

## **Faculty interview assessment of student group work**

Frank Quinn, August 2000

This memo concerns the use of interviews to assess work assigned to groups of students. While there are benefits, current practice is not cost-effective for either faculty or students. Ways to remedy this are discussed.

### **History and practice.**

For the past six semesters Vector Calculus (1224) has had an out-of-class group work component. After each assignment faculty members interview the groups to ensure that all members understand the material.

- No written work is collected, but the groups are expected to have clear printouts and notes for use in the interview.
- If a group's interview is not satisfactory then they are asked to redo the work and repeat the interview.
- Interviews are “pass/fail”, requiring satisfactory completion of roughly 70% of the material.

This is a 2-credit 1-semester course, so ordinarily would meet for 100 minutes a week for 14 weeks. To compensate for group work, classes were reduced to 60 minutes/week. Group assignments consisted of 10 Mathematica-based labs. Some material was covered only in the labs. Significant problems were encountered in the first semester.

- Most difficulties with labs were identified (often incorrectly) as problems with Mathematica.
- There were serious problems scheduling interviews.
- Testing showed students tended not to learn material covered only in labs.

The labs were revised and help facilities improved for the second semester. Genuine Mathematica problems declined significantly. Scheduling problems were addressed by using more personnel. In the second year lecture time was expanded to 90 minutes/week so all material could be covered in class. Grade value of group work was reduced to 10% of the course. In the third year labs were revised again so they could be worked by hand, and used Matlab as the preferred computational environment.

### **Benefits**

- Nearly every student enjoyed group work. This is an experience than can be offered only at a physical University.
- The interview process was reasonably effective at getting the group to work together, and ensuring all members understood the material. So far we have not found any other way to do this.

- When they did work together, students found groups helpful as learning environments. The few students working through the labs alone seemed to be at a considerable disadvantage.
- Students appreciated the individual attention of the interview process.

### **Drawbacks**

Most of the drawbacks boil down to “too expensive” or “not cost-effective” in terms of faculty and student time.

#### *Student problems:*

- It takes far more time than justified by 10% of a 2-credit course. Increasingly we see students “blowing off” the last few labs and the harder problems on individual labs. They aim for the bare minimum needed to pass.
- Organizing group meetings can be difficult. Meeting twice, once to do the lab and then again for the interview, is too much for some groups. Instead they meet just before the interview and try to get it done before their scheduled time. This is often unsuccessful, partly because the labs vary considerably in difficulty.
- There is not enough repetition in the labs to drive home a new idea.
- There is not enough qualified help available when they get stuck. Some help is available in the Emporium, but to be effective further training and faculty backup is needed.

#### *Faculty problems:*

- It takes far more time than justified by 10% of a 2-credit course. Further, interviews are scheduled at the students' convenience (in the evening) and this can be disruptive to faculty family life.
- Teachers are increasingly reluctant to accept assignment to this course. Unfortunately this is not always recognized as a symptom of a genuine problem, because most of these teachers are instructors or graduate students.
- Interviewers are reluctant to fail groups because they are unsure exactly what their classroom teacher's expectations are, or are unsure where the pass/fail boundary should be. This is particularly a problem when the students are aiming for the minimum to get by. Interviews sometimes turn into tutoring sessions which go over time and mess up the schedule.

#### *Technical problems:*

- Groups are supposed to come to interviews with clear enough notes to enable quick diagnosis of problems. Examples, more explicit standards, and more carefully designed labs are needed to achieve this.
- Many texts are not well-adapted to independent work or computing. Tying assignments too closely to such texts can make group work and interviews harder.
- Problems with hand work and Matlab programs are difficult to diagnose. Curiously, the interpreted and single-line execution structure of Mathematica often produces an easily-diagnosed transcript.

- Feedback procedures are needed to identify and correct difficulties with assignments and reference materials.

### **Time budgets**

Personnel resources provided by the University for teaching 1224 work out to about 2.5 faculty hours/student each semester. This is supposed to cover everything: preparation, lecturing, testing, grading, office hours, and interviewing if that is part of the course.

Suppose 20 minutes of faculty time is allocated for each interview. This might be achieved if actual seat time were rigorously restricted to 10 minutes. However students do not reliably show up at the scheduled times, and actual demand for interviews fluctuates somewhat randomly. To avoid congestion and complaints at busy times and to compensate for additional travel time to evening interviews, it would be better to budget 25 minutes per interview.

20 minutes per interview, times 10 interviews per semester, divided by 3 students per group gives an expenditure of 67 minutes/student on interviews. This is 45% of the total faculty time budget for the course. Allocating 25 minutes per interview brings the expenditure to 83 minutes/student, or 55% of the total budget.

Students have implicit time budgets. The average time spent on schoolwork (including attending lectures) seems to be around 2 hours/week per semester hour. For a 2-credit course they expect to spend around 4 hours/week. A short lab and interview rarely takes less than 2 hours. A long lab, or getting stuck and not getting prompt help, or failing the first interview and having to rework material can easily stretch the time out to 4 hours. Group work and interviews thus consume 50-100% of the time students expect to spend on the course.

### **Conclusions**

Group work assessed by interviews is one of the many attractive techniques that fail if done half-heartedly. The current practice is such a failure, and should be discontinued. For the practice to make sense we would need:

- The labs should have a very significant instructional function, giving primary coverage of on the order of 50% of the course material.
- There should be sufficient repetition to fix ideas, and provide a payoff for effective understanding.
- Essentially perfect work should be required. (Note they can get help and several tries with hints if they need them. Requiring only 70% lets them get by with working examples and blowing off the conceptual material. This should be thought of as a lecture substitute, not a test or homework. We expect lectures to be complete, even if we accept less on tests and homework.)
- Tutoring and effective help should be available.
- Lectures should be reduced by at least 50%.
- Faculty time overhead associated with the course should be reduced in other ways, for instance by doing all testing by computer. Lectures consume only about 20% of the time budget, so a 50% reduction in lectures does not compensate for interview costs.

- Labs must be designed so students can document their work with clear, easily diagnosed notes or transcripts.

We expand on the last item. Interviewers have 10 minutes to determine if the group actually did the work, and if all members understand how it was done. It is not possible to do this from an inscrutable mess followed by the right answer. It is also not possible to diagnose the mistake in an inscrutable mess followed by the wrong answer. But in order to require clear notes and transcripts it must be simple and routine for the students to produce them. This requires very careful design of the labs, with effective organizational clues.

Routinely achievable clarity in this course may require Mathematica. Many problems require extensive computation. Hand work cannot be checked in the time available, nor can we expect them to repeat it sufficiently many times to fix ideas. Further, working these problems by hand focuses attention on strategy and tricks rather than concepts. Matlab also has serious drawbacks. The compile-and-execute design produces complete programs that hide the development process. In the time available it is difficult or impossible to be sure that the final program was not simply copied, or to analyze it sufficiently to quiz the group on the development process.

Finally, notations and concepts that promote clarity must be used, even if they are not completely consistent with the text. For example a vector-valued function should be thought of, and manipulated, as a single function rather than a collection of real-valued functions.