STLF Report to CWSEI and Mathematics Department

STLF: Katya Yurasovskaya

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Specific activities performed by STLF

1) Professional development

- Attended **weekly STLF meetings** (March 21, 28, April 4, 11).
- Attended **weekly Reading Group meetings** (March 22, 29, Apr 5).
- Attended **NOJO meetings** (March 16, 23, 30)
- Attended **Science Supper Series** (March 29)

2) Department meetings/activity

- Conducted a Mathematics Education seminar, reviewing Moris Kline’s paper ‘Logic versus Pedagogy’
- Attended departmental Mathematics Education seminar - ‘Interacting with students’; March 29th
- April 4th: conducted two elementary school workshops as part of PIMS outreach.

3) MATH SEI general meetings/activity

- Meeting with other Math STLFs (March 28, April 5)
- Held individual meetings with Math STLF director (April 3rd?)

4) Course-specific meetings/activities

**Math 230/335 – Finite mathematics course (Math for future elementary school teachers)**

- **Literature review:** I have come across two new books that could be used in the Math 230/335 course:
  - *Elementary Mathematics for Teachers*, by Thomas Parker and Scott Baldridge. I would like to thank Dr Melania Alvarez, PIMS BC Education coordinator, for pointing out this book and the Singapore math textbooks. The book is not too large, it is entirely dedicated to the content the teachers will need to teach - and it is designed to prepare teachers to work with a set of elementary school books from Singapore - the so-called ‘Singapore math’. The textbook can be purchased with the textbooks for elementary ed math, and along with teacher manuals. ‘Singapore math’ textbooks are of careful mathematical exposition, and there has been a great interest in them among educators in the US and Canada. In particular, they have been mentioned during my meeting with Cynthia Nicol at the UBC Department of Education. If the communication between Department of Mathematics and Department of Education is re-established, this textbook could certainly come up in discussion.
  - *A Moscow Math Circle, Week-by-week Problem Sets.* by Sergei Dorichenko. This publication is by MSRI Mathematical Circles Library. The book is a collection of problem sets for Russian-style math circles that have been gaining popularity in the US
and Canada - hence a series of MSRI publications and a promotion of Math circles by universities (including UBC Math Department). This book can be used to supplement the above - or any - textbook with lovely problems, and provide future teachers with examples of material that can inspire students to mathematics.

• Diagnostic end-of-term test was given to students - the summary of results will be available by the CWSEI end-of-year event. So far results are not too promising, for example:
  • out of 38 people writing the test, only 16 knew how to divide fractions: $1 \frac{3}{4} : \frac{1}{2}$. Out of those 16, only two people simplified division along the way.
  
  • Given a question: $0.2 *0.3=0.6$ - True or False? - only 14 people answered False. Some of them may have selected ‘False’ for wrong reasons - I am at present looking at a work of a student who cross-multiplies when multiplying fractions. Thus $2/10 * 3/10$ becomes $20/30$. However, at least the thought pattern that $0.2$ is in fact $2/10$ is already a progress.
  
  • How Confident are you teaching mathematics to elementary school students after taking Math 335?
    Confidence level, rated on a scale of 5 is 3.485, with stdev=0.83 - with 5 being ‘very confident’, 4 - confident, 3 - adequate, 2 - uncomfortable, 1 - very uncomfortable. Only 3 people selected ‘uncomfortable’ - the rest of the scores were in the 3-5 range. Notably, the above student lists the comfort level as ‘confident’.
  
• Interviews with students are now finished. One of the main concerns - and that is voiced on the surveys as well - is that the students are not presented with mathematics that would be relevant in their future teaching of the students. At present, following the departmental policy, the course is taught as a general introduction to mathematics, rather than a course for future teachers. Some of the topics covered are relevant to the future teachers - such as the structure of numbers, a bit of statistics, some geometry.

• Students took diagnostic test during the last workshop. The format was as follows: write the test individually for 20 minutes, then turn the individual part in and work in groups of 3 or 4 on the non-computational part of the test - for 10 minutes. For the remaining 20 minutes followed discussion of solutions, with students presenting on the board, discussion among students, and my explaining some of the answers. We also covered (which means - I showed them) the explanation behind addition algorithm, and the reason why we “flip and multiply” why dividing fractions.

  Note: I told students after the individual part of the diagnostic, that an answer to a question was ‘No’.(Discuss a child’s conjecture that as perimeter of rectangle increases, the area also increases. The conjecture is false.)The students then worked in groups, knowing the correct answer. I have not yet graded the group part of the work - however, by glancing through the work it seems that knowing correct answer did not help the situation. Students circled the answer ‘No’ - but did not give a correct rationale for the solution. Let us hope that students will at least walk away thinking and looking for the correct rationale.

• Positive result: we have not yet discussed the results of the test with the course instructor. However, he shows great concern and interest in the results, and has said that he would modify the course curriculum next time he teaches it, so as to take into account the gaps in student knowledge that must be at least partly remedied before the future teachers face their own classroom.

Math 220 – Introduction to proof
The following is the summary of interactive engagement activities that have been implemented and tried in Math 220:

- **Bi-weekly workshops ended**: we had 6 workshops in total. Following midterm survey, student response was positive. End-of-term survey responses need to be tallied up yet - but response seemed largely positive as well.

- **The main question that should now be looked at in context of workshops** is how to make students have as much benefit as possible from solving workshop problems - mainly in terms of targeted and correct feedback. There is a time constraint in the course, so some of the activities will be moved to out-of-class time.

  **Potential activities would be**:

  - a peer proof review according to a rubric - by analogy with a writing class.
  - students should write up the solutions to the problems they worked out in the workshops. Perhaps, other students can grade/review them?
  - Students should speak through their proofs and present them. Unless a person verbalizes an idea, the knowledge is not yet in its structured form. Again, the time constraint is an issue. Students do speak to each other in groups during the workshops - so that helps some, but still their ‘math speak’ is rather jumbled.

- **Group quiz was now given 3 times**, and we have 5 sets of them - from the two sections together. Analysis remains to be finished on the last set of quiz. The activity fits workshops environment very naturally, students response from midterm survey - after only one quiz - were either positive or neutral. The average mark for group part increases, as expected.

  One benefit of the group quiz is that it helps identify weak groups. The class average of individual members is often not indicative of the group performance - individual members may perform quite well on midterms as a concentrated effort, but their in-class performance may not be up to par. There were 3-4 weak groups in the main class - that means 12-15 students, who were not benefiting from the workshop fully. In the 50-people workshop they can hardly be identified by instructor.

- **Final exam review workshop** was given on Tuesday, April 11 - again in workshop form. 49 people and stayed working on problems for all the two hours.

  The setting was as in any workshop, with students working independently, and the instructor and myself circulating and answering questions. 18 students were from the second (not instructor’s in charge) section. Problems were taken from Fall and Spring 2011 final exams for Math 220. Solutions to the problems were available online - courtesy of graduate students of the Math Department.

  This was the most exciting office hour I have seen yet. The large number of students present was surprising to both instructor and myself. We collected attendance - so we can see what, if anything, can be said about students’ grades in the end.

- Following the review workshop, additional questions from the workshops pool were made available to students. No solutions were posted.
• End-of-term diagnostic was given, for a small homework credit. Data has not yet been entered. It is interesting to see if there is any shift in diagnostic mark due to workshops.

• End-of-term survey was given along with the diagnostic. All of the surveys given this term were not anonymous. Data has not been entered yet - both the survey and the test were returned by students on the last day of class.

EOT survey questions included study habits. Additional questions referred to students’ out-of-class mathematical activities, hobbies, and participation in competitions. Also, we collected data regarding student participation in Sci113 - Science Writing class. We’ll see what, if anything, can be said about students performance and proof writing skills, and pass that information to people working on Sci113.

• Students wrote Midterm 2 - however it was not possible to compare it to control Midterm 2 from 2010, since the level of difficulty was not comparable question to question. However, Andrew Rechnitzer - instructor-in-charge - gave a very sound suggestion: if the average on the harder question now is comparable to the average on easier question in 2010, then this would indicate a positive gain as well. I will look at data in this light as well - that increases the range of questions we can look at.

• Students are writing the final exam on Thursday, April 12. Instructor-in-charge and I have discussed the final exam structure, so that a set of questions from this year can be easily compared to a set of questions from Fall 2010. Results of the final exam should be available by next Tuesday, April 17th. Preliminary results will be shown at the CWSEI end-of-year event.

Current Project Status (material prepared STLF and/or other members of MATH SEI group)

Math 220 – Introduction to proof
Learning Goals: no new additions.
Assessments:
• none

New Methods/Materials:
• Final Exam review workshop has been successfully tried.

Math 230/335 – Finite Mathematics
Learning Goals: none.
Assessments:
• Two questions were added to the diagnostic test - based on recommendations of Dr Rina Zazkis, Faculty of Education and Department of Mathematics, SFU. The questions are to test
understanding of basic concepts: if a student understands a given concept, then the answer is straightforward, otherwise the answer is difficult to compute - with or without calculator.

New Methods/Materials:

• After looking at student performance on the group part of the diagnostic test, make recommendation to use group quizzes in workshop settings in Math 335.

Plan for immediate future work

Math 220 – Introduction to Proof

1 Summarize end-of-term survey.
2 Enter diagnostic post-test, compare performance pre and post.
3 Group quiz: finish data analysis, write recommendations for departmental use - advantages and disadvantages of the method, student reactions, potential pitfalls, etc.
4 Compare final exam performance on workshop-covered material - 2010 vs 2012. Additional analysis could be done on Spring 2012 vs Fall 2011 finals: the material covered in both courses, is similar - there was no analysis component done last semester.
5 Meet with the two instructors and put together a final document with observations, findings, recommendations, etc - to pass down to the next instructor.

Math 230 / Math 335 – Finite Mathematics

1 Summarize Diagnostic results.
2 Compose a summary document with the present course instructor, to keep track of useful finding, observations, and recommendations for future use on the course.