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**TECHNOLOGY AND LANGUAGE TESTING
APPLYING COMPUTERIZED ADAPTIVE
TESTING TO READING COMPREHENSION**

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DEMONSTRATION/POSTER SESSION

Session Title: Technology and language testing: Applying
Computerized Adaptive Testing to reading
comprehension

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TECHNOLOGY AND LANGUAGE TESTING: APPLYING COMPUTERIZED ADAPTIVE TESTING TO READING COMPREHENSION

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Problem

The availability of cheap but powerful microcomputers has made possible many computer applications to testing: access to large test item banks, effects of computer use on student motivation and computer administered tests. This paper focuses on the exciting application of computerized adaptive testing (CAT) to reading comprehension skills. CAT is a computer-assisted interactive process which facilitates the rapid, accurate measurement of the ability of the student. It began mainly in the U.S. through the exploration of large-scale testing by the military and is currently used in the universities as well as in national standardised testing.

The critical feature of the computerized assessment procedure is that the test items are presented in an interactive fashion, allowing the student and the computer to alternate in transmitting information. The advantages of CAT include flexibility in item selection and administration time, efficiency, greater test security, and enhanced clerical processing power. Compared with conventional testing, CAT allows greater scoring accuracy, shorter testing periods, quicker availability of results, and reduces guessing and other undesirable test behaviour. However, like most testing procedures, the quality of the test items and their psychometric attributes should be determined at the preparatory stage.

Establishing a CAT Project

To make use of this efficient innovative assessment system, a CAT project to assess reading comprehension skills was set up in the NIE Centre for Educational Research, Nanyang Technological University, in January 1994. The project aims to develop a CAT system for reading comprehension tests across four levels, Grades 3, 5, 7 and 9. It required the development of a bank of items, adaptive tests and on-line administration of the tests. There will be a flow chart to show the stages of each of the areas.

Development of an Item Bank

In the development of the item bank, the ability area (in this case, reading comprehension) is first selected. Factors to consider on reading comprehension items are dimensionality of the test, item types, and sampling of the content domain. Current research on the process of comprehension indicates both understanding of the content (the domain) as well as the language itself. The skills approach in reading comprehension shows five categories of sub-skills to be assessed: locating relevant information source(s), following the sequence of events/ideas, anticipating story development, reading to make inferences, and reading for main ideas.

The next stage in the development of the item bank is the writing of items. Items were written for the specified reading sub-skills for the four grade levels. The items were then field tested, i.e., administered to students in eight primary and eight secondary schools. Using the data from the field testing, the items were calibrated using item response models using the Rasch model (one model of Item Response Theory) in the program, QUEST. The QUEST program uses the joint or UCON maximum likelihood procedure to estimate both the item and person parameters with a correction factor for bias.

Development of the Adaptive Test

All items were be calibrated on the same scale, with the estimation of person ability being independent of the items selected. The adaptive test of items could now be assembled and developed using a software system, MICROCAT, from the Assessment Systems Corporation. MICROCAT was identified to develop the adaptive test and administer the test items on line. After the item bank of calibrated questions were entered into the MICROCAT system, the criteria of adapting the test procedure to the student and termination criteria had to be identified. There was a choice of different criteria: Bayesian adaptive test, maximum information adaptive test, minimum and maximum number of items to be administered and the variance termination criterion. Finally the test was created using the appropriate test template and compiled.

On-line Administration of Adaptive Test

The testing process begins with the student, seated at the

computer terminal, being presented with a test item and his responding to it (there will be another flow chart showing the steps of the on-line administration). After each response, an estimate of the student's ability is given and updated as the testing proceeds. The computer program then selects a test item, which is either easier or more difficult, depending on the student's estimated ability at that point.

The MICROCAT process selects the next test item out of a pool of available items, one that will minimize the standard error of estimate of the student's ability when it is administered. This tailoring process, with a minimum of test items, maximizes the information obtained about an individual's ability level. Essentially, the testing procedure "adapts" the test to the student on the basis of the response patterns by presenting items successively more appropriate to the individual's (estimated) ability level.

The last stage of the CAT project is the on-line administration of the adaptive tests for the four grade levels. The four CAT tests are ready and the Grade 7 and 9 tests will be demonstrated in this poster session. Two primary and two secondary schools are currently being selected for the on-line administration of the CAT tests. The results will be analyzed and reported to the schools. Any problems encountered in the administration will be handled accordingly and the system will be improved for future administration of the items.

In Singapore, computerized testing is still at an early experimental stage. This CAT project has been set up to make use of innovations made available in the United States to increase the efficiency and power of testing - it exploits the potential of recent developments in computer technology to improve the practice of testing in Singapore.