

Activities for the First Week or Two of an Introductory Algebra-based Physics Laboratory

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Abstract:

We have revised these activities to include physical demonstration of various mathematical relationships and physical principals. For example, using only a sheet of graph paper students experimentally determine the sine or cosine of an angle drawn on a clear transparency. Some activities are similar to Piaget-type tasks, and involve simple proportions and the demonstration of a conservation principle. Other activities involve percentages and rates. The activities are presented as problems which groups of students are to solve. Further information will be available at <http://www.public.iastate.edu/~fcp/>

Outline:

- * Our setting
- * A Diagnostic Math Exam
- * A group activity entitled, "Some Fundamentals of Math and Science"

Our Setting:

- * A two-semester, algebra-based physics sequence
- * A two-hour lab each week
- * The laboratories are staffed heavily by international TA's who frequently have some language difficulties. This often is their first teaching assignment.
- * Typical annual enrollment in the first semester of the sequence is 700.

Previous early-semester activities:

- * A diagnostic math exam
- * A "Math Review":
 - Traditional mathematics problems, done individually by students, with help from the instructor if desired.

- Classroom is relatively quiet during the "Math Review"; certainly seems like an uninspiring activity.
- The existing "Math Review" duplicated some of the activities associated with the Diagnostic Math Exam.

What we have done

- * We have replaced the "Math Review" with a group-centered activity which we call, "**Some Fundamentals of Math and Science**".

The Diagnostic Math Exam

- * Using the ideas and materials of Tom Hudson, for over ten years we have administered a diagnostic math exam to at the beginning of the first course in this sequence. (H.T. Hudson, AAPT Announcer, p. 54, Vol 17, No. 2 (1987); Tom currently is at the University of the Incarnate Word, San Antonio, Texas, hhudson@universe.uiwtx.edu) The test contains two questions for each of 19 math topics. Each student receives an individualized report of their performance on the test. This report gives to the student a personal set of assignments which addresses only those topics for which the student missed one or both of the questions on the test. The students complete these assignments during the first few weeks of the course.
- * Students who score low on this test receive general advice about the implications of such low scores. In particular, low scoring students are advised to consider dropping the course and enrolling in an appropriate preparatory mathematics course.

"Some Fundamentals of Math and Science", our new group-centered activity

- * **Goals of this activity:**
 - **Correlate contents with those in the Diagnostic Math exam.** In particular, eliminate overlap with, and address some topics not addressed by the Diagnostic Math exam and its follow-up activities.
 - **Try some cooperative learning in our laboratories.** Progress has been reported by others (such as Pat and Ken Heller at the University of Minnesota) of learning gains achieved by revising the structure and content of their large enrollment laboratories. We wanted very much to see if some of their methods and those of others can do similar good things for our students. We based the design of our group structures on the Heller's work ([http://www.physics.umn.edu/groups/phised/.](http://www.physics.umn.edu/groups/phised/))
 - **Evaluate what the students learn in this activity.** A key feature of the work of leaders in the development of modern physics instructional materials, such as that of Lillian McDermott and her colleagues at the University of Washington, is that of measurement of the students learning and revision of the instructional materials in response to the results of those measurements.
 - Incorporate some **measurements and hands-on activities related to mathematics.**
 - **Create a miracle**, i.e., design an activity that results in a spirit of excitement, interest and engagement in the classroom (i.e., replace the funereal ambiance associated with the Math Review).
- * **Teaching materials always seem to be a work in-progress!**
 - Attached is our current version of this activity, which we have used for about two years.
 - Attached also are some additional problems which we are not currently using.