Innovative Math For Liberal Arts Majors

Nora Strasser, Ed.D., Friends University, USA

ABSTRACT

An innovative Math for Liberal Arts course was designed to provide liberal arts students with the life skills necessary to survive in the 21st century. The course emphasizes application driven mathematics. This course has been successful in changing students' perceptions of the usefulness of the course and improving student success rate as well as actively engaging them in the study of mathematics. Topics such as critical thinking, unit analysis, statistical reasoning, and managing money are included. Students spend time analyzing a budget as well as learning about the stock market and the mathematics associated with each. Students who took this course were far more likely than those who took the more traditional survey type of course to rate the course as being important. The course changes are delineated and the students' responses to those changes are described.

Keywords: mathematics; liberal arts; applications

INTRODUCTION

Most college graduates are required to have at least one mathematics course. This has always been particularly difficult for students majoring in fields totally unrelated to mathematics such as the liberal arts. One question that needs to be answered is how should mathematics be thought of by liberal arts students? This course should inspire students to think about mathematics as a field directly related to how humans think (Blumenthal, 2003, College Teaching, 39).

The problems with typical courses range from a lack of applications of mathematics in their field to boredom due to the student having taken more advanced mathematics in High School. The problems associated with teaching such a course include: bored students (those who are mathematically over-qualified), low mathematical ability, bad attendance, bad attitude (math is seen as unrelated to their field or life), and lack of student effort.

It has been suggested that liberal arts math courses should be designed to serve many purposes such as engaging students in positive experiences, increasing reasoning ability, strengthening math ability, and improving quantitative communication (Barker, 2004, Undergraduate Programs and Courses in the Mathematical Science: CUPM Curriculum Guide, 27 - 32). Our goal was to develop a course that also minimized the impact of the problems listed above. The course was designed to have the following goals:

- The mathematics would be totally different from that studied in High School.
- The mathematics would still be within reach of all the students' abilities.
- Attendance would be important since the material was unfamiliar.
- The mathematics would be totally application driven.

This course was piloted in the spring of 2009 and has been taught each semester since. Insights into how well the course is working will be shared as well as how the content of the course has been changed to reflect the new goals.

The number of topics covered and to what extend were also under debate. We wanted students to see that mathematics has influence everywhere (Banchoff, 2002, Journal of Education, 17 - 23). It was decided that student understanding was more important than the number of topics treated in the course. Therefore, topics were studied more in depth to promote deeper understanding (Barker, 2004, Undergraduate Programs and Courses in the

Mathematical Science: CUPM Curriculum Guide, 27 - 32). Finally, students having passed this course should be able to learn new mathematics, to reason mathematically, and communicate their results (Vandervelde, 2002, Journal of Education, 7 - 15).

ORIGINAL COURSE

The original course that had been taught was a traditional liberal arts course. It was a survey course where mathematical topics such as Algebra, Geometry, and Statistics were taught. Applications were studied, but they were simply used to demonstrate the mathematics. None were truly real life problems. The instructors reported that many students had more advanced courses in high school and as such were either bored or failed to attend class. For these students nothing new was being presented. It was just the same old tired math that they had been studying since grade school. These students could have taken more advanced math classes, but knew that this met their requirements so they chose the path of least resistance.

The instructors also had students in the class whose math ability was so low that they struggled with even the generally low level of competence needed to maintain a good grade in these classes. Trying to teach to the appropriate level was almost impossible. The class was made up of two distinct groups, those who were over-qualified mathematically and those who were under-qualified mathematically. Sometimes there was a small set of students at the appropriate level for the course, but this group was usually in the minority.

Finally the applications were seen as add- ons and not essential to the course. The applications were contrived at best and did not add to the students' enthusiasm for the course. The mathematics was motivating the applications not the other way around. Students were unable to see any use for what they were studying outside of class.

Instructors of the course reported low attendance rates with as little as 40% of the class attending on any given day. Most students felt they could pass the course without any effort by simply showing up for exams. Finally, students also felt that the course did not add anything to their educational experience and was not necessary for future success. The appreciation for the subject was lost and did not inspire students to learn more.

NEW COURSE

The new course was designed so that no matter what level the students were at mathematically, the topics would be new to them. The traditional topics of algebra, geometry, and statistics were not studied directly as is typical with most math for liberal arts classes. Instead the topics were selected by choosing practical applications and deciding what mathematics was required to solve the problems. The applications motivated the study of the various mathematics topics. The approach used was to choose a real life application, look at the problem thoroughly, and then decide what mathematics was needed to solve the problem. This approach is entirely different from what had been done in the past.

The students were unfamiliar with this type of course and even those with extensive math backgrounds had probably not studied these types of application problems before. Those students with less ability were not required to study topics that were more difficult than in the previous course. However, they were asked to use the mathematics in the context of a real life problem. Some of the problems studied included paying income taxes, budgeting, understanding the stock market, understanding statistics as seen in various forms of media, using geometry to decide on the amount of carpet to purchase, etc.

TOPICS COVERED

The topics for the course included many things that were previously studied in the traditional course. However, the topics were approached from a different perspective. These topics included: critical thinking and logic (students learned to analyze statements as to whether they represented truth or fallacy. They learned to create truth tables, draw Venn diagrams, and decide if an argument is valid.); unit analysis (students learned to use unit analysis to solve problems that apply to such life skills as currency conversion, weight and measurement conversion, and

temperature conversion. Basic problem solving of other types were also studied.); real world numbers (students learned about percentages, scientific notation, large numbers, and the consumer price index.); managing money (students learned to create a budget, prorate expenses, calculate interest, understand bonds, mortgages, income taxes, the stock market, and the deficit.); statistical reasoning (students learned to critically analyze data presented statistically, understand the margin of error, sampling, and understand and analyze graphs.); probability and statistics (students learned to find the mean, median, mode, standard deviation for a set of data, find the probability by various methods, and understand the meaning of these statistics.).Extensive time was spent on solving real world problems in this class. Real data was analyzed as much as possible. Many classroom activities were used.

One extensive activity that was used was to divide the students up into small groups. Each group was told that they had $6000 to invest in 6 stocks. They were also given the stock table from the current day's paper to make their choices. They were to determine the number of shares of each stock they wanted to purchase. We then followed the progress of the groups for one month. Each class period the group was asked to get together and calculate the profit or loss that they had since the last class and since the beginning of the project. At the end the data was compiled and analyzed by the class as a whole.

RESULTS

The new course succeeded in creating a culture where all students needed to attend class. It also succeeded in giving students a more equal footing in the classroom, students were not bored, and students found that they needed to be attentive. Students' grades were not significantly different from those grades received prior to the modification of the class. However, students seemed to respond well to the applications and most students recognized the value in the course.

Eighty percent of the students felt that the subject was significant and important. During the previous semester, only 68% of the students felt that the subject was significant and important. For the new course, 90% felt that the material was related to real life situations. Previously, only 41% felt that way. The new course was successful since the same percentage of the students was inspired to set and achieve goals that really challenged them as was true in previous classes. Most students also reported that they had developed a more positive attitude toward the subject because of this course. Previously this was only 18% and for the new course this increased to 60%.

Overall we consider the course change successful. Student attitudes seem better and the material is more challenging for students with extensive mathematics backgrounds. Also the attitude change is probably most significant. We are continuing to offer the course in this format and we will continue to evaluate the success of the course.

AUTHOR INFORMATION

Nora Strasser is a Professor of Mathematics at Friends University in Wichita, KS. She has been teaching mathematics at the college level for over 25 years. She has a Bachelors and a Masters in Mathematics from the University of South Dakota. She also has a Doctorate in Higher Education from Nova Southeastern University. Nora is a recipient of the W.A. Young award for Excellence in Teaching. Her research interests include innovative ways to teach undergraduate mathematics particularly through the use of effective technology.

REFERENCES

1. Banchoff, T. (2002) The Power of the Liberal Arts in the Mathematics Classroom. *Journal of Education*, 183(3), 17-23.
2. Barker, W., Bressoud, D., Epp, S., Ganter, S. Haver, B., Pollatsek, H. (2004) *Undergraduate Programs and Courses in the Mathematical Science: CUPM Curriculum Guide*. Mathematical Association of America.
3. Blumenthal, R. (2003) Mathematics: What Role in a Liberal Arts Curriculum? *College Teaching*, 51 (1), 39.
4. Vandervelde, S. (2002) Mathematics as a Liberal Art. *Journal of Education* 183(3), 7-15.

NOTES