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A pedagogical reflection

Students and their instructor co-developing the final exam

(…… and hopefully other strategies ☺ elementary friendly and appreciated ☺)

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I will share my strategy of co-developing final exams with my students and some of the data I have collected that examines the effects of such a process. I have had students create final exams with me several times in a high school upgrading course. This course has an average enrollment of 30 students. The course covers a grade 11 provincial mathematics curriculum and is offered at a local college. The course covers linear and nonlinear systems, polynomial and other nonlinear equations and functions, circles and coordinate geometry. It is expected that students enrolled in this course write a traditional final exam worth 30% of their final grade. Upgrading courses are intended to prepare students for college programs.

The process of co-developing the final exam included students creating practice exams, providing solution keys to their created practice exams, and writing and providing feedback to the responses of their classmates practice exams. The final exams in these courses consisted of six long answer questions. To create the practice exams, students reformulated questions from class and crafted new questions. Students were instructed to create practice exams that they thought best represented the material that was covered in the course. They were guaranteed that the 'actual/live' exam would include questions from their practice exams. My role, as the instructor, in co-developing the final exam was to choose and modify the numbers within five questions from their practice exams and craft one additional question of my choosing. The final actual/live exam was written in a traditional setting, i.e., students wrote the exam individually with only a pen or pencil.

Silver (1994) defines problem posing to be "both the generation of new problems and the re-formulation of given problems" (p. 19) and claims that problem posing can be viewed as a feature of inquiry-oriented teaching. Thus, a classroom where students and their instructor share the responsibility of problem posing can be considered an inquiry oriented classroom.

Students often posed problems that involved inverse functions, finding intercepts of functions, finding solutions of systems of equations and determining if relations were functions. For instance, one group of students asked their classmates to derive the quadratic formula. Another group of students asked their classmates to find the inverse of a function. For example, students might have asked colleagues to find the inverse of $f(x)=1/x+3$. Students have often asked a question about finding the roots of polynomial equations. This will be the context in which the presentation of this vignette will take place. I will share the process that my students underwent to pose a problem about finding the roots of a polynomial equation. My students wanted to craft a polynomial in one variable with constant coefficients of degree three that had three integer roots. A narrative, based on classroom video data, will be shared to provide evidence that my students' understanding grew to a more generalised understanding during this process.

During the student interviews following the process, students had very positive things to say about their experiences but expressed their initial anxiety towards a process that was new to them. They talked about how they loved co-developing the final exam and how it was an interactive way to review the material. It is interesting to note that students also spoke about concept retention. I will share student quotes during the presentation.

Although the data shared here is in context of high school curricula, I believe the strategy of co-creating tests can be used in elementary grades. There has been research about mathematical problem posing and middle school students (for example see English, 1997; Lowrie, 1999). I would love for elementary teachers to join us and share their expertise.

My colleagues and I have also recasted other traditional practices to fit within inquiry based teaching and learning. If time permits, these strategies and some of my other research projects based in elementary schools will be shared. The vignette will be (hopefully) dependent on and infused by strategies shared by our group. I want to hear from you too! It is intended that you, the participant, will be inspired to share your experiences of recasting traditional mathematics teaching strategies to fit within current mathematics school curricula. I hope that you will share and think of other strategies that can provide students with practice and fit within inquiry-oriented learning and teaching. We may decide to co-develop a more detailed document to post on the CMEF website, after our time together.

English, L. (1997). Promoting a problem-posing classroom. *Teaching Children Mathematics*, *4*(3), 172-179.

Lowrie, T. (1999). Free problem posing: Year 3/4 students constructing problems for friends to solve. In J. Truran & K. Truran (Eds.), *Making a difference* (pp. 328-335). Panorama, Australia: Mathematics Education Research Group of Australasia.

Silver, E. (1994). On mathematical problem posing. *For the Learning of Mathematics, 14*(1), 19-28.