

FAIM – Formative Assessment In Mathematics

by

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Introduction

One of the main challenges for UK mathematics students in their transition from school to university is to become better independent learners than they have been at school. Although the content of university courses is provided in a number of different ways, and teaching and learning methods vary, lectures still tend to prevail as the main medium for the dissemination of information, mainly because of the size of classes. To supplement lectures, students get additional tutorial support, in smaller groups, receiving feedback on completed work from staff or senior graduate students. This is in stark contrast to their pre-university experience where classes are smaller, more informal, with plenty of interaction between teacher and students. Individual class teachers will also give detailed feedback on work, both orally and in writing.

In this paper we present the results of a trial designed to improve learning for first year university students by greater use of formative assessment, with little additional cost.

Peer-group formative assessment – ‘buddy system’

The trial was conducted in the Mathematics Department at the University of Reading in the session 2002-3. A ‘buddy’ system was introduced for a year 1 core course with the aim of encouraging students to take a more active rôle in their learning. The scheme involved pairing-up students and exchanging their solutions with each other, then commenting on and correcting the work using model answers, followed by the students getting together to discuss the marked work. Solutions were then brought to tutorials in order to go through any outstanding problems; the scripts were then gathered and further comments added by staff.

In year 1 each tutorial group contained about ten students who were mostly following the same degree programme. Following the initial meeting of a tutorial group, which was used mainly as a ‘getting to know one another’ exercise, the second meeting began by forming the pairings, or ‘buddies’ as they were referred to. Students were encouraged to find their own ‘buddy’, with the member of staff responsible for the group arranging this where it did not occur naturally. The staff then explained when model solutions would be available and what meetings of the pairings would need to take place. There would need to be a brief meeting to exchange their solutions, say two or three days before the work was due in, and then again for up to half an hour a day or two before the work was due in. In between these meetings the ‘buddies’ would read through their partner’s work, in conjunction with the model solutions,

making any comments in pencil, including any on clarity of explanation, or lack of it, where appropriate. In the second meeting the comments would be discussed, and erased if either party wished it. Each student would then submit a revised version of their solutions for the tutorial staff to mark; in most cases the changes being informed by the discussions and comments made between the ‘buddies’. The staff would also erase erroneous comments. This process was monitored throughout the trial, as well as at the end of it. Pairings were changed when students requested it, although the overwhelming majority remained ‘buddies’ throughout the trial.

The course chosen for this was *Calculus*, primarily because all students have some prior knowledge of some of the material, but have different strengths and previous experience, so that both partners should benefit in any pairing. The other year 1 core course in *Analysis* was not considered suitable for the trial because all the material is new to students.

Results

To assess the impact of the introduction of peer-group assessment we make a number of comparisons. First, we compare the end of year examination results for the two core courses in *Calculus* and *Analysis* with each other, and with the corresponding results for the previous session 2001-2. Both the *Analysis* course for the years 2001-2 and 2002-3 and the *Calculus* course for 2001-2 had only regular tutorial support with staff marking work and discussing any problems students had encountered. We also compare the qualifications by grade of the student intake for the two years under consideration. The students considered take both core courses, and the comparisons made are only for these students which number 40 for each year.

The comparisons for the two courses are shown in Figures 1-4, and the qualifications of the intake in Figure 5.

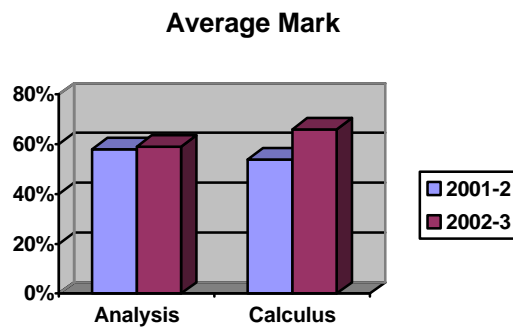


Figure 1

Pass Rate

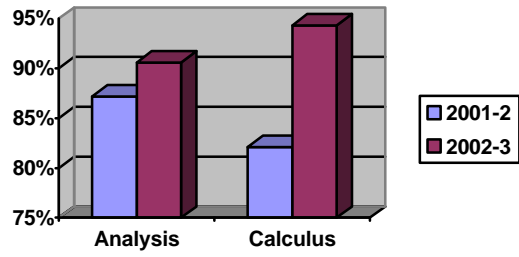


Figure 2

Analysis Grades

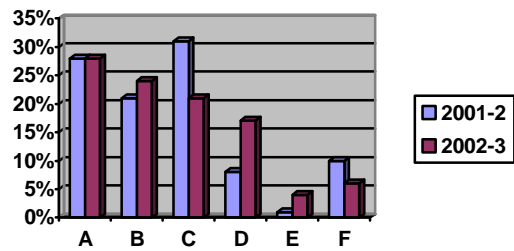


Figure 3

Calculus Grades

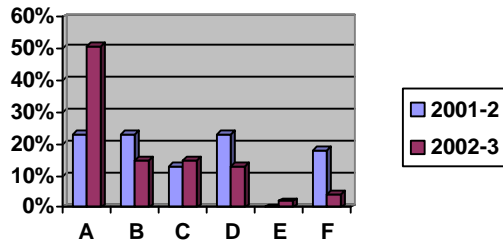


Figure 4

Intake Grades

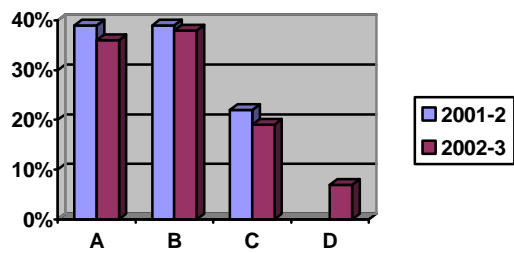


Figure 5

The level of intake is broadly similar for the two years 2001-2 and 2002-3; if anything, the intake for the former being slightly better than the latter. There is a slight improvement in the final average mark and pass rate (grades A-D) from 2001-2 to 2002-3 for *Analysis*, but a much larger improvement for *Calculus* in 2002-3 when the trial was conducted. Looking more closely at the grade profile for each of these courses, we see again a slight improvement for *Analysis*, but a strong shift to the upper end for *Calculus* from 2001-2 to 2002-3, and far fewer students failing with grades E and F.

Conclusions

Our overall conclusion is that peer-group formative assessment, based on a 'buddy' system, for students making the difficult school to university transition, can be of benefit, and is worth the small amount of additional effort required to set it up. We do not feel it appropriate to do this for the other core year 1 course in *Analysis*, mainly because all the material is new to students, although we would encourage the same pairings to get together to discuss this course once the initial contact has been made for the *Calculus* course. Moreover, having introduced students to the idea, we recommend students discuss their work for courses in later years, maybe with different pairings, or in larger groups. Because of the ever-increasing diversity of learning needs of the student intake, this additional aid to learning ought to be of benefit. However, we would not advocate continuing with new ideas unless students welcome them. At the end of the trial, therefore, student opinion was sought (anonymously), and responses to the question '*Do you think the "buddy" system is a good idea*', 55% replied *yes*, 26% *no* and 19% *indifferent*. Although these do not demonstrate overwhelming support, if we take into account the examination results as well, we believe there are positive reasons to continue with the scheme.

There is some scope to introduce such a scheme in schools, particularly for the later years, but it is more difficult to assess the benefits because of the way national examinations change from year to year, and the way that they are moderated. Differing personalities can also have a greater influence for the younger age group, particularly those in their early- to mid-teens. Mentoring can act as an alternative, but the relationship between a student mentor and the student being mentored is clearly different, and the outcomes of the pairing will be different from one based on 'buddies'.

We should not forget, though, that for many years students in the lower years at school have been swapping homework and marking in a pair while the teacher reads out the answers. The 'buddy' system here is merely a modification of this and for a different age range.