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# Diagnostic Testing in Mathematics

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# Disciplines

## Diagnostic Testing in Mathematics

DAVID L. OUTCALT

High school graduates have been demonstrating less skills in mathematics at the same time that students entering colleges and universities need to have more of those skills to be able to succeed in an increasing variety of disciplines. One way to ease that problem is to develop criterion-referenced diagnostic tests together with remediation keyed to the results of such tests. Diagnostic tests of that type contrast with norm-referenced tests in that they provide a profile of strengths and weaknesses in each essential topic for every student. Such a profile has several important advantages. Students can receive advice in terms of their demonstrated competency in skills needed to succeed. Efficient remediation can be designed to fit the needs of each student. Instructors in subsequent courses can be provided information about the strengths and weaknesses of their entering students in a manner that helps them respond instructionally. High schools can be provided information about the performance of their graduates in a way that can help them strengthen their programs.

There are several pitfalls in developing such tests. There must be sufficient items on each topic that is to be separately scored to ensure reliability. There must be determination of mathematics topics needed for a certain goal as well as a specification of the level of mastery in each topic required to achieve that goal. In large testing situations there must be sophisticated data analysis capacity to provide rapid grading and reporting in profile form.

A major effort to develop such diagnostic tests for entering students planning to enter basic science and mathematics courses is underway in California. A Joint Mathematics Science Workshop

has been formed consisting of faculty in the University of California, the California State University and Colleges, the community colleges, and high schools. This group is in its third year of developing, pilot testing, evaluating, and revising diagnostic tests covering the essential topics in mathematics for students planning to take a course in calculus, chemistry, physics or, for students not ready for those courses, a course in precalculus mathematics. An initial test on precalculus mathematics was pilot-tested in Fall 1978 at several campuses. Detailed item analyses were prepared as were studies comparing the performance in calculus and precalculus courses with performance on the diagnostic test. Based upon the findings from those evaluations, the precalculus diagnostic test was revised and tests on the mathematics needed for beginning courses in chemistry and physics as well as intermediate algebra were developed. All four tests were piloted in Fall 1979.

This is an ambitious project which has met with considerable success in dealing with some of the inherent problems of diagnostic tests. In so doing, it has raised a number of research issues and a number of problems to be solved in implementing the tests. Remediation materials have yet to be developed. The format of the tests has been almost exclusively multiple choice while interactive computer versions are also being developed.

Further information about the project may be obtained from the author or from Professor Philip Curtis, who chairs the project. His address is Mathematics Department, University of California, Los Angeles, CA 90024. The group would appreciate information about similar projects elsewhere.