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## **Pilot study on the impact of frequent computerized assessment on student work rates**

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# Pilot Study on the Impact of Frequent Computerized Assessment on Student Work Rates

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## Abstract

In 1997, Institute of Technology Sligo, decided to carry out a pilot study on the impact of frequent computer assisted assessment (CAA) on 1st year students' attitudes to their studies. This was carried out during the 98-99 academic year. The results of this work will be the basis on which a decision will be made on the full implementation of a CAA facility for continuous assessment at the Institute. The study was also used to identify the logistical problems involved in providing such a service to lecturers and to result in the drafting of 'best practice' recommendations. Apart from these objectives this was to be a high profile model within the Institute, which would generate demand from lecturers from other courses and so increase the rate of uptake of CAA for continuous assessment.

The aim, for each lecturer taking part, was to set a weekly short (2 - 5 minutes) multiple choice test in their subject using software from Question Mark Computing. Lecturers were given minimal training on the assessment software (2 hours) and were specifically informed that the purpose of the tests was to improve work rates and not to accurately measure knowledge.

The impact of the study was determined by the use of questionnaires on the perceived impact of the study (and on other relevant issues). The questionnaires indicated that there was a noticeable improvement in the work rates of students taking part. The study created enthusiasm for CAA among lecturers taking part and significant interest in CAA among other lecturers in the Institute. It was shown that this type of continuous assessment could be undertaken with modest demands on computing resources and minimal level of commitment from lecturers.

## Aims of the Study

This study was undertaken as a first step in the implementation of Computer Aided Assessment as a formal method of continuous assessment within the Institute of Technology, Sligo. The following reasons were identified for undertaking this first step:

1. To determine whether frequent (weekly) continuous assessment could make a perceptible difference to students' attitudes to working continuously throughout courses.
2. To demonstrate to lecturers (and to management) the benefits of computerized continuous assessment.
3. To determine the level of resources required for the implementation of a computerized continuous assessment facility.
4. To determine the level of commitment required from lecturers involved in computerized continuous assessment.
5. To make 'best practice' recommendations for the implementation of a computerized continuous assessment facility.

## Objectives

The following objectives were to be achieved in the pilot study:

1. Implement a simple CAA facility that requires a minimum level of support and intervention.
2. Train lecturers in the use of the system.
3. Carry out weekly assessments on all students for the first two thirds of an academic year.
4. Carry out a set of surveys to determine the outcomes in relation to the aims of the study.
5. Make recommendations with regard to the wider implementation of CAA within the Institute.

## Methodology

### **Selection of Student Groups**

The class groups selected for the pilot study were chosen on the basis of an informal survey of interest among lecturing staff. Although it was obvious that the groups of lecturers involved were not representative of all lecturers, it was felt that by selecting the most interested groups, the pilot study would be more likely to illustrate what could be achieved under ideal conditions. Three National Certificate (equivalent to HND in the UK) groups were selected, one from each of the three schools in the Institute: National Certificate in Engineering (Mechanical), National Certificate in Business Studies (General), National Certificate in Applied Science. The Applied Science group did not complete the study because of problems of availability of lecturers. The Mechanical Engineering class had around 40 students and 7 lecturers covering 8 subjects. All of these lecturers took part in the study. The Business Studies group had 14 lecturers of which 10 took part in the study.

## **Resources**

The following is a description of the resources that were available for the execution of this pilot study:

### **Implementation, Training, Management and Support**

The author was available for about 16 hours per week in the early parts of this study to set up the system, train the lecturers involved, manage the system on an ongoing basis and provide advice and support for lecturers using the system. This commitment gradually reduced to about 6 hours per week towards the end of the 20-week study.

A very high level of support was provided to the lecturers involved, as it was felt that this was necessary to demonstrate what could be achieved in the longer term when staff would become experienced in using the system. There was a small amount of technical support available from the Computer Services Department as required.

### **Computer Facilities**

Adjacent computer rooms containing 60 workstations were scheduled for the group of 120 Business Studies students for 90 minutes per week. Another computer room containing 25 workstations was made available for the group of 40 Mechanical Engineering students for 1 hour per week.

### **Supervision**

An experienced examination supervisor with some computer knowledge was supplied.

## **Technical Implementation**

### **Software Used**

Software from Question Mark Computing was used for this study for the following tasks: creation, scheduling and delivery of tests, as well as the export of results to a database. Microsoft Access was used for generating cross-tabulated views of reports which were then saved as Excel spreadsheets, a form that lecturers were most used to dealing with.

### **Network setup**

Question Designer was stored on the network where only lecturers had access to it. Sub-directories were created at this location where lecturers could publish their weekly tests for subsequent checking before publishing to shared student class directories where students could access the tests. Lecturers had full access privileges in the Question Designer directory and sub-directories.

Student test files were stored in shared student directories along with the delivery software. Test answer files were stored here also. Students had 'read', 'execute', 'create' and 'write' privileges here.

On completion of tests, answer files temporarily moved to the hard drive of a PC where the results database was updated. Test answer files were then

archived on a ZIP disk. A Microsoft Excel spreadsheet of the latest test results was generated from the results database and stored in the appropriate sub-directory of Question Designer on the Network where lecturers could access them.

## Training

Lecturers were given two hours initial training on how to create simple multiple-choice tests and how to store them in the appropriate directory for checking. This was generally adequate for those who were familiar with the use of PC based applications.

Lecturers were informed at this point that the purpose of the study was merely to see if frequent assessment effected students' attitudes to their work. The tests did not necessarily have to be an accurate measure of students' knowledge or understanding of course material. For that reason they were advised that they were only required to create a small number (about 4) of multiple choice questions each week that would merely test the students' knowledge in a relatively superficial way.

For the rest of the pilot study they had access to weekly workshops where they could work on more advanced skills, or review the initial training or just create their weekly tests with access to immediate help.

## Assessment Procedure

The procedure that was put in place for the delivery of assessments and subsequent feedback of results was as follows:

1. Lecturers were to create their weekly multiple choice tests and store them in a specified directory before a specified time each week.
2. All tests were to be checked for critical errors (e.g. saving answers to a file) and then published to the shared student directories.
3. Tests were to be scheduled for the correct period.
4. Students were to take all the weekly tests they were scheduled for at one sitting and sign an attendance sheet to verify that they were in fact present at the particular time. Classes were to be divided into sub-groups and taken at separate sittings of about 25 minutes.
5. Answer files were to be moved to the results database storage area, the database updated and the results files archived.
6. A Microsoft Excel spreadsheet of the week's results was to be generated and made available for lecturing staff.

## Surveys Undertaken

Several surveys were undertaken at the end of the study to determine the extent to which the aims of the study were achieved. The groups surveyed were as follows:

### **Students and Lecturers taking part in the Study**

A separate computer based survey was undertaken for each of these two groups, with a very high response rate. Most of the survey 'questions' were essentially statements, to which the respondent was required to indicate their level of agreement.

### **Lecturing staff who chose not to take part in the study.**

It was felt that the only way for frequent assessment to make an impact on student work rates was to include most, if not all, of the subjects being studied. Lecturers who chose not to take part in the study were given a short survey in order to determine the reasons why they chose not become involved and to determine the circumstances under which they would become involved.

### **Lecturing staff from other class groups not involved.**

The intention was that this study would be a model or demonstration project that would generate interest among lecturers not involved and generally increase the profile of Computer Aided Assessment in the Institute. A sample of staff were chosen at random and surveyed on their awareness of CAA and the pilot study, their impressions of and interest in CAA, and their interest in finding out about the results of the pilot study.

### **Test Supervisor and Pilot Study Manager**

The test supervisor answered a series of questions on the practicalities of administering and supervising computerized tests. Although not formally surveyed, the pilot study manager (this researcher) documented his views on all issues pertaining to the study.

## Results

### **Execution of the Procedure**

In general the execution of the procedure went according to plan. Problems were mostly logistical or related to hardware faults. There were relatively few software problems.

### **Problems and Solutions**

Although not all the problems listed below were unforeseen, all had to be dealt with on an *ad-hoc* basis.

### **Logistical**

Allowing up to 40 students into a computer room for a 20 minute sitting and signing them out caused some confusion and some supervision problems. Students had to be gradually allowed to enter the room and take their places in smaller numbers, which meant that two people were required in the room.

Students sitting next to each other, taking the same test was a problem early in the study. At first this was solved by the use of another adjacent computer room, and using every second machine. Eventually it was found that time pressure, shuffling questions and unsynchronized starting times, made it ineffective for students to look at other students' screens.

### **Hardware and Software**

Failure of individual computers was not uncommon and the computer network failed twice during the pilot study. Failure of the software was very rare. When hardware failures occurred the scheduling software would not record that a student had completed a test and so the student could try again on another machine. The same held true for network failures. On the two occasions that the network failed, students were able to take their tests in the subsequent week.

### **Security**

If tests were scheduled for a specific time, students were able to change the time and date on their PC and take the test at any time. The only way to counteract this was to create the test schedule just before the assessment session began and remove the tests immediately afterwards. It is possible to create a startup script (batch file) for the delivery software that will synchronize the student's computer clock with the network, however, the technical support staff were too busy to implement this.

It was not possible under the existing setup of the network to restrict student access to tests to specific rooms. It was therefore possible for students to take the tests in another room and then come to the specified room to sign the attendance sheet. No solution was found for this problem, however there was no evidence of such behaviour during the pilot study.

## **Analysis of Survey Results**

The surveys have been analysed by examining the aims of the study and looking at the questions that give some insight into whether these aims have been achieved or not.

Before using the results of the two main surveys, it is worth commenting on the scoring systems. These two surveys were analysed by awarding scores to each possible response (2 = strongly agree, 1 = agree, 0 = neither agree nor disagree, -1 = disagree, -2 strongly disagree) and then calculating an average score for each question. A table of questions including the percentages for each possible response and the resulting average score was considered to be the most concise way of publishing the results of this survey. For brevity and clarity, the results of only the most important questions are discussed in this paper, although all of the results are available at the pilot study web site ([http://www.itsligo.ie/staff/bmulligan/web/caa\\_pilot.htm](http://www.itsligo.ie/staff/bmulligan/web/caa_pilot.htm))

It also should be noted that in a survey where respondents have no reason to lie, a score of 1.0 would indicate general agreement by the respondents to the statement made. This is considered to be the case in the staff survey. However, in the case of the student survey, the respondents would have

many reasons not to be honest in their answers. This makes it difficult to draw any strong conclusions from such a survey and because of this the reader is advised to examine the data and draw his or her own conclusions. This fact has also led the author to the view that a lower positive score than 1.0 would indicate general agreement to a statement.

The student survey was completed by 117 of the 160 students that took part in the pilot study. The staff survey was completed by 15 of the 17 lecturers that took part.

### Increase in work rates of students

The surveys of staff and students involved in the study were used to achieve aim No. 1 : To determine whether frequent (weekly) continuous assessment could make a perceptible difference to students' attitudes to working continuously throughout courses.

The following tables list the relevant questions (question number and text of the statement) from the staff and student surveys along with the resulting scores:

<u>No.</u>	<u>Text</u>	<u>Score</u>
5	I feel that students studied more because of these tests!	1.1
6	I feel that students paid more attention in lectures because of these tests!	0.8
7	I feel that students attended more lectures because of these tests!	0.3
8	I feel that doing the weekly tests made it easier for students to learn the material!	0.7
9	Doing these tests has made the students better prepared for the summer exams!	0.7
10	I feel that student results have improved because of this type of testing!	0.6
11	I felt that students undergoing computerized continuous assessment asked more questions during lectures!	-0.1
12	I felt that students undergoing computerized assessment had a better attitude to their work than other students	0.6
13	I felt that students paid more attention to their work on weeks where they knew that they had a test!	0.7
41	I think that this form of assessment would be useful in creating the correct attitude to study within the first few weeks	1.3
42	I think that if regular, frequent assessment of students were a normal part of student courses it would change student attitudes	1.3

**Table 1: Results of staff survey relevant to Aim No. 1**

<b>No.</b>	<b>Text</b>	<b>Score</b>
21	I liked this form of assessment as it forced me to work harder during the year	0.3
22	I liked this form of assessment even though it did NOT make me work any harder during the year	-0.1
23	I did not like this form of assessment as I prefer to work harder towards the end of the year as opposed to earlier in the year!	-0.3
24	Students did more study because of these tests!	0.3
27	The weekly assessments did NOT make me work any harder	0.1
28	Students paid more attention in lectures because of these tests!	0.1
29	Students attended more lectures because of these tests!	-0.1
30	Doing the weekly tests made it easier to learn the material!	0.4
31	Doing these tests will make it easier to study for the summer exams!	0.2

**Table 2: Results of student survey relevant to Aim No. 1**

Although the scores for each statement may be interpreted in various ways some comments should be made before drawing conclusions:

1. The lecturers' views were almost exclusively positive, especially in the critical question No. 1 about the amount of time spent studying.
2. The contradictory results of questions 21 and 24 with 27 in the student survey would seem to indicate that students will not necessarily answer questions honestly.
3. Student responses were generally slightly positive and in the light of earlier comment on honesty in answering questions would seem to indicate that their views concur with those of the lecturers. Questions 21, 24 and 30 would particularly indicate this.

### Attitude of lecturing staff to the use of CAA

#### **Lecturers involved in the study**

The results of the above questions would, to a large extent, support the idea that lecturing staff in the pilot study are convinced of the benefits of frequent assessment using CAA. Table 3 is a selection of some of the more important questions to lecturers that would support or deny this. In addition to this some comments are made on the results of the two surveys of staff not involved in the pilot study.

<u>No.</u>	<u>Text</u>	<u>Score</u>
3	For my subjects, multiple choice questions are NOT a suitable method of assessment!	-1
14	I would like this facility to be available to me for the same class group next year!	1.4
16	I would like this facility to be available to me for other class groups next year!	1.4
21	If other staff were aware of the results of this study, more would get involved in this form of assessment!	0.9
23	I feel that Computer Aided Assessment makes it easier to manage larger numbers of students!	0.9
26	I found that the results of these tests were a useful indicator of the progress of individual students!	0.9
40	I think that this system of assessment would be useful in identifying students not working within the first few weeks	1.3

**Table 3: Results of participating staff survey relevant to Aim No. 2**

The above results indicate that once exposed to CAA lecturers are convinced of its usefulness. Questions 14 and 16 could be considered to critical questions in this regard.

#### **Lecturers who chose not to become involved**

Of the four lecturers who chose not to take part in this study only one had returned the survey at the time of writing of this paper and thus the results cannot be taken to be representative. However, the author can state that the attitude of this respondent was not untypical of others who chose not to get involved and so some of the results of this survey are worth stating.

The respondent stated that the main reason for not getting involved was that the class group for their subject was a mixture of students on the pilot study and some who were not. (This was also true of other lecturers both taking part and not taking part in the pilot study.) The respondent also stated that if the commitment required could be reduced to 4 hours training and 20 minutes per week they would definitely use CAA.

#### **Lecturers from other class groups not involved.**

Only four questionnaires were analysed from the twelve lecturers chosen at random from those in the Institute that had no involvement with the pilot study, as there was insufficient time to contact all of them to make sure they returned their survey forms. The responses, therefore, cannot be taken to be representative as it is probable that the most interested lecturers responded to the survey. The responses were, however, extremely positive and are summarized as follows:

1. Two of the four lecturers had some contact with staff involved in the pilot study.
2. All of them were aware that CAA was being used in the Institute and that the pilot study had taken place.
3. This awareness had made all of these lecturers interested in finding out about the effectiveness of CAA and reading a summary report on the pilot study.
4. All were also interested in using CAA in the future.
5. The main factor that would influence them against using CAA was the reliability of the computer system.

## Level of resources required for a permanent CAA facility

### **Computing facilities**

It is estimated in this study that the amount of computer time required for carrying out continuous assessment is 30 minutes maximum per student per week and 15 minutes on average. It was also noted that all computers in a computer room could be used, as proximity of students to each other was not a problem if tests were designed and implemented correctly. This was verified by a question to students worded as follows: "*It was possible to improve your marks by looking at the screens of nearby students!*", which scored -0.5. It was also felt that groups of students taking tests at different times was also not a problem. Although the statement "*Students who took the tests later were at an advantage!*" scored 0.4, this was contradicted by the behaviour of students, as the vast majority chose to take their tests at the earlier sittings when given the choice.

### **Support**

Questions in the staff survey indicated that lecturers felt it was necessary for beginners to get the high level of support that they received during the pilot study, and that they would like this level to continue in subsequent years. The author would agree with them with regard to beginners, however would feel that this level of support would be both unnecessary and infeasible after a lecturer's first year.

### **Level of commitment required from lecturers.**

Staff taking part in the pilot study had the following views on the commitment required to use CAA for continuous assessment:

1. Initial training should be about 5.5 hours (most of the participants actually had much less)
2. It would take 6 weeks of testing to get become proficient at creating tests.
3. It would take just under 4 minutes to create a single multiple choice question.

### **Best practice.**

To draw up recommendations on 'best practice' staff, student and supervisor surveys were used in conjunction with the researcher's own observations. However, these are not thought to be particularly relevant to this paper and so have not been included. Those interested should look up the pilot study web site already listed in this paper.

## Conclusions

### **Impact on Student Work Rates**

Most of the relevant questions to lecturers and students would indicate that the frequent continuous assessment that took place during the pilot study did have some positive effect on student work rates.

### **Attitude of staff to the use of CAA for continuous assessment**

Lecturing staff, who have participated in the pilot study, wish, almost unanimously, to keep using CAA for continuous assessment. In general, other lecturers seem to be well disposed to the idea of using CAA and this pilot study has had some influence on them in this regard.

### **Level of resources required for a permanent CAA facility.**

#### **Delivery Hardware**

For time-tabled scheduling of students for continuous computerized assessment, 30 minutes per student per week should be used for requirement calculations.

It may be more efficient to provide a CAA facility on a 'drop in' basis, where 15 minutes per student per week should suffice.

#### **Support**

Although no manpower calculations have been done at this point, it is the researcher's view that a high level of support is required in the first year of any lecturer's use of CAA, lest they become disappointed with the success of the facility and lose interest.

### **Level of commitment required from lecturers.**

Staff require a minimum of 4 hours initial training to reach minimum proficiency for creating, publishing and scheduling simple multiple choice tests.

Having reached full proficiency, a lecturer will be able to produce useful weekly tests in as little as 20 minutes.