

# The Use of CADATS to Establish an Item Bank for Formative Assessment in Primary Schools

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This short article proposes the use of a computer assisted assessment system, the Computer Assisted Design, Analysis and Testing System (CADATS), developed at Durham University to establish an item bank system for conducting effective formative assessment by teachers in primary schools.

## Introduction

Tests are frequently used to assess students' learning progress, and feedback has become an important and integral part of almost all forms of educational assessment, particularly formative assessment. It has been recognised that feedback to students can act as an effective means for improving students' performance. Results from research have generally indicated that the use of effective feedback can improve students' learning outcomes substantially. Feedback generating process has to include the following fundamental elements for it to be effective:

- A recognised and measurable standard must be set in the assessment;
- There exists a means to identify students' performance in relation to the standard set in the assessment;
- There exists a way that applies the information obtained in order to narrow the gap between the student's performance and the standard set by the assessment.

The generation of feedback can therefore represent a demanding and complex task for teachers, since it is the teachers themselves that are responsible for developing tests; setting target standards; undertaking results

analysis and data interpretation; identifying gaps between students' performance and the target standard; and developing procedures to improve teaching and students' learning in areas where students are below the target standard. The complexity of the feedback generating process has hindered the use of effective feedback procedures in formative assessments as part of normal classroom practice. In view of the limited time available to teachers and the difficulties involved in producing feedback, a dedicated computer assisted system that can perform all or part of the work involved in the process of generating feedback would help teachers substantially in terms of saving their time and encouraging them to adopt effective feedback methods in teaching. Although the last element listed above is teacher-specific as different teachers may use different methods in dealing with the specific problems their students encounter, a computer assisted system can be developed to help teachers with the first two elements.

The computer assisted assessment (CAA) system CADATS (Computer Assisted Design, Analysis and Testing System) developed at Durham University which has been tried out in some schools in Hong Kong and in China would seem to fulfil the above requirements.

## The CADATS System

CADATS can perform a range of functions to generate information that can be used by teachers to provide effective feedback to students. Main functions provided by CADATS include:

- Creating items of various types and construct item banks.
- Designing tests (Classical Test Theory – CTT based or Item Response Theory – IRT based including Computer Adaptive Tests – CATs) effectively by selecting items from an item bank.
- Conducting tests (CTT and IRT-based tests, including CATs) on standalone or networked computers.
- Analyzing test results. The system is able to undertake detailed diagnostic analysis on the performance of students and test items at individual, class and whole year group levels in order to identify curriculum areas where students are under-performing.

- Analyzing the performance of test items using CTT and the Rasch IRT model, and equating tests.

## Building an Item Bank System Using CADATS in Primary Schools to Facilitate Effective Formative Assessment

Given the functions provided by CADATS, an item bank system can be built using CADATS to facilitate effective formative assessment by teachers in schools. This section explains how to build such a system.

Research has indicated that feedback in improving students' learning outcomes is most effective when it is task-oriented. Questions developed by experienced teaching professionals who understand the curricula very well have specific assessment objectives in measuring skills gained by students in specific curriculum areas and are particularly useful for goal-setting.

To make the system more effective and efficient, it would therefore be best if the system is built and used by a consortium of, say, 20 primary schools for all year groups in the schools. These schools will need to work together. The following activities will need to be taken:

### *Item and Test Development – Item Banking*

Participating schools will provide items to cover topics taught in their schools for the selected subject (such as mathematics, English or any other subject). Items should cover the full primary curriculum and developed by experienced teaching professionals. Items will need to be classified based on year groups and curriculum topic areas. These items will then be digitised for inclusion in the item bank built using CADATS.

Tests for different year groups will be designed using the items in the item bank for each academic year. In order to equate the tests for different year groups, common items will be embedded in tests for adjacent year groups.

The item bank and the associated tests can be shared by all schools in the consortium so that the schools can use the item bank in conjunction with other

functions provided by CADATS to enhance their teachers' teaching and students' learning experience.

### *Test Administration and Diagnostic Analysis*

Schools in the consortium will need to administer the tests included in the item bank to their students using the CADATS test delivery system. Teachers can use CADATS to conduct diagnostic analysis of the results from the tests in order to help them identify curriculum areas where individual students are having difficulties and to provide individualised help to the students.

### *Item and Test Analysis and Test Equating*

Responses from students from all schools in the consortium will be analysed together using the analysis functions of CADATS in order to derive item and test statistics (both CTT and IRT statistics, including for example item percentage score or facility and item difficulty) for the population. To place items for all year groups on the same difficulty scale, the test equating function of CADATS can be used to equate the different tests using the common item equating procedure. The statistics of the items can be loaded into the item bank.

### *Development of a Computer Adaptive Test*

It would be possible that after about three years, a reasonably large calibrated item bank can be created. Once a calibrated item bank has been established, a computer adaptive test for the subject covering all year groups can be created. Such a test would be particularly useful for monitoring students' study progress. Teachers can also use the items in the bank to design their own tests if they so wish.

### *Training for Teachers*

In order to help teacher to use CADATS to conduct formative assessment effectively and make it part of their normal classroom practice, training should be provided to teachers from schools in the consortium. Focus of training should be on how to use CADATS to undertake detailed diagnostic analysis for identifying problem areas in their teaching.

## Discussion

Benefits of using the system described above would include:

- The encouragement of the willingness in using formative assessment by teachers to enhance the teaching and learning process as part of their normal classroom practice.
- The establishment of a calibrated item bank (in which items have known statistics) to cover all year groups in primary schools for specific subjects. A number of CTT and IRT based tests can also be included in the item bank. Specifically, the items in the bank can have a common difficulty scale and a computer adaptive test can be created for adaptive testing across the year groups. The item bank can also be used in conjunction with CADATS to enhance teaching and learning with the aim to improve students' learning outcomes. Teachers can also create tests themselves by using the items in the bank. Because the item statistics (such as item percentage scores) for the population can be established through the use of the system, teachers can use the results from the test designed using the items in the bank to compare the performance of their students with the average (norm) performance of the population to identify areas where their students under-perform and therefore enhance teaching in those areas.

## Further Reading

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