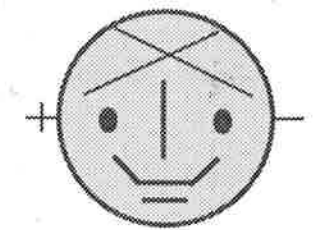


# MATHEMATICS SUPPORT Newsletter



Welcome Address

EDITORIAL

Issue No 1

Spring '94

"There is little doubt that many students - possibly the great majority - are apprehensive, if not fearful, about taking mathematics and statistics as part of their higher education programme of study. On the other hand, there is extensive evidence that if this initial reluctance can be overcome, and an opportunity provided for individuals to learn at a rate and in ways appropriate to them, then a genuine sense of enthusiasm and commitment is often engineered. More importantly, there is usually a ready appreciation of the ways in which real competence in numeracy can be not only worthwhile in itself, but also, of immense practical value in the deeper understanding of a wide range of other disciplines.

For all these reasons - educational and practical - it is increasingly recognised that institutions of higher education must make proper provision to enable students to gain at least basic competence in numeracy. The Numeracy Newsletter represents just one step in facilitating such a development, and will provide a support network of all those staff who are involved, and a channel for the dissemination of good practice".

Dr D T John  
Deputy Vice-Chancellor  
University of Luton.

This Newsletter has come about as a result of a conference held at the University of Luton (May, 1993) - see pages 14-15. We hope to publish it twice a year and look forward to future conferences. The newsletter has separate sections on Workshops, Supplemental Instruction, Open Learning, Computer Assisted Learning, Adults & Numeracy, Conference Proceedings, and considers the use of all forms of support as they pertain to mathematics. There was sufficient interest shown in all forms of maths support, at last year's conference, to create specialised interest groups. Delegates' interests are listed on the last page to encourage communication between institutions.

We have established links with the Adult Numeracy Research Forum, which was set up last November by Diana Coben of Goldsmiths College and Joan O'Hagan of Fircroft College. Their overseas network shows there is a basis for establishing further links with maths support networks in Europe. Moreover, there are various regional organisations in the US with whom we can exchange information.

Ideas for future newsletters include additions such as a 'Letters Page' (please write to us) and sections on 'Writing in the Maths Classroom', 'Cooperative Learning Groups' for activity based maths courses, and 'Psychometric Testing'. Helping students to perform well in psychometric tests is a substantial part of the numeracy projects of the University of Durham and also of Cheltenham & Gloucester College of Higher Education - see page 11.

There is a charge of £15 for the annual subscription of *Maths Support in FHE*. (Over a dozen institutions have already paid! Thank you.) It will entitle you to the next two issues and to a discount for the next annual conference. We are looking for original articles, perhaps those written for in-house magazines, that may justify a wider audience. So please scan your files and send them on. The next issue is due in September, 1994. It will attempt to establish a discussion or research agenda on the topics outlined in this first issue. It also has the objective of suggesting the key issues for a second annual conference late in 1994, or early 1995. We need an editorial board for the next newsletter so, please, indicate your willingness on the form on page 7.

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# Drop-in Mathematics

## 'Maths Workshops do exist'

written by David Bowers  
Suffolk College

**M**athematics Workshops do exist! An HMI report ("Mathematics in Vocational Courses in Further Education", 1991) states that almost half the colleges in England have them, and by 1993 a survey by Beveridge & Bhanot of the University of Luton indicated that 76% of FHE institutions (see page 13) were offering this form of support. Maths

Workshops still seem less prevalent in universities than in FE. This is perhaps one area where HE staff can make use of the experience of colleagues in Further Education.

Difficulties arise when it comes to the definition of a 'Mathematics Workshop'. Some colleges use the 'total' workshop approach, where the whole student experience in certain maths courses consists of a more or less flexible attendance in a large open learning resource centre. This is staffed for the whole day by general mathematics tutors. At the other extreme, some institutions consider a workshop to be a handful of nominated

hours per week when a lecturer is free to help students with problems.

Alternatively, there are towns where an external maths drop-in centre exists for all levels of numeracy and mathematics as a support for the community at large. This obviously includes students but it only has loose links to the main college.

Rather than argue what a maths workshop is, it might be more fruitful to be clear about what, in our view, a maths workshop should do. "Helping out students with problems", is a laudable aim and seems to be the main *raison d'être* for most drop-in workshops.

### Limitations:

- students soon perceive a stigma attached to its use
- 'Quick Fixes' are not, in the long term, the best form of assistance for the less able student (a 'lifeboat' would be more appropriate than a 'lifebelt')
- staff can be overwhelmed by the clamour for immediate attention by a whole range of difficulties at once.

### Research Uses - Workshops can be used for research into:

- open learning resources (including any which you have produced yourself and wish to market, or try out)
- students' expectations and perceptions of drop-in maths workshops
- the validity of diagnostic testing and how to incorporate a diagnostic element into workshop-based activities
- development of computer-based learning in a workshop environment.

# Workshops

(continuation...)

At Suffolk College, we were aware of these limitations. We wanted to integrate the maths workshop more into mainstream provision, yet, at the same time, not lose the teacher-learner relationship of the traditional classroom. Five strategies were adopted:

### THE STRATEGIES

#### Strategy one

Nominate one room, (as large as possible) as the maths workshop and put one person in charge.

#### Strategy two

Introduce a lecture-tutorial mode where traditional lectures are followed up with timetabled sessions in the workshop for directed private study and individual assistance. This will ensure the room is utilised throughout the day, and also get students used to the idea of the workshop as a place for maths.

#### Strategy three

Hold the staffed drop-in help service at similar times each day.

#### Strategy four

Encourage Open Learning students, and other formally enrolled flexi-study students, to take their tuition entitlement during help service hours. The drop-in help service then becomes partly self-financing with its own FTEs.

#### Strategy five

When fully established, offer your services to other areas (cost centres) of the college, take student referrals, keep records, and finally send 'bills' to these other cost centres (This need not be for cash; sets of reference books, unwanted computers etc., all come in handy; or even the occasional use of their photocopying cost codes or library order allo-

cation!).

### What a Maths Workshop should have

Individual directed private study by students, as well as remedial work, needs a readily accessible bank of user-friendly learning material. This is generally paper-based, although some colleges, including Suffolk college, are starting to look into the opportunities by "Authorware" to generate interactive computer-based material. It was clear at the conference that well-produced, affordable materials, which should ideally take the form of individual topic-centred units, are still comparatively rare, and delegates were keen to swap details of good resources.

### The way forward

The best way to get new ideas and examples of good practice is to visit existing workshops and observe them in action (preferably not at those institutions which charge for the privilege!). Alternatively, invite a colleague, who has experience of getting a successful workshop off the ground, to do a Harvey-Jones-type consultancy job to your own institution (although this will cost you at least a train ticket and a decent lunch). If neither of these is practical, then support the aims of the conference and join on page 7.

I am prepared to act as a contact point for any issues relating to mathematics workshops, to report back, and to disseminate any information or message to a wider audience through the Newsletter.

David Bowers can be contacted at:  
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## MATHEMATICS SUPPORT

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The next issue will be Autumn 1994.

The deadline for contributions in the next issue is September 30, 1994.

Join the Equal Opportunities  
Higher Education Network

The National Newsletter of the Network  
in edited by Rakesh Bhanot.  
Please send contributions to the

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Details from Lee Taylor, Open University,  
Milton Keynes MK7 6AA

## Open Learning

*The Open Learning Foundation exists to help its members meet the demands for teaching and learning.*

*It aims to increase the accessibility of university and higher education to individuals, companies and public sector organisers by supporting the growth of quality education.*

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Kim McCaffery  
0203-838872

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0602-418418

# Open Learning

## How to Get Started with Open-Learning-Modules in Maths: Some Tips

Interview with Tony Grove  
Senior Lecturer  
The Nottingham Trent Univ.

Tony Grove has been researching the current foundation and bridging courses in mathematics of the Open Learning Foundation's members (1).

There are two main routes to acquiring open learning materials. You can write them yourself, or buy a site licence to photocopy other institutions' materials. Exeter College, the University of Plymouth, Coventry University, Bradford and Ilkley College, and Stafford College are examples of institutions writing open learning packages. At Exeter, Coventry and Stafford, the open learning materials are delivered through their maths workshops, which are staffed for most of the day, most weeks of the year. There are many different approaches to handling open learning.

### Exeter College's Complete Package

Exeter has a highly structured

programme which teaches students effective independent learning skills. Students are interviewed, after a self-assessment procedure, on completion of each 'mini-module'. A 'mini-module' consists of about seven (out of fifty) open learning modules. They have open-learning packages in Basic Maths, GCSE, A level and are currently completing a GNVQ version. Roy Gold, who manages their maths workshop, will train purchasers of their material in the techniques they have developed at Exeter to make the delivery of this material more likely to be successful. The material is aimed specifically at students who have narrowly failed GCSE or A level. The cost of the total package is between £2,000 to £3,000, depending on how much support you buy in.

### 'Off-the-Shelf' Offers

Bradford and Stafford Colleges offer free-standing open learning material which is sold as independent units. For example, a unit in Correlation or Algebraic Fractions. The units are all designed to follow one format so familiarity with one unit encourages students with other units. For this reason, it would make more sense to purchase a complete package of units. Although

# What Support does it need?

each unit costs only £10 at Stafford, a complete set of units, for example, GCSE, (continuation) would cost over £500.

Coventry University's material is written by Kim McCaffrey and Royston Young. They have developed more advanced materials, as well as materials more specific to the needs of engineering students.

## Supporting Open Learning in Drop-In Workshops

The use of open learning material in a maths workshop has delivery advantages as many students need help with this kind of material. The workshop offers assistance to first time users, to students with the odd difficulty and to students who cannot abide being 'stuck'.

Since much of the material is developmental, ignoring the examples you are 'stuck' on is not always an option. The assistance of a workshop mathematician smooths the process. However, it is also true that many students like to take the material away and get that same help from a spouse, partner or friend.

## Don't Mix and Match

The literature of each of these colleges has resulted in their own unique terminology. While 'units' is a popular term for the basic amount of material a student is expected to master in one sitting, some institutions call this a 'frame'. Beyond these differences of language are differences of style. The Open University has a formal style. Exeter has a handwritten set of worksheets which is designed to motivate students. The Nottingham and Trent University's own material is written in a 'folksy' and intimate style. It would not be a simple job to mix and match parts of one open learning package with that of another.

## Don't Write Your Own Material

Tony Grove considers the time and effort needed to delve through the different open learning course offerings to be considerable. The market for college open learning materials is different from that of the Open University. Its maths offerings are aimed at mature, well-motivated students who are able, have good study skills and who like working on their own. The mode of presentation is formal; for

example, the use of function notation, such as  $f(x)$  and  $g(x)$ , is unfamiliar to many students. Tony Grove concludes that the time and talent required to write effective materials is not cost effective for most colleges with limited resources; for example, each tiny unit of open learning material in his package took between twenty to fifty hours of creative effort to write.

## It isn't Cheap

The Keller Plan is used by Southampton University. Its open learning materials require considerable support to address the present rate of attrition, currently 50% on many OU course-modules. Tutor-student ratios were kept to 1: 10 at Southampton to provide effective support for foundation courses. It is reported that the additional administration expense, plus the heavy tutorial load, drove the total cost of open learning above those of the traditional 'chalk and talk'.

## Reference

- (1) Grove T. (1993). Report on Open Learning for Non-specialist Mathematicians. Open Learning Foundation.



# Computer Assisted



## Creating Common Entry Standards of Mathematics Skills

Report by Andy Fitzharris  
to the University of Hertfordshire  
summarised by the editor

Prompted by a concern over the increasingly weak maths backgrounds of new students, the Resources Development Fund of the University of Hertfordshire provided a grant to investigate ways to provide remedial help.

During 1992, all the Polytechnics were contacted and eleven responding institutions were interviewed by telephone. Brighton, Napier and Sunderland Polytechnics all had successful programmes of remedial help and they were visited.

Videos, textbooks and open-learning materials were examined



but the main area for investigation was Computer Assisted Learning (CAL). Derive, Mathcad and TK Solver were reviewed separately. They are not CAL packages since they are designed to apply rather than teach maths.

The University of Herts. wanted a CAL package which included:

- diagnostic tests which individualise tutorials
- a variety of presentations
- records & printed reports charting students' progress for both staff and students.

None of the packages reviewed below met all of these conditions.

The principal recommendations were that remedial maths support should:

- be university wide, across faculties
- identify 'at risk' students early by diagnostic testing

| CAL Package | Developers                           | System | Diagnostic test | Managemt. system | Revision tests | Reports | Variety | Ease of use |
|-------------|--------------------------------------|--------|-----------------|------------------|----------------|---------|---------|-------------|
| CALM        | Herriot Watt Univ.                   | IBM    | no              | yes              | good           | good    | good    | good        |
| TOPCLASS    | Topclass Technology                  | IBM    | no              | optional         | optional       | na      | poor    | poor        |
| CALMAT      | Univ. of Glasgow & Univ. of Illinois | IBM    | yes             | yes              | poor           | na      | poor    | poor        |
| CALC        | Univ. of Sunderland                  | IBM    | yes             | yes              | ok             | good    | good    | na          |
| MACTUTOR    | St Andrews Univ.                     | Mac    | no              | no               | ok             | na      | na      | good        |

# Learning



- be implemented during the first semester and level 1 maths components should not begin until semester two.
- use up-to-date teaching materials which are course specific
- vary teaching styles with lectures, tutorials, practicals & workshops
- use a CAL package
- allow students to discover relationships using the computer program DERIVE
- be supported by a variety of open-learning materials in a drop-in maths workshop.

An interim plan is to adopt CALMAT for new students. Over a two year experimental period, an attempt will be made to tailor this programme to the specific needs of the University of Hertfordshire. A final decision is planned to be taken at the end of this time.

| Tuto-rials | Graphics | Rem-edial | Content  | Cost per copy |
|------------|----------|-----------|----------|---------------|
| good       | good     | no        | calculus | 350           |
| poor       | poor     | yes       | GCSE A/L | 1435 plus     |
| good       | poor     | yes       | GCSE A/L | 250           |
| good       | na       | yes       | GCSE     | 400           |
| hard       | na       | no        | A/L plus | na            |

## MEMBERSHIP APPLICATION

### MATHEMATICS SUPPORT

NAME.....

JOB TITLE.....

INSTITUTION.....

MAILING ADDRESS.....

DAYTIME TEL NO.....

FAX NUMBER.....

E-MAIL.....

Are you willing to join the editorial board for the next newsletter  
YES / NO

Are you willing to help plan the next conference  
YES / NO

I enclose a cheque for £15.00, made payable to  
"The University of Luton".  
In return, my institution will receive the next two copies of this  
newsletter and discounts for all delegates to the next conference.

RESEARCH INTERESTS:

Send to:

Ian Beveridge  
Centre for Educational Development  
University of Luton  
Park Square  
Luton  
Bedfordshire  
LU1 3JU

E-Mail: IBeveridge@UK.AC.Luton.Vax2

# Supplemental

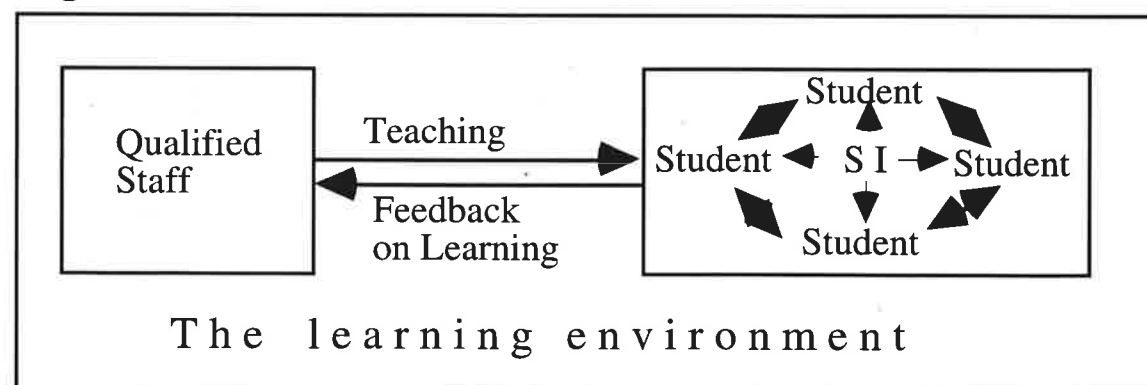
## Putting SI at the Heart of your Staff Development Programme

Report by Ian Beveridge  
University of Luton

A Supplemental Instruction (SI) programme is proposed for first year course modules that require numeracy skills at the University of Luton. This will use second year students to run support sessions for first year students. Currently a pilot scheme is being run in the Faculty of Business.

A study skills module will be written for second year students and then researched as to its capacity to apply SI to first year students in quantitative modules. Later on, a system of information gathering will be devised to inform staff on first year student difficulties. It is this information system that is represented by the 'Feedback on Learning' arrow in Figure 1. In the first (control) year of running this module for the research programme, information about the learning difficulties of students will simply be given to staff and their reactions to it observed. In the second (experimental) year, a staff development programme will be implemented to derive common solutions for all teaching staff to apply.

Figure 1



## Evaluation

The results of both control and experimental years will be compared and also the results of supported students versus unsupported students within each year. Profiles will be developed for students who make use of support services, and those who don't. An evaluation procedure is needed to measure value added while controlling for both ability and motivation.

## SI Helps to Develop Understanding

SI is located at the centre of the right hand box in Figure 1 since it deals with student interaction. SI concerns itself with the problem-solving, communication, study skills and small group skills of students. Students interact, as they always have, to attempt to understand their instruction. In Piagetian terms, they need this processing to assimilate the information. Students process their knowledge from passive declarative knowledge to active procedural knowledge, or 'understanding'. This transformation of the lecturers' and tutors' material is essentially an individual one according to constructivist theories of learning. It is facilitated by interacting in small groups. If the small group is a peer group then the absence of an authority demands that students devise

their own understandings rather than parroting an 'expert'. There is no evidence in the literature to suggest that problem solving strategies of experts are relevant for novices.

## Changing HE Population

The 1993 report on future trends by PCAS indicates a continuation of recent rises in demand for information studies and mathematical sciences in student applications. At the same time, the increase in students studying maths at GCSE Higher is consistently below the growth of HE students. The number of A level maths candidates has grown 40% from 10,000 to 14,000 between 1975 and 1990, whereas the number in higher education has grown over 200% during the same period. One reason for the growth in HE student numbers is the expansion of entry to mature groups. The new student body has much more varied qualifications: A levels, AS levels, BTEC, Access, GCSE, O levels, Overseas qualifications, Open University, and GNVQs. *"The mathematical skills of university entrants are declining, even within the A level framework, partly because the GCSE programme has changed the starting level in the sixth form. Many students begin their degree work without fluency in the basic mathematical languages of algebra and analysis. These essential*

# Instruction

*elements must be mastered before further developments are possible"* The Guardian [27/4/93]

The backgrounds of non-specialist students of maths are even weaker. For example, 49% of the 381 students surveyed during an introductory module in financial accounting, lacked GCSE (higher) in maths or equivalent. Some had never learned algebra even though such course modules assume high competency in numeracy.

## Support Strategies for Numeracy

This SI research project helps the students in HE who lack sufficient numeracy skills, on entry, to get the most out of higher education. The consequence otherwise - high attrition rates in the 'hard' modules, can be expected to cause students to abandon studying altogether. There are a number of strategies to reduce attrition rates. One strategy is to control admissions more rigorously. This would narrow the diversity of the University of Luton's student makeup, which is its great strength. A second is to establish support facilities. For example, the University of Luton now has drop-in workshops. This strategy is subject to the criticism that it is covering up bad teaching, a 'patch-up' operation. The implication is that the fundamental ills of ineffective teaching and learning strategies remain unaltered. A third strategy is to establish systems, such as SI, which empower students to play a greater role through informing the teaching and learning process.

## First Year Quantitative Workout

At the University of Luton, 1000 students sought maths help before Christmas at the Drop-in Workshop. They are enrolled in Psychology, Computing,

Business, Accounting, Geography and Engineering. Students who were unable to learn algebra, probability, statistics, calculus and linear algebra, when given time in secondary school, are expected to apply them within one year. However, there are no prior checks of the real degree of familiarity by students with those topics. Tony Groves' report (see page 5) makes it clear that crowded revision maths syllabuses in HE foundation courses for non-specialist mathematicians are common.

## What Students Want

In its day to day operation, the Drop-in Workshop is limited in its capacity to redress the students' lack of problem-solving strategies. One tutor dealing with several students from different courses has insufficient time to understand the particular student's difficulties well enough to facilitate understanding and often ends up teaching. The students themselves expect lecturers to provide information and feel cheated when lecturers refuse to play this role. The consequence is a remedial image for the workshop. Nevertheless, many students do want a problem-solving approach. For instance, twenty BSc Engineering students got together two months after their course began and requested our maths workshop to run a GCSE revision class in maths, although many of them already had this qualification. They have a need to make their maths skills active and useful.

This homogeneous group needed the workshop environment of a tutor who is an active listener and who facilitates cooperative group work, rather than providing information. What was not wanted by this group of engineering students was the workshop with its varied students with unconnected needs. SI provides a small cooperative group environment with the educational

benefits of students pooling expertise and sharing understanding, which is what the engineering students wanted.

## Supporting Open Learning

At the University of Luton and also nation-wide, there are plans to develop significantly more open learning modules and this requires students to become independent learners quickly.

Open learning modules demand more study and problem-solving skills than many first year students possess. SI specifically teaches these skills. Moreover it is a social activity which can compensate for the isolation of much open learning activity. It is perceived by students as non-remedial. Isn't this just what open learning modules need?

## GLASGOW CALEDONIAN UNIVERSITY

Preparation for Learning

SUPPLEMENTAL INSTRUCTION CONFERENCE

29th April 1994

at the

Centre Hotel, Glasgow

For further details

Tel: 041 331 3554

(HEFCE funded)

## Adults Learning Maths: A Research forum

Diana Coben is a Lecturer at Goldsmiths College.  
Joan O'Hagan is a Maths Tutor at Fircroft College in Birmingham.

**"What is needed is an independent forum for research, which would act as a focus for publication, committed to bringing together information and ideas of interest to numeracy practitioners and researchers, no matter what discipline they emanate from."**(1)

These words, published in *Adults Learning* last year, sparked off a tremendous amount of interest. The article argued for the establishment of a research forum bringing together those engaged in research, teaching and learning about adults learning maths and invited those interested to write to the author, Diana Coben. Researchers and practitioners from eight European countries, North America, Australia, as well as the UK, wrote expressing their support for the idea and wishing to be involved.

The inaugural conference of *Adults Learning Maths - A Research Forum*, took place at Fircroft College, Birmingham, in November 1993, and was attended by fifty delegates from the UK and other European countries. Many from further afield asked to be kept informed of developments and offered themselves as 'foreign correspondents'.

The conference aimed to establish a research forum and to begin the process of sharing information and ideas about research into adults learning maths. The keynote speaker, Professor Leone Burton, challenged delegates to examine how their views about maths shape research agendas, curriculum and assessment policy and practice, and teaching approaches.

Other workshops explored these themes further and Alexandra Withnall (University of Lancaster) outlined her research into older adults' needs and usage of numerical skills in everyday life. Joan O'Hagan ran another workshop entitled, "How Political and Educational Stances Drive Assessment Programmes". We pooled ideas and information about current and potential research projects and identified common aims for the research forum.

**"We are long past the pioneering era but numeracy is still the poor relation of adult literacy. What we need is the recognition of numeracy as a field worthy of serious study."**(1)

More research into adults learning maths is surely the key to achieving that recognition. The exercise of establishing the research forum has revealed a huge range of research interests and projects. Examples include 'Numeracy and Citizenship' at the University of Essex (2) and "Adults' Problem-Solving Strategies in the Supermarket" at the University of Utrecht (3).

The conference formed an Interim Steering Group, reflecting the wide range of research interests represented, including people from higher, further, adult and community education in the UK and abroad. The steering group met in January 1994 to formalise membership arrangements and plan the next conference. If you would like to be kept in touch with developments and receive membership details in due course, please write to "Adults Learning Maths: A Research Forum", c/o Dr Diana Coben, Department of Educational Studies, Goldsmiths' College, University of London, New Cross, London SE14 6NW.

### References

1. Coben, D. (1992) "What do we Need to Know? Issues in Numeracy Research." *Adults Learning* Vol.4. No.1. Leicester: Nat. Inst. of Adult Continuing Education pp 15-16.
2. Working Papers (1991-3); *The Role of Continuing Education in Overcoming Innumeracy*; Dept. of Mathematics, University of Essex, Wivenhoe Pk., Colchester CO4 3SQ.
3. VanGroenestijn, Mieke (ed.) Amersfoort, J. "Supermarket strategy: A Procedure to Determine the Level of Numeracy in Adult Basic Education. Available from HNM/FEO, PO Box 14007, 3508 SB Utrecht, NL.

**This article is an edited version of a forthcoming feature article in *Adults Learning* (Leicester).**

### First Inaugural Conference

Adults Learning Mathematics  
Sharing Research

Friday 22 to Sunday 24 July

at Fircroft College of  
Adult Education

1018 Bristol Rd  
Selly Oak, Birmingham

Tel: 021 472 0116  
ask for Joan O'Hagan or

081 692 71 71 ext 2133  
ask for Diana Coben

# Numeracy

## Numeracy across the Curriculum

Marion Canham and  
Vivien Ferguson of  
Cheltenham & Gloucester  
College of HE

This report covers the first part of a two year EHE - funded project, which commenced in May '93. The overall aim of the project is to ensure that students across the college have the necessary numeracy skills for both courses here and employment afterwards.

### Cheltenham & Gloucester College of Higher Education

The College offers courses in a wide range of disciplines at different levels. The undergraduate and BTEC programmes are mainly offered as part of the modular scheme, and a modular postgraduate scheme is commencing this academic year.

This undergraduate modular scheme contains around forty different subject areas, known as 'fields', from which students generally choose two main subjects of study. In addition, there are a variety of other courses offered, leading to professional or postgraduate qualifications.

### Phase One

The first phase of the project, from May to July, was concerned with identifying the numeracy skills in our College courses. In order to identify the numeracy skills required in courses, questionnaires were sent out to all field chairs, programme leaders and course leaders - some ninety in all. Fifty-eight responses were received (64%), and these are summarised in the table.

### Phase Two

The overall objective is to develop a suitable diagnostic test to be administered, on entry, to all students in the college. The purpose is to identify areas of possible weakness and provide appropriate systems for remedial help. We are investigating diagnostic tests in use in other institutions so we can adapt one for use here. Can you help us?

### Numeracy in Student Profiles

Discussions have also taken place with the heads of the undergraduate and BTEC Modular Schemes, the Senior Careers Advisor and Information Services, and all have expressed support for the project. One outcome is that a numeracy category has been introduced into the Academic Counselling Student Profile.

### Psychometric Testing

An area of concern for the College careers service is our students' ability to cope with psychometric tests, which are widely used in the graduate employment selection process. These

findings have been reinforced by recent visits to employers.

### Comments by Field Managers

"It has long been suggested by course representatives that many of our entrants need a preparatory numeracy skills pack to work on over the summer as a preparation for the course. ... our course needs it desperately...."

"GCSE Maths appears to guarantee little in terms of basic skills of understanding".

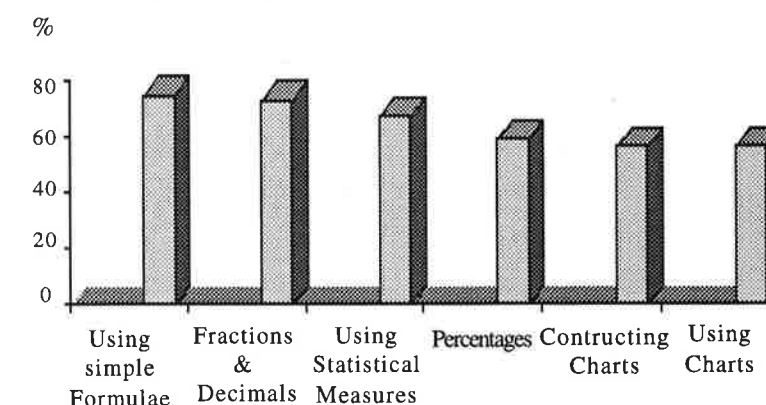
"All lecturers, who have a numerical content to their modules, are concerned about the poor level of numerical skills possessed by students in general".

"It is vital for students to have an understanding of how data is collected".

### Conclusions

We need to provide more numeracy support for our students and to better equip them for courses here and future employment.

## NUMERACY SKILLS IN OUR COLLEGE COURSES



# Adult Numeracy

## Using Reflective Journals in Numeracy Classes

Written by Ian Beveridge  
Centre for Educational Development  
University of Luton

Teaching adults numeracy is at once challenging and hugely rewarding. It is challenging when so many adults believe that maths is boring, difficult, irrelevant, too precise and, paradoxically, that there really should be only one way to do it and one correct answer. Moreover, it can only be achieved by those with 'maths minds' which they don't possess. Teaching adults means dealing with feelings which are often deeply rooted in past experiences (sometimes terrible).

The numeracy module which I teach aims to provide an understanding of arithmetic and also an interest in errors as opportunities to find out how our minds actually work. It is a first year module of a Diploma in HE in Educational Studies. The class consists of mature students who work in schools as nursery nurses and in other ancillary support roles in schools in the Luton area.

I thought that asking students to write reflective journals might allow future teachers to understand that the problem-solving process is just as much about managing your feelings as it is about learning useful heuristics. Students were asked to:

- analyse the environment they create in order to do their work
- learn to reflect on and articulate how they think while doing arithmetic problems
- note how they feel at each stage of doing each activity
- reflect back and identify the points where they feel like giving up

- explain regularly occurring errors and find a strategy for dealing with them
- note what is hard to understand and collect different explanations from other teachers
- consider how they would explain their newly learned knowledge to others
- collect literature which follows up ideas found to be interesting

Students were expected to write one to two sides per week on selected topics of interest. Alternatively, they wrote a similar amount as a commentary on their homework. In addition, they were asked to write a summary set of reflections looking for changes over time. What follows is a case study of one student:

*"I was dreading subtraction and that was what we were doing tonight. I hung on Ian's every word but I still could not grasp the concept. I was feverishly writing everything down off the overhead, when it disappeared. In disgust I wrote, 'I can't do it' to Sandie [a group member in a class of forty organised into ten small co-operative learning groups]. She wrote back, 'yes we can'. I know my group will try to help me but I think I have major problems..."*

*"We had to leave the security of our chosen student groups to play a game. I was number 4 [we counted off in twenties using clock arithmetic to get twenty groups of two]. Who will be my partner? It was Joan and I know her. We read the rules of the game together and she asked if I wanted addition or subtraction. I told her I could not do subtraction and she said 'Are you dyslexic?' I asked if there is a numerical form and she thought there was..."*

This student spoke to me after class and agreed that being able to subtract should be the goal for this module, "Understanding Arithmetic".

*"(My Partner) had sat with me for two and one-quarter hours and I still could not see why, for instance in  $72 - 23$ , I can't just take 2 away from 3 and leave 1. My partner got some grapes and put them in front of me, then showed me if you only have 2 grapes you cannot take 3 grapes away. I did this first sum and cried when I got the answer right. BY JOVE, I'VE GOT IT!!!!"*

The symptoms of a short term working memory, poor knowledge of addition and multiplication facts, and difficulty in recognising order in subtraction and division were all characteristic of this student, and of dyslexic thinking. However, after finding out how to subtract, long multiplication was found to be easier to learn than subtraction. Armed with these skills, long division was mastered and subsequently all four rules with fractions and decimals.

*"My total lack of skills and dyslexic tendencies have made ('understanding arithmetic') a difficult climb but I have now gained these skills, albeit a few years late. I am still very slow doing all my calculations and automaticity is not yet attained. Yet I shall continue to practise and feel that, although I still make silly mistakes, maths does not hold the terror and feeling of stupidity it once did."*

*Thank you not only for your patience and support, but also for allowing me to work slowly, at my own pace. You have shown me that maths can be fun."*

Had I given a grade based solely on the final exam, this student would have failed, despite having learned an enormous amount of mathematics. Using reflective journals has taught me that by allowing a student to go slowly, more learning can be accomplished. "Less is more" is not just true for Taoists but also for maths teachers.

# Maths Support Survey

## An Examination of Maths Support in Further and Higher Education

Ian Beveridge & Rakesh Bhanot  
CED University of Luton

A questionnaire was sent to eight hundred FHE institutions in the UK in February 1993 to ascertain current practice in maths support. We received one hundred forty-two replies, forty-two from HE and one hundred from colleges of FE. The extent of maths support in the FHE sector is shown by the following statistics:

- All responding institutions have at least one form, and most commonly three forms, of maths support. 76% offer drop in workshops, 47% offer open-learning opportunities, 40% foundation and bridging courses, 34% computer assisted learning and 23% supplemental instruction by students.
- In 60% of the institutions this support is resourced through faculty and in 40% through central funding.
- It is almost entirely staffed by maths lecturers, or dedicated support tutors.

Our survey also sought to identify key concerns of staff providing maths support:

- forty-five institutions identified high drop out rates in maths and related classes
- twenty-three reported low enrolments in courses with maths requirements.
- fourteen considered the content of the maths currently taught to be irrelevant, or an obstacle.

The survey also raises the issue of lack of co-ordination between major sectors of the educational system: between primary and secondary schools; between GCSE and A level; between A level and college maths; and especially

between FE and HE. Maths support is more readily available in FE and students moving to HE can be discouraged from pursuing courses of study requiring mathematical skills.

Our survey supports the observation, made by all three contributors to the feature in The Guardian (27/4/93) on 4 year maths degrees, of declining standards in the teaching of maths in schools. The comments in our survey provide further evidence of this.

In FHE institutions where there has been decentralisation into various faculties, the desire of faculties to control the content and delivery of courses has reduced the amount of servicing required from maths specialists. This tendency is reinforced by the linking of maths with other subject specialisms, such as geography with maths or business with maths. Brunel University is an example of an institution with a wide range of 'joint degrees'. Such courses are common and increasing among the newer universities.

The widening of access to higher education has meant that A level in maths is no longer the pre-requisite for studying technology that it was in the past. At the same time, the status of maths at A level is in question, as implied in Professor McBeth's finding, that A level grades are a poor predictor of final degree results, (Guardian of 27/4/93). In view of this, the FHE sector needs to respond to the new challenges of preparing a larger section of the population by providing more maths support.

The pressure for such support can be expected to increase as a consequence of the new funding arrangements which began in 1993. Under the new rules, a student on a technology course 'earns' for HE institutions more than twice the amount of a student on e.g. a humanities degree. Ironically, students of pure maths will be placed in the lower band. This will inevitably mean fewer maths courses on offer in HE and in the long run even fewer maths teachers who are pure mathematicians.



# Conference

Ian Beveridge and Rakesh Bhanot of the Centre for Educational Development, University of Luton, organised the first national conference in maths support in FHE which attracted sixty-six delegates from across the country. The keynote speaker was Professor Kath Hart of the Shell Centre at Nottingham University who was introduced by Dr. Dai John, deputy Vice-Chancellor, at Putteridge Bury, on 26 May, 1993.

John Lane  
Newman College,  
Birmingham.

1. **Overwhelming impression:** dedicated enthusiasts, struggling to cope with a desperate situation which is getting worse each year. Usually with inadequate resources.
2. **Heartfelt cries:** how do we cope with ever-larger classes and with an ever-widening range of backgrounds?
3. **Metaphors:** 'lifeboat, lifebelt, plugging gaps'; giving reassurance, giving more individual time.
4. **Issues:** lowering hurdles, helping over hurdles, changing entry level, changing exit level, changing content.
5. **Tortoises into Hares:** lowered entry requirements and maintained exit targets produce the paradox that we expect 'slow learners' to catch up with (i.e. learn faster than) 'fast learners'!
6. **No employment guarantee:** - industry wants higher standards, while colleges lower them, to widen access to students desperate to acquire qualifications.
7. **Is Maths a Critical Filter?** It is all too easy, in this context, for 'maths requirements' to expand beyond the needs of students - and so, beyond the reach of many. Maths acts as a filter to reduce the number of students permitted to succeed - and legitimises the process by making most of the others feel like failures.
8. **Inequalities:** race, gender and class inequalities are likely to persist and be reinforced. Good resources help if equally available.
9. **Proactive versus Reactive:** we may make gains if we change the focus from reactive stop-gaps on content to pro-active development of individual learning styles.
10. **Workshops and maths support must be seen as 'innovative mainstream':** some view this as a cheap option for helping the 'undeserving', and allow it to be marginalised and stigmatised: working in corners and cloakrooms; at lunch times and after hours; with resources begged, borrowed or stolen; without technical help.  
  
*The vital need here is to professionalise the work.*

# Proceedings

11. **Two tendencies were manifest at the conference:** there were humanists, raising the wider issues and ready to face the question of whether 'helping' students in a piecemeal, short-term way is of benefit to students. And there were eager technocrats, pioneers, getting on with the job as set, networking, building empires, hi-jacking the conference!
12. **The paradox arising in primary teacher education:** some students have internalised both traditional practices and personal feelings of failure/antipathy associated with them. The package they want combines the comforting familiarity of traditional practices with the opposite affective outcome of success/confidence. *They ask for 'magical' methods courses which show them "how to get it across". They resist teaching for "relational" rather than "instrumental" understanding.*
13. **The Question of the Paradox:** can we expect student-teachers, many of whom are not independent learners, to produce students who are?
14. **Maths blockages don't exist:** Professor Kath Hart identified the problem of school children who are bright and feel successful in other subjects but experience failures in maths. *Research attempts have never been able to sustain the existence of non-mathematical brains'. Do we expect too much too early? Can we encourage more positive attitudes to errors?*
15. **Proposals left on the table:** to develop the theme of the conference: namely; a national organisation, a newsletter and an annual conference.  
*Higher quality means higher unit costs. It is hypocritical for institutions to enter this arena unless they accept this.*

## Postscript by a Student-Teacher

Before the course I was apprehensive about it but open-minded. I saw the course as a challenge and in some ways was quite excited about it. Hooked forward to having my eyes opened.

I don't believe I have a maths phobia. It was just a subject I didn't do well in at school and had no particular interest in. I was usually graded near the middle of the top group. At the all girls school, a secondary modern, we were schooled in preparation to become "good secretaries". So our maths was based on book-keeping, with very little algebra, trigonometry or geometry. Six months before I left school I attended a mixed school, where the emphasis was the other way.....it seemed all algebra, trigonometry and logarithms. My maths teacher there decided that it was better to let me write letters to my French pen-pal than to try to teach me. The little I did learn, I have forgotten. In basic mental arithmetic, I have no problem. One of my jobs in the past was statistics. Everything had to be worked out in my head or on paper because this was the time before pocket calculators. I would like to achieve something with this course because it would boost my confidence and, hopefully, I could take GCSE maths.

(written in a reflective journal for a numeracy course)



## Delegates' Interests at the First National Conference Supporting Mathematics in FHE

SI = Supplemental Instruction; WS = Drop-in Workshops; OL = Open Learning; CAL = Computer Assisted Learning;  
 Num = Numeracy, Foundation & Bridging maths; Pol = Political Dimensions of Mathematics.

| First Name     | Last Name   | Organisation                             | SI                   | WS | OL | CAL | Num | Pol |
|----------------|-------------|--|----------------------|----|----|-----|-----|-----|
| J N            | Ahmad       | University of Sunderland                 | 0                    | 1  | 2  | 0   | 3   | 0   |
| Afzal          | Ahmed       | Centre for Maths Education               | 0                    | 1  | 2  | 2   | 1   | 1   |
| R              | Baldwin     | Stamford College of FE                   | 0                    | 1  | 2  | 0   | 3   | 0   |
| Ian            | Beveridge   | University of Luton                      | 1                    | 2  | 2  | 2   | 1   | 2   |
| Rakesh         | Bhanot      | University of Luton                      | 0                    | 0  | 3  | 0   | 2   | 1   |
| David          | Bowers      | Suffolk College of FE                    | 0                    | 1  | 0  | 2   | 3   | 0   |
| Christine      | Bowmaker    | North London College of FE               | 2                    | 0  | 1  | 0   | 3   | 0   |
| C              | Boyce       | Telford College of Arts and Technology   | 2                    | 1  | 0  | 0   | 3   | 0   |
| Dr B D         | Bunday      | University of Bradford                   | 1                    | 3  | 0  | 2   | 4   | 0   |
| Marion         | Canham      | Cheltenham & Gloucester College of HE    | 3                    | 2  | 4  | 5   | 1   | 6   |
| John           | Cummings    | Bracknell College of FE                  | 0                    | 1  | 2  | 3   | 0   | 0   |
| A W            | Cushen      | Eastbourne College of Arts and Tech      | 2                    | 1  | 1  | 1   | 2   | 3   |
| Maureen        | Donelan     | Acad Enterprise University College Lond. | 1                    | 0  | 0  | 0   | 0   | 0   |
| Susan          | Elliott     | Sheffield Hallam University              | 0                    | 1  | 2  | 0   | 3   | 2   |
| L A            | Farrow      | Tresham Institute                        | 0                    | 3  | 0  | 1   | 2   | 0   |
| Tony           | Fleet       | Liverpool Institute of Higher Education  | 0                    | 0  | 1  | 0   | 0   | 0   |
| M E            | Freeman     | Stamford College of FE                   | 3                    | 0  | 1  | 2   | 0   | 0   |
| Barry          | Galpin      | Open University                          | 0                    | 3  | 2  | 1   | 0   | 0   |
| Barry          | Grantham    | Liverpool Institute of Higher Education  | 0                    | 0  | 0  | 1   | 0   | 0   |
| Tony           | Grove       | The Nottingham Trent University          | 0                    | 3  | 1  | 3   | 1   | 0   |
| Peter          | Gwilliam    | Lewes Tertiary College                   | 0                    | 1  | 3  | 2   | 0   | 0   |
| C              | Harding     | Wulfrun College of FE                    | 0                    | 1  | 0  | 2   | 3   | 0   |
| K              | Harding     | West Kent College of FE                  | 0                    | 1  | 0  | 2   | 3   | 0   |
| Professor Kath | Hart        | Shell Centre for Mathematics Education   | 0                    | 1  | 1  | 1   | 1   | 0   |
| Carolyn        | Hawkes      | University of Northumbria at Newcastle   | 0                    | 1  | 0  | 3   | 2   | 0   |
| Paul           | Heley       | University of Luton                      | 2                    | 3  | 4  | 0   | 1   | 0   |
| Lynette        | Helmores    | Clarendon College of HE                  | 0                    | 0  | 0  | 1   | 0   | 0   |
| Angela         | Herbert     | Merton College of FE                     | 0                    | 1  | 0  | 3   | 0   | 2   |
| Christine      | Jenkins     | Dunstable College of FE                  | 0                    | 1  | 3  | 2   | 0   | 0   |
| Helen          | Johnson     | Bolton College of Higher Education       | 1                    | 0  | 0  | 0   | 0   | 0   |
| Gerry          | Jones       | East Berks College of FE                 | 0                    | 0  | 0  | 0   | 0   | 0   |
| Nigel          | Jones       | Stoke-on-Trent College of HE             | 0                    | 2  | 3  | 1   | 0   | 0   |
| M A            | Kujawa      | South Trafford College of FE             | 0                    | 1  | 0  | 2   | 3   | 0   |
| John           | Lane        | Newman College of FE                     | 0                    | 3  | 0  | 0   | 2   | 1   |
| Dr Alan        | Longstaff   | University of Hertfordshire              | 3                    | 0  | 1  | 0   | 2   | 0   |
| H              | MacKirdy    | Orpington College of Further Education   | 0                    | 1  | 4  | 2   | 3   | 0   |
| Wendy          | May         | University of Plymouth                   | 0                    | 1  | 3  | 4   | 2   | 0   |
| Kim            | McCaffrey   | Coventry University                      | 0                    | 0  | 1  | 0   | 2   | 0   |
| Joan           | O'Hagan     | Fircroft College of FE                   | 0                    | 1  | 0  | 0   | 1   | 2   |
| Diane          | Parker      | Cheltenham & Glos. College of HE         | 0                    | 1  | 2  | 3   | 0   | 0   |
| Judith         | Pitchforth  | The Sheffield College of FE              | 3                    | 0  | 2  | 0   | 1   | 0   |
| Dr H Gareth    | Roberts     | Coleg Normal                             | 0                    | 1  | 0  | 0   | 2   | 3   |
| Anthony        | Robinson    | Colchester Institute                     | 0                    | 2  | 3  | 1   | 0   | 0   |
| Peter          | Samuels     | Brunel University                        | Psychometric testing |    |    |     |     |     |
| C J            | Schramm     | South Thames College of FE               | 0                    | 1  | 3  | 2   | 0   | 0   |
| Michele        | Selinger    | Open University                          | 0                    | 0  | 1  | 2   | 3   | 0   |
| Chris          | Shoostarian | University of Luton                      | 2                    | 3  | 4  | 0   | 0   | 1   |
| Europe         | Singh       | BBC Education                            | 0                    | 0  | 0  | 0   | 0   | 1   |
| B              | Smith       | Basingstoke College of Technology        | 0                    | 1  | 3  | 2   | 3   | 0   |
| Evelyn         | Snowdon     | Glenrothes College                       | 3                    | 1  | 0  | 2   | 0   | 0   |
| Celia          | Storey      | Bracknell College of FE                  | 1                    | 0  | 0  | 3   | 2   | 0   |
| Maggie         | Thomas      | Northampton College of FE                | 0                    | 1  | 0  | 0   | 3   | 2   |
| Frank          | Turner      | North East Surrey College of Technology  | 0                    | 0  | 0  | 2   | 1   | 3   |
| Elaine         | Walsh       | University of Luton                      | 0                    | 0  | 2  | 1   | 3   | 0   |
| Alf            | Westwell    | Liverpool Institute of Higher Education  | 0                    | 0  | 0  | 0   | 0   | 1   |
| Alison         | Whitehead   | Coventry University                      | 0                    | 1  | 3  | 0   | 2   | 0   |
| Clyde          | Wood        | Peterborough Regional College            | 3                    | 1  | 0  | 2   | 0   | 0   |
| Stephen        | Young       | Nene College of Higher Education         | 0                    | 0  | 0  | 0   | 0   | 0   |
| Royston        | Young       | Coventry University                      | 0                    | 2  | 1  | 0   | 3   | 0   |