

STLF Report to CWSEI and Mathematics Department

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Specific activities performed by STLF

1) Professional development

- Attended the weekly Reading Group discussions (Mar. 15 , Mar. 22 and Mar. 29)
- Attended Richard Shavelson's talk on assessing science learning in higher education (Mar. 25)
- Attended the weekly STLF meeting (Mar. 25)
- Observed an “example class” - BIOL112 (unicellular life) that has been radically transformed. Notes were taken for discussion in the STLF group, but overall I was amazed at the level of class participation, particularly the level of discussion and debate between classmates about course material.

2) MATH SEI general meetings/activity

- Met the Math-CWSEI group to discuss future work (Mar. 12)
- Attended a Math Dept. seminar on the online math homework system “WeBWork,” presented by DJun Kim (Mar. 12)

3) Course-specific meetings/activities

Tracking Proof Skills Project (MATH 220-Mathematical Proof and subsequent courses)

1. Met with Carl Wieman (Mar. 17) to discuss general approaches for this project, as well as strategies for faculty interviews and developing an assessment tool. Following this meeting, I identified a number of things to do in the near future (1) read the relevant literature on teaching and learning in order to start thinking about an effective assessment tool, (2) in addition to M220 instructors, identify and interview instructors of follow-on courses (courses for which M220 is a pre-requisite) for input into M220 learning goals and (3) find out the history of M220 and how it fits into the Math curriculum.
2. Read and summarized chapters 1-3 of “How People Learn.” I found the chapter on experts vs. novices to be particularly relevant to the learning and teaching of proof skills. Specifically, it seems likely to me that metacognitive abilities (the ability to monitor and adapt one's own learning or problem solving process) plays a large role in understanding and constructing mathematical proofs, so this may be a fruitful direction to study.
3. Met with undergraduate chair Rajiv Gupta (Mar. 25) to learn about the history and role of M220 in the curriculum, as well as to find out what kind of data is available relating to this course. I learned a number of things that require future action:
 - M220 plays a central role in the curriculum - it is a required course for nearly all non-honours Math programs, it is a pre-requisite for most 3rd-level Math courses (honours students use the alternative MATH 226 pre-requisite). In addition, students cannot be promoted to 3rd year status without completion of M220. Failure rates in M220 are very high, roughly 2-fold that of other standard 2nd year math courses. A comparison is shown in the following table

Aggregate Final Grades for Winter Terms (04W-09W)							
	# stud.	Avg	A (%)	B (%)	C (%)	D (%)	F (%)
MATH 220 Mathematical Proof	879	57.9	11.6	18	31.2	13.2	26.1
MATH 200 Calculus III	4673	66.4	26.5	26.5	22.9	10.4	13.7
MATH 215 Elemen. Diff. Eqns. I	1477	68.3	36.7	22	18.3	8.3	14.8
MATH 221 Matrix Algebra	3058	68	28.2	27.9	24.9	9	10

- In 2003 the course title and calendar description for M220 were changed. Greg Martin was instrumental in this change, as well as an instructor of M220 several times, and so should be interviewed soon.
 - Data on students' progress through their programs is available and in a format that can allow for identifying past and future cohorts of students to be studied. I have obtained some of this data, as well as a list of instructors of M220 for the past 8 years.
4. Met with Greg Martin (Mar. 30) to discuss both the changes made to the course in 2003 and to solicit his opinions about desired learning goals for the course (as both an instructor of M220 and of follow-on courses). In summary, prior to 2003 this course was primarily introductory analysis (and was titled "Analysis") but in the few years prior had gradually shifted more and more focus to proof since this was not taught elsewhere. In 2003, the course title was changed to "Mathematical Proof" to reflect this, and also much of the analysis content was removed to allow for more focus specifically on proof skills. Some analysis content remains though, both because it is not taught elsewhere (ex. infinite series) and to allow a basis on which to do proofs. Dr. Martin also had many suggestions for potential learning goals, especially with regard to what instructors of follow-on courses would like students to be able to do with regard to mathematical proofs.
 5. Developed a chart of course dependencies, to aid myself and others in understanding the role of MATH 220 in the Mathematics curriculum (see attached). This will also aid in targeting faculty and student interviews, as well as identifying cohorts of students for later assessment.
 6. Collected various resources required for the development of an assessment tool: final exams for 2008WT2, 2009S, various literature on assessment of proof skills, course outlines and textbooks, and final grades for M220 and related courses (pre-requisites and follow-on courses) for the past 5 years.

Current Project Status (material was prepared by either STLF or other members of the MATH SEI group)

MATH 220:

Learning Goals: Faculty interviews are in progress to compile suggestions for course-level learning goals.

Assessments: None yet. A literature review of proof skills and assessments has been started to aid in the development of assessment tools.

New Methods/Materials: A chart of course dependencies relating to MATH 220 is complete.

Plan for immediate future work

MATH 220:

1. Continue literature search and reading on proof skills and assessment of proof skills.
2. Continue faculty interviews with past instructors of M220.
3. Determine the most common first follow-on courses for M220 students, from the data obtained from Rajiv Gupta and course dependencies.
4. Identify and interview faculty who have taught these most common follow-on courses, for input into course-level learning goals (what skills do follow-on course instructors want students to have?).