, 99-114.
- Lampert, M. (1986). Knowing, doing, and teaching multiplication. *Cognition and Instruction*, 3(4), 305-342.
- Lampert, M. (1990). When the problem is not the question and the solution is not the answer: Mathematical knowing and teaching. *American Educational Research Journal*, 27(1), 29-63.
- Lo, J.J., Wheatley, G.H., & Smith, A.C. (1991, April). Learning to talk mathematics. Paper presented at the annual meeting of the American Educational Research Association. Chicago, IL.
- McArthur, D., Stasz, C., & Zmuidzinas, M. (1990). Tutoring techniques in algebra. *Cognition and Instruction*, 7, 197-244.

Technology in Mathematics Education

- Adams, D.D., & Shrum, J.W. (1990). The effects of microcomputer-based laboratory exercises on the acquisition of line graph construction and interpretation skills by high school biology students. *Journal of Research in Science Teaching*, 27(8), 777-787.
- Harel, I. (1991). *Children designers: Interdisciplinary constructions for learning and knowing mathematics in a computer-rich school*. Norwood, NJ: Ablex.
- Harel, I., & Papert, S. (1991). Software design as a learning environment. In I. Harel & S. Papert, *Constructionism: Research reports and essays, 1985 - 1990* (pp. 41-84). Norwood, NJ: Ablex.
- Kaput, J. (1986). Information technology and mathematics: Opening new representational windows. *Journal of Mathematical Behavior*, 5, 187-207.
- Pea, R. D. (1987). Cognitive technologies for mathematics education. In A. Schoenfeld (ed.), *Cognitive science and mathematics education* (pp. 89-122). Hillsdale, NJ: Lawrence Erlbaum Associates.

Mathematical Cognition/Problem Solving

- Dufour-Janvier, Bednarz, N., & Belanger, M. (1987). Pedagogical considerations concerning the problem of representation. In C. Janvier (Ed.), *Problems of representation in the teaching and learning of mathematics* (pp. 109-122). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Kaput, J.J. (1987). Towards a theory of symbol use in mathematics. In C. Janvier (Ed.), *Problems of representation in the teaching and learning of mathematics* (pp. 159-195). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Mason, J.H. (1987). What do symbols represent? In C. Janvier (Ed.), *Problems of representation in the teaching and learning of mathematics* (pp. 73-81). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Roth, W.-M. (1991). The development of reasoning on the balance beam. *Journal of Research in Science Teaching*, 28, 631-645.
- Schoenfeld, A. (1985). *Mathematical problem solving*. Orlando, FL: Academic Press.
- Schoenfeld, A.H. (1992). On paradigms and methods: What do you do when the ones you know don't do what you want them to? Critical issues in the analysis of data in the form of videotapes. *The Journal of the Learning Sciences*, 2, 179-214.
- Wilensky, U. (1991). Abstract meditations on the concrete and concrete implications for mathematics education. In I. Harel & S. Papert, *Constructionism: Research reports and essays, 1985 - 1990* (pp. 193-203). Norwood, NJ: Ablex.

Gender and Mathematics

- Burton, L. (1990). *Gender and mathematics: An international perspective*. London: Cassell

Fennema, E., & Leder, G.C. (1990). *Mathematics and gender*. New York: Teacher's College.
Walkerdine, V. (1990). *Counting girls out*. London: Virago.

Constructivism

Cobb, P., Yackel, E., Wood, T. (1992). A constructivist alternative to the representational view of mind in mathematics education. *Journal for Research in Mathematics Education*, 23(1), 2-33.

Davis, P.J. & Mason, J.H. (1989). Notes on a radical constructivist epistemology applied to didactic situations. *Journal of Structural Learning*, 10, 157-176.

von Glasersfeld, E. (1987). Preliminaries to any theory of representation. In C. Janvier (Ed.), *Problems of representation in the teaching and learning of mathematics* (pp. 215-225). Hillsdale, NJ: Lawrence Erlbaum Associates.

Wheatley, G.H. (1991). Constructivist perspectives on science and mathematics learning. *Science Education*, 75, 9-21.

Collaborative Problem Solving

Kroll, D.L. (1989). Cooperative problem solving and metacognition: A case study of three pairs of women. (Doctoral dissertation, Indiana University, 1988). Dissertation Abstracts International, 49, 2958A. (University Microfilms No. 89022500)

Smith, E., & Confrey, J. (1991, April). *Understanding collaborative learning: Small group work on contextual problems using a multi-representational software tool*. Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL.

Students' Beliefs

Lester, F.K., Garofalo, J., & Kroll, D.L. (1989). Self-confidence, interest, beliefs, and metacognition: Key influences on problem solving behavior. In D. McLeod & V. Adams (Eds.), *Affect and mathematical problem solving: A new perspective* (pp. 75-88). New York: Springer-Verlag.

Stodolsky, S.S., Salk, S., & Glaessner, B. (1991). Student views about learning math and social studies. *American Educational Research Journal*, 28(1), 89-116.

SIMON FRASER UNIVERSITY
New Graduate Course Proposal Form

Calendar Information:

Department: FACULTY OF EDUCATION Course Number: Educ.845

Title: Learning Mathematics with Computers

Description:

Experience in incorporating computers in mathematical problem solving, adaptation of materials for use in intermediate mathematics classroom.

Credit Hours: 4 Vector: 2-0-2 Prerequisite(s) if any: _____
=====

Enrollment and Scheduling:

Estimated Enrollment: 10-15 When will the course first be offered: 1995-3
How often will the course be offered: every second year
=====

Justification:

Following the Year 2000 Document and the change in the focus of teaching mathematics found in the NCTM Standards, there is a repeating recommendation to incorporate technology in a process of constructing mathematical knowledge. The proposed course attempts to familiarize the learner with the highlights of educational software for teaching mathematics through a variety of personal hands on experiences and through related literature.

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Resources:

Which Faculty member will normally teach the course: Rina Zazkis

What are the budgetary implications of mounting the course: 1/8 FTE

Are there sufficient Library resources (append details): Appended literature resources locally available

- Appended: a) Outline of the Course.
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

=====

Approved:

Faculty Graduate Studies Committee: [Signature] Date: Oct 18, 1993

Faculty: [Signature] Date: 18 Oct '93

Senate Graduate Studies Committee: [Signature] Date: June 28, 1994

Senate: _____ Date: _____

Learning Mathematics with Computers

Objectives:

The similar belief in learning theories of Dewey, Montessori, Piaget and Papert is that people learn by "doing and thinking about what they did". Therefore this course has a dual goal: to provide the intellectual challenge of "doing" hands on problem solving and to provide the theoretical understanding--based on the constructivist views on the learning of mathematics--of "what they did", and how it is applicable for children's learning of mathematics.

Description of Course:

The course will integrate two main formats: Computer Laboratory and Seminar. The Computer Laboratory will involve students in a variety of mathematical problem solving activities (that is, "doing mathematics"), that invite students to use a computer to explore unfamiliar environments and to experience the process of construction a new mathematical knowledge. The Seminar will involve students in discussions on these activities (that is, "thinking about what they did"), addressing mathematical problems and methodological issues. Classroom implementations, including adaptation and modification of such activities will be suggested. Furthermore, through the seminar discussions and related literature, students will become familiar with the contemporary research on the uses of computers in mathematics classroom.

The software will include programming languages LOGO and ISETL, spreadsheet, Geometric Supposer, Cabri Geometry or Geometer's Sketchpad, Function machines, among other software packages and microworlds.

Assignments and expectations:

Attendance and active participation in discussions

Presentation to the class

Paper based on literature review

Project based on designing mathematical activities using computers

Assessment and grading:

The above items - 25% each.

Bibliography: Available upon request

SIMON FRASER UNIVERSITY
FACULTY OF EDUCATION

MEMORANDUM

To: Ron Heath
Senate Graduate Studies Committee

From: Robin Barrow
Dean, Faculty of Education

Re: **Library Assessment**
Educ 844-5 - Research Basis of Mathematics Education

Date: December 7, 1993

The Faculty of Education will support the one-time costs for the above course at \$1029.



RB/cp

c.c.: M. Manley-Casimir
S. Kanehara

SIMON FRASER UNIVERSITY
FACULTY OF EDUCATION

MEMORANDUM

To: Ron Heath
Senate Graduate Studies Committee

From: Robin Barrow
Dean, Faculty of Education

Re: **Library Assessment**
Educ 845-5 - Learning Mathematics with Computers

Date: June 24, 1994

Further to my memorandum of December 7, 1993 the Faculty of Education will cover the costs associated with the profile change through a one-time budget transfer (see attached memorandum from J. Munro).

I trust this now enables the speedy approval of Education 845-5.



RB/cp

c.c.: M. Manley-Casimir
S. Kanehara
K. Kirkland

SIMON FRASER UNIVERSITY
FACULTY OF EDUCATION

MEMORANDUM

To: Ron Heath
Senate Graduate Studies Committee

From: Robin Barrow
Dean, Faculty of Education

Re: **Library Assessment**
Educ 845-5 - Learning Mathematics with Computers

Date: December 7, 1993

The Faculty of Education will support the one-time costs for the above course at \$486.

The Faculty does not support the recommended profile charges of \$764 of recurring costs.



RB/cp

c.c.: M. Manley-Casimir
S. Kanehara

M.R.

MEMORANDUM

W.A.C. Bennett Library, Simon Fraser University
Burnaby, British Columbia, Canada V5A 1S6

Date: 17 September, 1993

From: Ralph Stanton (Collections Librarian) (5946)

To: Cornel Hamm, Acting Dean of Education (3643)

Re: Library Course Assessment for Master's Programme in
Mathematics Education

I have assessed the Library's ability to support the new Master's Programme in Mathematics Education, here are the results.

This new Master's programme involves the introduction of four new courses, two in Mathematics and two in Education. We have not received an assessment request for the two mathematical courses designated in the documentation as MATH 6xx-4 Discovering Mathematics I and MATH 6xx-4 Discovering Mathematics II.

Book Prices:

The average price of books in this field is \$54 (BNA07/10/93 direct).

EDUC 844-5 The Research Basis of Mathematics Education

This course will first be offered in 95-2 to 15 to 20 students and every 2 years after.

There are 29 monographs listed in the course reading list of which 6 are not in the catalogue, they should be bought at a cost of \$324. A further 13 are on loan and should have added copies purchased for \$705. Catalogue checking for both courses was done August 1993 when use is low.

One time costs:

Monographs not in the catalogue	\$324
Added copies of monographs	\$705

Total	\$1029

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EDUC 845-5 Learning Mathematics With Computers

This course will first be offered in 94-3 to between 10 and 15 students and every two years after that.

There are 13 monographs listed in the course reading list of which 8 are not in the catalogue, they should be bought at a cost of \$432. Another title is on loan and should have an added copy purchased for \$54. Of the 5 serials citations 1 is not available from Library resources, it is Logo Exchange at \$29. This resource could be provided through inter-library loan or other arrangement.

One time costs:

Monographs not in the catalogue	\$432
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PROFILE CHANGES

For both these courses we recommend profile changes as follows:

In the sub-profile 003 Science Books the non subject parameter 14/08 (teaching of pre-college mathematical) should be switched on. This would produce 11 books at an average cost of \$54 for a total of \$594 per year and a further 6 forms (of which we expect to select 2 per year) at an average cost of \$40 each for an annual cost of \$80 per year.

Add to sub-profile 022 Education Books the subject describer Math in the curriculum BNA #36645480 which will add an estimated 3 titles per year at a cost of \$30 each for a total of \$90 per year.

The total cost of profile changes $\$594 + \$80 + \$90 = \764 .

THE TOTAL RECURRING COSTS FOR PROFILE CHANGES ARE \$764 PER YEAR TRANSFER FROM BASE BUDGET. ONE TIME COSTS ARE \$486 PLUS \$1,029 FOR A TOTAL OF \$1,515.

Please contact me to discuss this assessment if you have any concerns or questions (Phone 5946).

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c.c. Michael Manley-Casimir, Director, Graduate Programs
Stan Kanehara, Assistant to the Dean
Sharon Thomas, Head, Library Collections Management

MEMORANDUM

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THE TOTAL RECURRING COSTS FOR PROFILE CHANGES ARE \$764 PER YEAR TRANSFER FROM BASE BUDGET. ONE TIME COSTS ARE \$486 PLUS \$1,029 FOR A TOTAL OF \$1,515.

Please contact me to discuss this assessment if you have any concerns or questions (Phone 5946).

c.c. Michael Manley-Casimir, Director, Graduate Programs
Stan Kanehara, Assistant to the Dean
Sharon Thomas, Head, Library Collections Management

PROPOSAL FOR
MATH 601-4 AND MATH 602-4
AS PART OF THE
MATHEMATICS/EDUCATION MASTER'S PROGRAM

The two courses described on the following pages are an integral part of the new Master's Program in Mathematics Education recently approved by the Faculty of Education. They are designed to give the student both breadth and understanding of four fundamental areas of mathematics and will complement the mathematics currently taught in the elementary and intermediate grades. Each course covers more than one area: Discover Mathematics I - Arithmetic, Algebra and Geometry; and Discovering Mathematics II - Discrete Mathematics, Probability and Statistics, and will be taught in two parts (usually with a different instructor teaching each part). In each case the goal will be to give the students a hands-on exploratory experience which will lead to mathematical understanding and discovery. This will be achieved by the use of projects, videos, guest speakers, experiments and discussions. No formal mathematics background will be assumed and material will be presented in a non-theoretical manner. At all times efforts will be made to ensure that the material is related to the so-called "real world", a variety of applications will be presented and students will be encouraged to relate the material to their own interest and experiences.

No suitable text is available for either course. Further, no reference materials are known which would be accessible to students with no more than a high school mathematics background. Suitable handouts and notes will be prepared.

Department of Mathematics and Statistics
Application for new graduate courses
Appendix

Proposal:

We want to introduce two new graduate courses, MATH 601-4, Discovering Mathematics I, and MATH 602-4, Discovering Mathematics II

Justification:

Over four years ago, in the Fall 1989 semester, the Department of Mathematics and Statistics and the Faculty of Education introduced a Master's Program in Secondary School Mathematics Education. This program has proved to be very successful and highly popular. It has served as a paradigm for a similar program at the University of Victoria.

Members of the Faculty of Education and the Department of Mathematics and Statistics felt that it was time to introduce a Master's Program in Mathematics Education to meet the needs of practicing teachers who have assignments in the elementary and intermediate grades (approximately grades 4 to 10). This program, like the one for secondary school teachers, will consist of courses in both the Education Faculty and the Department of Mathematics and Statistics. The courses, MATH 601-4, Discovering Mathematics I, and MATH 602-4, Discovering Mathematics II, will be the Department of Mathematics and Statistics part of the program.

Course descriptions:

MATH 601-4, Discovering Mathematics I

A discussion of the basic ideas of the arithmetic and geometry of the elementary and junior secondary school. Emphasis will be on the students understanding through exploration and discovery. Topics will include some of the following: language of mathematics, number systems, fractions, decimals and percents, estimation and measurement, algebraic systems, classification of plane and solid figures, properties of Euclidean geometry, transformation geometry, and other geometries.

MATH 602-4, Discovering Mathematics II

An exploration of discrete mathematics and statistics with emphasis on the ways in which they arise and are used in "real world" applications. Emphasis will be on understanding and discovery and students will see how these topics can be addressed in their own teaching. Topics will include: counting, graphs as models, algorithms, scheduling, coding theory, measuring, interpreting data, testing, experimental design, uses of statistics.

Budgetary implications:

See attached memo from Kathy Heinrich.

Competence of faculty teaching the course:

The faculty chosen to teach these courses are certainly competent to do so.

Library resources:

No new library resources will be needed. The material for these courses will be developed by the instructors.



SIMON FRASER UNIVERSITY

MEMORANDUM

To: H. Gerber	Date: February 23, 1994 From: Katherine Heinrich, Chair Department of Mathematics & Statistics
Subject: Math 601 and 602	

It is proposed that Math 601 and 602 (two new courses to be offered in Mathematics Education by our department) would be offered in alternate years. We currently offer 20 graduate courses, 2 of which are offered jointly with undergraduate courses. In the calculations I have been doing regarding our teaching resources for the future, I have assumed no undergraduate/graduate courses offered simultaneously (although we should encourage such), 20 graduate courses a year and "space" for one or two special topics courses.

On that basis alone I believe we have sufficient resources to offer these two courses. Further, as indicated by the attached e-mail message from the Dean of Education, in recognition of the graduate courses we offer to their graduate students, each year a faculty member in education, as part of her/his regular assignment will teach a course in this department. Last year Rina Zazkis taught Math 190 and it was very successful.

This is an excellent opportunity, both to be part of a new joint program with Education, and in support of our teaching program. I believe we have the resources to support it.

KH:jc

Simon Fraser University

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Mathematics/Statistics Course Number: Math 601-4

Title: Discovering Mathematics I

Description: See attached.

Credit Hours: Four Vector: 4-0-0 Prerequisite(s) if any: Acceptance into the Master's program in Mathematics Education or permission of the department. Graduate Students in the Department of Mathematics and Statistics cannot take this course to satisfy their degree requirements.

=====
ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 25 When will the course first be offered: _____

How often will the course be offered: Once every two years

=====
JUSTIFICATION:

See attached

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RESOURCES:

Which Faculty member will normally teach the course: J.L. Berggren, H. Gerber

What are the budgetary implications of mounting the course: _____

Are there sufficient Library resources (append details): Yes

- Appended: (a) Outline of the Course
(b) An indication of the competence of the Faculty member to give the course
(c) Library resources

Approved: Departmental Graduate Studies Committee: [Signature] Date: March 17, 1994
Faculty Graduate Studies Committee: [Signature] Date: _____
Faculty: R. S. Smith Date: July 14, 1994
Senate Graduate Studies Committee: [Signature] Date: 14 July 94
Senate: _____ Date: _____

**MATH 601-4
DISCOVERING MATH I
OUTLINE**

Arithmetic and geometry form the core of the elementary school curriculum. The fundamental concepts in both these areas of mathematics will be approached through exploratory exercises and problems as well as in projects. The students will work both singly and in groups to explore the ideas of mathematics. The presentations will be non-theoretical.

Among the topics to be discussed are some of the following:

PART I: ARITHMETIC

1. The language of mathematics

2. Number Systems

- a) Evolution and description of base-ten system
- b) Other base systems
- c) Operations of addition and multiplication
- d) Primes, factors and perfect numbers

3. Fractions

- a) Ratios and commensurability
- b) Models of fractions
- c) Operations on fractions
- d) Density and other properties

4. Decimals and percents

- a) Development of decimals
- b) Operations on decimals
- c) Periodic decimals and fractions
- d) Percents

5. Estimation and measurement

- a) Estimation
- b) Measurement

6. Algebraic Systems (2 weeks)

- a) Modular Arithmetic and coding
- b) Dihedral groups
- c) Matrices

PART II: GEOMETRY

1. Classification of plane and solid figures

- a) Terminology - polygons, polyhedra, vertices, edges, etc.
- b) Symmetries of figures
- c) Regular figures

2. Properties of Euclidean Geometry

- a) Congruence
- b) Parallel properties and angles of figures with applications to tessellations
- c) Pythagorean theorem
- d) Distance in the plane

- e) Areas and volumes
- f) Similarity properties
- g) Possible and impossible constructions

3. Transformation geometry

- a) Motions of the line and plane
- b) Translations
- c) Reflections
- d) Rotations

4. Fractal Geometry

CALENDAR DESCRIPTION

MATH 601-4 Discovering Mathematics I

A discussion of the basic ideas of the arithmetic and geometry of the elementary and junior secondary school. Emphasis will be on the students understanding through exploration and discovery. Topics will include some of the following: language of mathematics, number systems, fractions, decimals and percents, estimation and measurement, algebraic systems, classification of plane and solid figures, properties of Euclidean geometry, transformation geometry, and other geometries.

Prerequisite: Acceptance into the Master's program in Mathematics Education or permission of the department. Graduate students in the Department of Mathematics and Statistics cannot take this course to satisfy their degree requirements.

Simon Fraser University

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Mathematics/Statistics Course Number: Math 602-4

Title: Discovering Mathematics II

Description: See attached

Credit Hours: Four Vector: 4-0-0 Prerequisite(s) if any: Math 601 and acceptance into the Master's program in Mathematics Education, or permission of the department. Graduate students in the Department of Mathematics and Statistics cannot take this course to satisfy their degree requirements.

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 25 When will the course first be offered: Fall 1995

How often will the course be offered: Once every two years.

JUSTIFICATION:

See attached.

RESOURCES:

Which Faculty member will normally teach the course: K. Heinrich, C. Dean

What are the budgetary implications of mounting the course:

Are there sufficient Library resources (append details): Yes

- Appended: (a) Outline of the Course (b) An indication of the competence of the Faculty member to give the course (c) Library resources

Approved: Departmental Graduate Studies Committee: [Signature] Date: March 17, 1994 Faculty Graduate Studies Committee: [Signature] Date: [Signature] Date: July 14, 1994 Faculty: [Signature] Date: [Signature] Date: [Signature] Date: [Signature] Date: [Signature] Date: [Signature]

MATH 602-4

DISCOVERING MATH II

Discrete Mathematics is used in computer communications, scheduling and transportation problems. Statistics is encountered by each of us every day in the newspapers and on television as medical findings, sporting results and economic strategies are discussed. These are two of the most accessible areas of modern applied mathematics and many problems and the ideas behind their solution can be understood and appreciated by students with only a modest mathematical background. Several topics in these areas and their relationship to "real-world" problems will be explored. The exploration will be done through a series of projects with students often working in teams and making presentations of their discoveries. The presentation will be non-theoretical.

Topics:

PART 1: DISCRETE MATHEMATICS

1. Counting

- ordered and unordered selections
- permutations and combinations
- elementary probability
- pigeon-hole principle

2. Graph Theory

- graphs as models
- trees and their properties and uses
- eulerian walks and applications
- games on graphs
- graph algorithms
- networks

3. Graphical designs

- graph decompositions
- tournament scheduling
- Hamilton cycles and 1-factors in complete graphs
- Steiner triple systems
- applications

4. Coding Theory

- binary arithmetic
- error correction and detection
- Hamming distance
- codes from graphs and designs

PART 2: STATISTICS

1. Measuring and Averages

- measures of central tendency
- measures of dispersion
- elements of graphing data - univariate, bivariate, multiway data

2. Designing Experiments

- randomization
- binomial, hypergeometric, normal probability distributions
- double - blind experiments
- paired comparisons

3. Interpreting Data

- components of a test of hypothesis
- hypothesis tests for means and proportions
- two - sample tests
- standard error of an estimator

4. Seminars

- Environmental Statistics
- Statistics and Medicine
- Statistics in Sport

CALENDAR DESCRIPTION MATH 602-4 DISCOVERING MATHEMATICS II

An exploration of discrete mathematics and statistics with emphasis on the ways in which they arise and are used in "real world" applications. Emphasis will be on understanding and discovery and students will see how these topics can be addressed in their own teaching. Topics will include: counting, graphs as models, algorithms, scheduling, coding theory, measuring, interpreting data, testing, experimental design, uses of statistics.

Prerequisite: MATH 601 and acceptance into the Master's program in Mathematics Education, or permission of the department. Graduate students in the Department of Mathematics and Statistics cannot take this course to satisfy their degree requirements

MEMO

TO: Katherine Heinrich, Chair Department of Mathematics
and Statistics

FROM: Ralph Stanton (Library Collections Management Office)

RE: New Course Proposal for MATH 601 and MATH 602 Dated
February 23, 1994

DATE: 11 July 1994

I have examined the Library's holdings for MATH 601
Discovering Mathematics I and 602 Discovering Mathematics
II. These 4 unit courses will be offered once every 2 years
to 25 students

The Library has no record of receiving the course outline or
other documents until the agenda of SGSC meeting of July 11,
1994 was received. No reading list is attached to these
courses.

The Library has completed a course assessment for EDUC 844-5
and EDUC 845-5 which cover topics in the teaching of pre-
college Mathematics. Changes to the Library profile made for
these courses should be adequate to support MATH 601 and
602.

The serial *Arithmetic Teacher* is in the collection. The
Mathematics Department has indicated it has not set a text
for either course and that it will allocate up to \$200 per
course to allow for the purchase of texts related to these
courses. The Mathematics department has indicated it is
satisfied with Library Resources as currently planned.

MAXIMUM TOTAL OF ALL ONE TIME COSTS IS \$400. NO OTHER COSTS
ARE ATTACHED TO THESE COURSES.

RS

K

c.c. Sharon Thomas, Head Collections Management

