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Math 204 Mathematics for Teachers: Mathematical Immersion

This Spring 2009 semester I happen to be teaching a 3 credit hour UMKC class (which we are offering for the first time) titled as above, which I have envisioned in two parts, an "immersion" in the doing of mathematics (a vital, personal experience I think every teacher should have at least once), and an "immersion" in the culture of mathematics (how we see and enjoy the profession, how it sees itself, its history, and so on.)

The course is designed for middle school mathematics teacher majors, so the mathematical background is mostly at the College Algebra level to at most the Calculus I level. I have 8 students enrolled. Since this course is part of the curriculum for a UMKC program called the Institute for Urban Education (3 of my current students are in the IUE), and is recommended for all such UMKC School of Education students, I expect to offer this course every Spring from now on.

For the "mathematics" part of the course I am using the Journal of Inquiry-Based Learning in Mathematics course "Graphs and Optimization" by David M. Clark from their web site: http://www.jiblm.org/jiblm/ . I make copies for the students, a few pages at a time, so it does not cost them. This is my first attempt at an inquiry-based course. I am more or less following David's prescription for the course, and have been in email contact with him regularly.

For the "mathematical culture" component of the course, I am using some readings from the book "The Mathematical Experience: Study Edition" by Davis and Hersh, which was the only text I had the students purchase. I also distribute various reading handouts of my own from an eclectic collection of sources. For all of these they write short 2-3 page responses, and must be prepared to discuss. In addition, I am having them attend this semester two 20 min expository mathematics talks by undergraduate students, and we will be visiting the rare book room of Linda Hall Library to see historical mathematics books. They will write responses for these experiences too.

So, the course is not simply about graphs, though that part of it is definitely inquiry-based. This is probably the first course I've taught in which I am sitting among the students and rarely go to the board. (OK, there are some times I just can't resist a teachable moment...) The students are really liking doing the mathematics themselves. I stress constantly the difference between conjecture and proof, and the importance of just boldly trying out their ideas whether or not they fail. They also appreciate the importance of the solution of such problems in practical matters.

Student Responses/Testimonials

About the Mathematics (Inquiry-base study of Graphs) Part of the Class:

- I think this class is great. I LOVE working on the graphs together in class. It's really fun to figure out the best paths and what works well and what doesn't. I'm not sure that what we are working on now is that fun though, just because the directions and everything doesn't seem that clear. Other than that, its new, fun, and challenging at the same time.

- I have really appreciated the graph section of the course because it deals with real-world problems such as finding the fastest route for a mail man. The graphs have challenged me at times to think in different ways than I normally do by following certain algorithms and by drawing several pictures. I'm glad that I will have all of my completed graphs in a binder to use as a great resource in the future.

- I really like the math that we get to do in this class! It is something I've never done before so it provides a good challenge. It is very enjoyable because we go through each problem as a class, which assures that we are all on the same page in our level of understanding. I also like that when we encounter something we don't understand, we all work through it together...there is a real sense of community between classmates.

- I feel that I have gained a greater understanding of the route utilized to solve graph theory problems, and have become more confident in my critical thinking and problem solving skills. Being a “non-math” person, I feel that this type of class is beneficial and necessary to every individual regardless of major. It teaches what true math is, and provides a broader understanding as well as great clarifications on the subject of math. We score amongst the lowest in the world in mathematics, and I feel if every person was required to take not just a math class that required them to memorize formulas and methods, but a class that encouraged critical thinking and problem solving we would fare far better not only on standardized tests but also in the world market and business world. I have been used to have concrete answers to each problem ,and working a systematic method to obtaining them, but with this class we often had to actually think about our method instead of blindly applying it in rote to every problem. The portfolio’s in my opinion are also a innovative method to compile and complete all of the information in the course, while having it organized for future reference.

- I have enjoyed learning about graph theory in a group setting. Being such a small class, I feel that I have gotten more out of it than if it were larger. Listening to my classmates questions and responses has given me more knowledge than any lecture could. The math is great too, though we've had some tough spots. It has been nice having a professor who has not taught the course before. I like discovering things at the same time as the professor. It makes one feel like they are in the class for a reason and are contributing to everyone's knowledge as well. Overall I am glad I am taking this class. It is unlike any other mathematics course I have ever taken, and I recommend all students going into mathematics take it.

- The course content of Math 204 is unlike any other class structure I have ever taken whether it be a math subject or something else. The interactive approach of learning is fabulous. It is important for every student to grasp all the ideas being presented in class. By taking turns doing problems at the board and having interactive class discussions, every student is guaranteed to come out of class understanding the material. The graphs are very interesting. They are applicable to real life situation that you wouldn't ever study in a typical tradional mathematics class. The content stretches your thought process to think more than the alegra and mathematical steps. It forces you to make conclusions and draw up theories to support your conclusions. It is very abstract and I love it. So many teachers just tell you the theorems or the equations and never tell you why or how. Math 204 allows me to come about reasons for why things are the way they are, and how things work. And by giving real life situations/problems, it makes the mathematics all the more important and fun to discover.