Introduction to MyMathLab

MyMathLab is learning and teaching software produced by Pearson publishers consisting of online course materials to supplement some of their textbooks. It offers homework, student assessment, and multimedia instructional tools that enrich student learning and intends to improve retention outcomes. The main feature used in this case study were free-response exercises (not multiple choice) that were algorithmically generated for unlimited practice and mastery. Other online tools were available to students, such as a multimedia textbook, a facility to show the steps interactively through a similar problem. Tests were produced by instructors by selecting relevant questions from an online bank of questions similar to those available in the textbook. Many more topics not on the syllabus were made available for those students that wished to explore further. Algorithmic generation meant each student had a different problem to solve. For instructors, the Gradebook facility automatically tracks students’ homework and test results and gives the instructor control over how to allocate marks to different exercises, and also monitoring students’ progress.

Rationale for introducing MyMathLab:

MyMathLab was introduced as a pilot study in two Modules in the faculty of Computing. These Modules were identified as modules of concern, meaning the pass rate for these modules were below the university’s expected benchmark rate. There was also some concern about students’ engagement in a subject that many had not chosen to study.

These modules were run in four-hour blocks, one and half hours of face to face lecture and two hours of small tutorial classes with paper based exercises. These exercises were replaced by exercises done at a computer screen.

The Two Module Profiles

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Number of students 2008-2009 Semester 1</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA0001N</td>
<td>Foundation of Mathematics</td>
<td>87</td>
<td>Preparatory (year 0)</td>
</tr>
<tr>
<td>MA1033N</td>
<td>Mathematical Techniques</td>
<td>20</td>
<td>Certificate (year 1)</td>
</tr>
</tbody>
</table>

Module MA0001N introduces students to the basic techniques of mathematics and develops the skills necessary for further study in science, engineering, mathematics and computing. Profile of the students doing this module ranges from those who where
educated abroad to mature students who have left education for a long time to those who marginally failed to be accepted into the certificate level.

Module MA1033N is a certificate level module that takes students without A level maths and prepares them for degree level studies in math sciences. It also caters for engineering and polymer, multimedia and others who need some preparation beyond GCSE level maths. It is also chosen as an elective module by Business and Life Sciences students.

“MyMathLab is not a multiple choice based assessment system, but algorithmically generates problems and requires open algebraic answers to be input. These are assessed algorithmically as well, and inputs are not merely strings to be checked against a correct answer.”

The overall progression rate for MA0001 has been poor for many years. Various teaching and learning methods were implemented such as smaller tutorial groups, more experienced tutors at this level and different textbooks; however the progression rates stayed low. The module team, after researching e-learning and blended learning methods, opted for MyMathLab in order to attempt to change the poor progression trend. This was thought to be more suitable for a generation of students who may not have engaged with traditional textbook use. Some of the most attractive features of the software were as follows. Students could learn to construct mathematical notation correctly and easily. The system could easily generate questions with changeable parameters, could provide hints and help if students were stuck, and had a reasonably low cost per student.

The progression rate for MA1033 was similar to the one above and staff believed it might be worth trying the MyMathLab package on a slightly higher level syllabus.

**How MyMathLab was used in Blending Teaching of these modules**

The Faculty of Computing agreed to fund the purchase of access codes to enable all students in the modules to use this pilot study rather than expecting each student to buy his or her own package separately. This sidestepped the issue of hardship and certain students being unable to afford to take a course.

The teaching team strategy for these modules in the academic year 2008-2009 was to blend face-to-face teaching with online learning via MyMathLab. It should be stressed that MyMathLab is not a multiple choice based assessment system, but algorithmically generates problems and requires open algebraic answers to be input. These are assessed algorithmically as well, and inputs are not merely strings to be checked against a correct answer. The questions often require considerable working and calculation on paper and are not instantly soluble. The same question appears to be different each time a student attempts it; however the concepts and difficulty remain the same although the numbers change. Partial marks can be allocated for answering parts of questions.

Homework exercises were selected from a bank of questions provided by MyMathLab. Each week the topic taught could be assessed with a selection of questions chosen by tutors.

Fig 1 shows that homework 1 was chosen from chapters 7, 11, 13 & 14. Students could refer to these chapters in the text [1] or in an online version of the text. The times that the test was available is seen as starting on 23rd September and to be completed by 9th January. These dates and times are set by tutors. There are many useful facilities available such as preventing a student from beginning homework 2 until they have obtained a minimum mark on homework 1.
In the dropdown menu in Fig 1, one can also see some of the actions available to the tutor for managing assessments.

Fig 2 is an example of what a student sees when answering a homework question. Along the top are the questions to be answered. They can be answered in any order by clicking on the number desired. We are looking at question 10 out of a set of 18. Completed questions would have a green tick or red cross by the number indicating correct and incorrect answers recorded.

On the left is a palette of common mathematical symbols which must be used correctly and was found to improve students’ ability to write mathematics in a formal way. The question tests understanding of function notation and simplification.

On the right are various levels of assistance available to the student. These and more methods can be made available by tutors. They take the form of an online textbook that opens at the appropriate chapter, a detailed complete worked example similar to the problem being faced, and finally ‘Help Me Solve This’ which proved to be an overwhelmingly popular interactive tool with students.

Students are expected to calculate the answer using as much pen and paper as is necessary and after typing the answer in the space provided should click on the button Check Answer. If the answer is correct it will be recorded and the next question can be attempted. If incorrect a message is displayed and the student may have two more attempts before a wrong answer is recorded. This proves quite useful if all that was in error was an accidental transposition of symbols or signs.

The save button enables students to stop what they are doing, saving all their answers and recommence at another time. If a student chooses ‘Help Me Solve This’, the screen below shows what can be expected. The problem is broken down to several stages and students should answer correctly the progress question at each stage. Encouraging feedback is given for each answer. Fig 3 shows that the help is provided in two parts, one part correctly completed and one part remaining in the yellow bar at the bottom of the screen. This is useful as it gives the learner an indication of how complicated or simple a solution is likely to be.

Fig 4 (overleaf) shows the Gradebook accessible to tutors. One of the useful features of MyMathLab is the record management screen. Marks are recorded for each completed assessment. Emails can easily be sent to any students meeting any given criteria; for example, to all students who have not obtained 60% on a test or whose homework average falls too low. Any student’s work in progress can be examined in detail. The assessments weightings are adjusted in this Gradebook. Results can be easily exported at any time into an Excel spreadsheet for further analysis and recording.

**Students’ use of MyMathLab**

The first two hour session in computer labs was introductory.
The registration process was demonstrated on a large screen as students were given an individual pack containing registration passwords and instructions. After registration students could begin immediately on the first homework exercise and explore all the help facilities on offer. The subsequent lab work consisted of ten weekly homework exercises. These were run in two different ways within the two modules: one group (MA0001) had a week to complete each homework exercise while another (MA1033) had a single deadline at the end of the course. Almost all students displayed huge motivation to make full use of tutorial time. Work was often completed in students’ own time, sometimes at very unusual hours, as most had an internet connection at home. Once they were used to the system, the concept of peer teaching and learning was preserved.

### Students’ results using MyMathLab

The number of students and pass rates before and after introduction of MyMathLab is as follows.

<table>
<thead>
<tr>
<th>Course</th>
<th>07/08 No.</th>
<th>07/08 Pass rate</th>
<th>08/09 No.</th>
<th>08/09 Pass rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA0001 Foundation Maths – year 0</td>
<td>91</td>
<td>48%</td>
<td>87</td>
<td>83%</td>
</tr>
<tr>
<td>MA1033 Mathematical Techniques – year 1</td>
<td>36</td>
<td>53%</td>
<td>20</td>
<td>85%</td>
</tr>
</tbody>
</table>

These figures indicate a large change in progression of students. The module results have improved significantly from around 50% to over 80%. This success could be attributed to the following MyMathLab features (as taken mostly from students’ comments):

- Students prefer computer-based exercises to paper based ones.
- Students have many opportunities to redo the exercise until they succeed.
- The work is not time constrained and is accessible at a time or place of their choosing.
- The additional computer help proved to be extremely popular.
- Immediate feedback from the program made them more likely to keep up their interest.
- More collaboration occurring than during traditional paper based exercises.
- Students did not feel shy about asking a machine for help.

### Staff impressions of MyMathLab

Some of the advantages of using MyMathLab according to the staff members who worked with it were as follows.

- Students’ attendance at tutorial sessions was much better than in previous years.
- Students’ motivation was very encouraging and seemed to be in tune with the computer-based way most new students like to communicate.
- Collaboration among students was more pronounced.
- More time could be spent by tutors with those who needed more help.
- Students had more control over their learning by being able to choose the ideal time and place that suited them.
- Students falling behind or with lower grades (or any other criteria) could be filtered out and identified by the

![Fig 4 – Screen showing Gradebook with students marks for each assignment and performance measures](image-url)
package. Tutors could use the package to message these students individually or as a group with minimal effort.

- A useful facility allows the use of prerequisites; e.g., students would have to obtain 75% on homework1 before they could begin homework2.

- It introduced a happier learning and teaching environment for both students and staff.

There were also disadvantages that may need addressing. These were as follows:

- The system only marked the final answer and answers that were close but were not written in a form exactly as required were penalised quite harshly. However students who had made use of the review facility could become used to the strict input requirements.

- Correct layout of mathematical solutions was emphasised during lectures but could not be tested in the program.

- Feedback and ‘Help Me Solve This’ features are somewhat didactic and may not reflect the methods taught to students causing some confusion among learners.

This suggests that this package could improve pedagogically by developing a system to make it possible to assess students’ work in cases where students have not reached a final result rather than waiting until a solution is presented.

### Conclusion and Future work

MyMathLab was thought to be a useful learning tool with evidence of good feedback by both students and staff.

The package is recommended, especially for large modules as it has been shown to engage students and assists where a tutor may be engaged with students who need individual attention.

This software blends well with traditional face-to-face teaching methods because it is primarily assessment software and can act as a teaching assistant where necessary.

Cost effective – the fairly nominal cost per student was small relative to the gain in student retention and resulted in many more students progressing.

Retention – this is possibly the main selling point of the program. The retention has markedly improved.

This package has the potential for further development by encouraging the students to demonstrate their understanding of the methods used to reach their solutions.

The issue of students paying for their software could cause problems especially if modules are compulsory, and it would be good if the package could be made available to departments in bulk.

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### Student Feedback Details

Student feedback was obtained using an online questionnaire. Over 90% of students showed satisfaction with this package and the way it was employed for teaching.

“The package is recommended, especially for large modules as it has been shown to engage students and assists where a tutor may be engaged with students who need individual attention.”

Students gave comments on the various aspect of the software concerning their learning experiences and the final outcomes. Some of these comments are shared below.

- **“MyMathLab was part of the key learning resources that I depend on for my Maths module since I can do my work anywhere and at any time.”**
- **“It has helped me improve my skills in mathematics”**
- **“MyMathLab is very good in helping me with questions that I do not understand with the ‘Help Me Solve’ button and the review exercises”**
- **“I find ‘Help Me Solve This’ very useful when I am stuck on a question”**
- **“If your answer was wrong while doing the homework you can have another question instead in this way you keep practising until you get the right answer.”**
- **“I found the system quite useful and interesting. It gives me exercises and ways in solving answers when I am stuck.”**

Importantly students found that this made mathematics fun to learn.

### References
