A Two-staged Inquiry-based, Wiki-enhanced Problem Solving Class
Ken Levasseur
Mathematical Sciences

Mathematical Problem Solving
92.520 for M. S. Teaching Option
92.420 for undergrad. Math majors

UML Catalog: Focuses on mathematical resources, ability to use heuristics, the student's beliefs about the use of mathematics to solve problems, and the student's self-confidence as a problem solver. Effective strategies for incorporating problem solving in the curriculum will also be discussed.

Stage One: Classroom Work

The class met in three hour blocks, once a week. Much of the class time was devoted to developing solutions to problems in graph theory and reviewing solutions that were later posted on the class wiki.

The class (18 students – 8 teachers, 10 undergraduates) was divided into different groups of 2-3 students each class and spent some time discussing problems. Ideas for a solutions were developed and presented to the class as a whole. When the class agreed on a solution, a student (not necessarily from the solving group) was assigned the task of presenting the solution in polished form on the class wiki.

Stage Two: The Wiki

Solutions were to be posted before the next class, all students were encouraged to read the submission and comment on it. Once any issues with the solution were addressed and the consensus was that the solution was complete, it would be labeled as "done."

As instructor, I reserved the right to remove the "done" flag if I saw issues that needed to be addressed.

One recurrent theme of the discussions at this stage related to the differences between oral and written communication in mathematics.

The Problems

One reason why I chose graph theory for the course is that most students don't take a course in the subject, yet it is an area of mathematics with a "low threshold, high ceiling." This made it possible for students with varied backgrounds to all benefit from the problems.

We started from scratch, defining a graph and working from first principles. Except for a few supplemental problems, students were given the task of solving the sequence problems in Graph Theory, by Martin Lewinter. Journal of Undergraduate Mathematics, (http://www.jiblm.org/).

Stage One: Classroom Work

The class met in three hour blocks, once a week. Much of the class time was devoted to developing solutions to problems in graph theory and reviewing solutions that were later posted on the class wiki.

The class (18 students – 8 teachers, 10 undergraduates) was divided into different groups of 2-3 students each class and spent some time discussing problems. Ideas for a solutions were developed and presented to the class as a whole. When the class agreed on a solution, a student (not necessarily from the solving group) was assigned the task of presenting the solution in polished form on the class wiki.

Stage Two: The Wiki

Solutions were to be posted before the next class, all students were encouraged to read the submission and comment on it. Once any issues with the solution were addressed and the consensus was that the solution was complete, it would be labeled as "done."

As instructor, I reserved the right to remove the "done" flag if I saw issues that needed to be addressed.

One recurrent theme of the discussions at this stage related to the differences between oral and written communication in mathematics.

The Problems

One reason why I chose graph theory for the course is that most students don't take a course in the subject, yet it is an area of mathematics with a "low threshold, high ceiling." This made it possible for students with varied backgrounds to all benefit from the problems.

We started from scratch, defining a graph and working from first principles. Except for a few supplemental problems, students were given the task of solving the sequence problems in Graph Theory, by Martin Lewinter. Journal of Undergraduate Mathematics, (http://www.jiblm.org/).

End of Class Survey

References

Lewinter, Martin, Graph Theory, Journal of Undergraduate Mathematics, (http://www.jiblm.org/), property of the Math Department of Guilford College, and protected under copyright by Guilford.

Parker, John, R. L. Moore: Mathematician and Teacher, Mathematical Association of America, 2005.


Other Facets of the Course

• Common Core - Standards for Mathematical Practice – discussion of their relation to the course.
• Discussion of the PARC assessment
• Graph Coloring Book (from Spiked Math)
• Chromatic Polynomials
• Implementation of graph theory using Sage, the open-source computer algebra system.

Wiki Issues

Students were invited to join the course wiki after the first class. Most students had no experience with wikis, but the interface made it easy to enter textual solutions and some basic mathematical notation. There were a few issues that made the Wiki experience adequate but not quite perfect:
1. A few students knew LaTeX and encouraged them to use it, but its use in the wiki was restricted to display mode, which limited its usefulness.
2. Students found the discussions substandard but many students used it frequently.
3. Email on the wiki was internal, students had to think to go to it, and messages didn’t always get read in as timely a fashion as if they were forwarded to external mail.
4. To assess students, I would have been nice to have a way to collect more statistics on student activity in the editing process. The class was small enough that this wasn’t a significant issue.

Inquiry-Based Learning in Mathematics

Inquiry-based learning refers to any pedagogy that replaces traditional lectures and textbooks with some form of student-centered activities. Instructors typically supply students with carefully crafted course notes consisting of a sequence of definitions, problems or theorems. Instructors then serve as mentors, by listening to the students, reading their work, and giving them the minimal information they need to understand the defined concepts, solve the problems, or prove the theorems. – from the Journal of Inquiry Based Learning in Mathematics.

Implementation of graph theory using Sage, the open-source computer algebra system.

Stage Two: The Wiki

Solutions were to be posted before the next class, all students were encouraged to read the submission and comment on it. Once any issues with the solution were addressed and the consensus was that the solution was complete, it would be labeled as "done."

As instructor, I reserved the right to remove the "done" flag if I saw issues that needed to be addressed.

One recurrent theme of the discussions at this stage related to the differences between oral and written communication in mathematics.

The Problems

One reason why I chose graph theory for the course is that most students don't take a course in the subject, yet it is an area of mathematics with a "low threshold, high ceiling." This made it possible for students with varied backgrounds to all benefit from the problems.

We started from scratch, defining a graph and working from first principles. Except for a few supplemental problems, students were given the task of solving the sequence problems in Graph Theory, by Martin Lewinter. Journal of Undergraduate Mathematics, (http://www.jiblm.org/).