

## Happy Abstract Algebra Classes

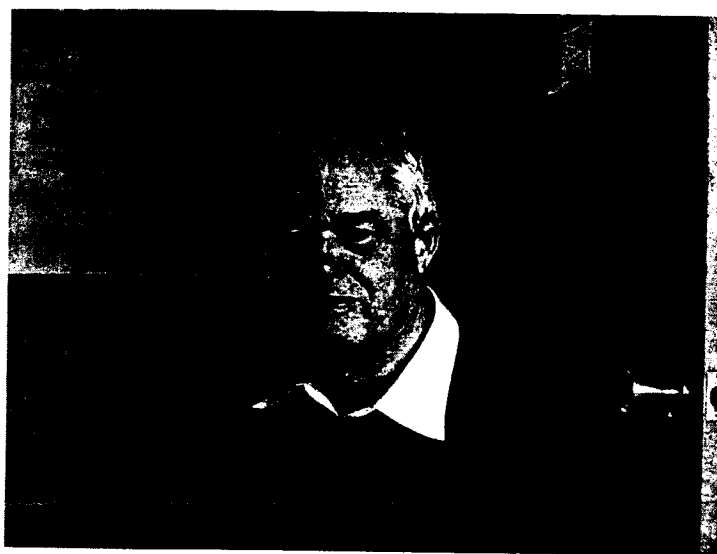
By John Fraleigh

Every teacher of abstract algebra from whom I have heard says that undergraduates find abstract algebra to be a difficult subject. At the University of Rhode Island, we have only a one-semester course that is not required for all math majors, probably because the majors found it difficult. When I started teaching it, I had the usual experience: the A and B students of calculus were dismayed with their first test grades in the 60's or 70's, and the C students didn't like their grades in the 40's. There were dropouts before the first test. Some students appeared sullen. One student accused me of doing nonstandard mathematics.

I am ashamed that it was not until about the last ten years of my teaching career that I solved this problem, had happy abstract algebra classes, and was a happy and relaxed instructor. My solution may horrify some, and there might be grumblings of relaxed standards and watered down courses, but they really weren't and it works. I am convinced that the happy students learned more than others did before and had a greater appreciation of the beauty of the subject, precisely because they were relaxed.

My course grades were based on daily homework (2/7), three hour-long tests (3/7) and a final exam (2/7). The daily homework handed in consisted of about three of the problems suggested for that lesson, marked with an asterisk on the syllabus. I was often asked about them in class before they were passed in, and I obliged, trying of course to get students in the class to give solutions. Furthermore, I told the students that this homework was part of their notes and that I had no objection to their correcting it in class before they passed it in. Consequently, everyone had a pretty good homework average.

A week or more before each test and the final exam, I handed out a preparation. The students were told that the definitions and proofs requested on this preparation would be exactly the same on the actual test, but that data and structures would be altered in other questions. Thus if a preparation question asked if two groups were isomorphic, and why, the student could expect different groups on



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the test. If the preparation asked for the irreducible polynomial over the rational field for some algebraic number, the number would be different on the test. Finally and most important, each preparation stated clearly that students could work together and get help from anyone (student, graduate student, faculty) other than their instructor in working the preparation. I also told them in class that they should write it all out once with no notes, timing themselves so they could be sure that they could do it with no notes in the available 50 minutes (3 hours for the final).

Here is what happened. I was able to give tests that would have been unreasonable to expect students to do without the preparation and in the time allowed. Even so, most students finished the 50-minute tests in 40 minutes or less, and the final exam in less than 2 hours. The A students of calculus had semester grades in the

90's, the B's in the 80's, and so on. The number of students electing the class more than doubled. There were hardly any drops before Test 1. As I indicated above, the class was happy and relaxed, and so was I. In addition to a better knowledge and appreciation of the subject, some students also learned a very practical lesson. If you need help with some problem, be sure you ask a competent person, and even then, do your best to check that the information is valid.

This method might not be suitable for honor students at schools like Harvard, although the occasional student of that calibre that I had never seemed to feel insulted.

Anyone who wishes to see my syllabus, the preparation final exam and the actual final exam for Spring 2000 can find them at <http://www.math.uri.edu/~fraleigh>. ■

*John Fraleigh received his MA in mathematics from Princeton University in 1956. He taught at Dartmouth College until 1962 when he joined the mathematics department at the University of Rhode Island. He was happily enjoying his December, 2000 retirement until Addison-Wesley pushed for a 7th edition of his text, A First Course in Abstract Algebra, first published in 1967.*

### How do you teach Abstract Algebra?

FOCUS would be interested in hearing comments on this article and other innovative teaching ideas and stories about the teaching of Abstract Algebra at the undergraduate level. We'll run a report on what our readers have come up with in a couple of months. Send your comments to [fqgouvea@colby.edu](mailto:fqgouvea@colby.edu).