STLF Report to CWSEI and Mathematics Department

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Specific activities performed by STLF

1) Professional development
- Attended the weekly Reading Group discussion (Apr. 12)
- Attended Alan Schoenfeld's talk on learning to think mathematically (Apr. 9), as well as lunch and math group discussion with him afterward.
- Attended the weekly STLF meetings (Apr. 1, Apr. 8 and Apr. 15)
- Observed an "example class" - PHYS 304 (intro to quantum mechanics) that has been radically transformed.

2) MATH SEI general meetings/activity
- Met with the Math-CWSEI group to discuss future work (Apr. 1)
- Met with department head to discuss and develop MATH-CWSEI plans for the coming year (Apr. 8)

3) Course-specific meetings/activities

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

1. Met with Andrew Rechnitzer (Apr. 1), previous instructor of several Math 220 sections (5 sections taught in the last three years) as well as the primary faculty member to be involved in the transformation of Math 220. We discussed his experiences teaching the course, as well as our immediate future plans. As a result of this meeting, we decided to survey Math 220 students in the current session to get a general sense of student attitudes regarding the role of this course in their program as well as generate some discussion points for future faculty interviews and ideas for areas in which to target future assessment and course materials.

2. Met with Philip Loewen (Apr. 8), an instructor of Math 220 during two summer terms. He described his experience teaching the course in the condensed 6-week format. Briefly, he is of the opinion that some of this material is especially difficult for students to absorb and master in a short time span. I think this could be something to consider for study in the future: what concepts and methods in the course can be learned (and retained) more quickly than others and why? Is there something about the material or the student's background (beliefs and prior knowledge) that makes it especially hard to learn some things in this course? Another major point that arose from this meeting and also in others is that communication skills, oral, written and symbolic all play a key role in student success in this course, so this may be a good area in which to target some assessments, learning goals and course activities. Also, since this course is one of the first times students are asked to explicitly communicate math to others this is when many underlying misconceptions come to the surface, even though they may have been from much earlier in their education. This may make it particularly challenging to focus on the core concepts of the course.

3. Constructed an end-of-term survey to be administered to Math 220 students in the two sections currently in session.

4. Analyzed the registration data for the past 5 years in mathematics courses (summer 2006-present), to identify courses to be considered in the longitudinal analysis for retention of proof skills as well as to determine a list of instructors of follow-on courses that will be helpful to interview for input into learning goals. I found this quite challenging and time consuming due to the complexity of the registration data, but have now compiled a list of courses taken by students after passing Math 220, and I have determined the frequencies with which these courses are registered in by such students (that is, by students who have passed Math 220). I have appended a table to the end of this report showing all mathematics courses that have >50 registration records matching this criterion. In this I have marked the courses that I expect contain a large amount of proof with stars (*), and the remainder of the courses I think are much less proof-heavy (this assumption needs to be verified by talking to instructors of these courses). I have a few comments and observations based on this data:

(a) It looks like a good place to start with instructor interviews for subsequent courses are those that have instructed (or will instruct) Math 342, 312, 308, 309, 320, 322. Possibly in this order.

(b) These numbers are much lower than I expected. In particular, it seems Math 220 students take very few pure math courses. This dataset contains 2-3 full cohorts of Math 220 students, which means even the most populated pure math courses only contain ~60 students a year that come from the Math 220 stream, and many that we plan to study (ex. Math 320) are much lower. Is this something I should be concerned about in terms of assessment? Are there particular things I should be aware of, or cautious about for small samples?

(c) With regard to the Math 320 stream, this course is the gateway to a whole range of analysis-based courses (maybe a dozen or so). Analysis is the base content for Math 220, but very few students actually continue on to take analysis later, likely because the 80% grade prerequisite required for Math 320 is tough, but it may also be interesting to substantiate this hypothesis by studying what courses are taken by students who do exceed 80% in Math 220.

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.
New Methods/Materials: An end-of-term survey has been prepared.

Plan for immediate future work

MATH 220:

1. Conduct interviews with the two faculty members currently teaching Math 220.
2. Make a more detailed timeline for materials and assessments planned in the next year for Math 220, as well as any work to be done in follow-on courses.
3. Administer the end-of-term survey, analyze and summarize the results.
4. Verify by discussion with past instructors of these courses whether the identified 3rd year courses above are in fact those that involve substantial use of mathematical proof.
5. Interview previous instructors of 3rd year proof courses identified above to get their opinions on student difficulties and desired learning goals for Math 220.
6. Continue literature search and reading on proof skills and assessment of proof skills.

Appendix: Registration Data for Courses Taken After Successful Completion of Math 220
extracted from registration records between Summer 2006 – Winter Term 2, 2009

Course	Frequency (number of registrations)	Frequency (% of total)
Math 307 Applied Linear Algebra	217	10.18
Math 340 Intro. to Linear Programming	213	10.00
Math 317 Calculus IV	168	7.88
Math 316 Elementary Differential Equations II	166	7.79
*Math 342 Algebra, Coding Theory and Cryptography	164	7.70
*Math 312 Intro. to Number Theory	163	7.65
Math 300 Intro. to Complex Variables	162	7.60
Math 303 Intro. to Stochastic Processes	154	7.23
Math 302 Intro. to Probability	146	6.85

Course	Frequency (number of registrations)	Frequency (% of total)
*Math 308 Euclidean Geometry	107	5.02
Math 215 Elementary Differential Equations I	90	4.22
Math 210 Intro. to Mathematical Computing	81	3.80
*Math 309 Topics in Geometry	73	3.43
*Math 320 Real Variables I	64	3.00
*Math 322 Intro. to Algebra	61	2.86
Math 221 Matrix Algebra	51	2.39
Math 301 Applied Analysis	51	2.39