

**Enriching the Learning Environment: a CALM approach.**

*Critical and Analytical Learning in Macroeconomics (CALM) through a Web mediated learning environment.*

C. Johnston and N. Olekalns

Paper for the EAIR Forum  
Berlin

September 2000

Dr Carol Johnston  
Teaching and Learning Unit  
Faculty of Economics and Commerce  
University of Melbourne  
Parkville, Victoria 3052  
Australia  
Phone +61 3 8344 9699  
email [c.johnston@ecomfac.unimelb.edu.au](mailto:c.johnston@ecomfac.unimelb.edu.au)

Dr Nilss Olekalns  
Department of Economics  
Faculty of Economics and Commerce  
University of Melbourne  
Parkville, Victoria 3052  
Australia  
+61 3 8344 9699  
[n.olekalns@ecomfac.unimelb.edu.au](mailto:n.olekalns@ecomfac.unimelb.edu.au)

## INTRODUCTION

The context in which learning takes place is changing rapidly and requires equally rapid and innovative changes in traditional approaches to teaching and in subject delivery. The direction that these changes take will to some extent be driven by the vision educational institutions have for their future. The road that these institutions choose will be a determinant of their success and the success of their students in being productive participants in the new millennium.

Employers in Australia report that graduate job applicants are likely to lack a capacity for independent, critical thinking and problem solving skills and a capacity for clear oral and written communication, DETYA (2000). These attributes are highly congruent with the capacities that academics aim to develop in their students, Ramsden (1993). Students report that they want subjects that relate theory to real world problems and that provide early feedback on their progress. They also indicate that they experience some difficulty in making the transition from school to university, McInnis and James (2000). If, as seems to be the case, the key stakeholders in the learning process are not fully satisfied there is a need to develop methods of teaching and learning that specifically address their requirements.

The Department of Economics at Melbourne University has responded to these challenges in a number of ways. It is concerned to develop appropriate skills for lifelong independent learning, to actively engage students in the study of economics from first year, to ease the transition from school to university and to provide students with the skills required by employers. In light of this the Department has taken its large, compulsory Introductory Macroeconomics subject as the focus of development of a number of teaching and learning strategies designed to support and challenge students in their learning. Included in these strategies, but not reported here, are self paced text editing revision modules<sup>1</sup>, audio streaming of lectures, interactive lecture delivery, Collaborative Problem Solving (CPS)<sup>2</sup> tutorials and individual economics, maths and language tuition as required by students. In 1999 a new element was introduced that has become central to teaching and learning in the subject and is the focus of this paper. This was the development of the Internet-based, subject delivery and assessment software, Critical and Analytical Learning in Macroeconomics (CALM). This paper outlines the nature of the CALM project and reports the results of an extensive evaluation of the effect on student attitudes and learning outcomes.

## BACKGROUND

Several elements of the current Higher Education environment have provided the context for the development of the CALM system. Among these the need to develop a closer relationship between the academic view and employers view of the skills required by our graduates including critical thinking and problem solving skill development; the emphasis on student learning rather than on teaching which encompasses an encouragement of deeper approaches to learning and lifelong learning; issues related to the transition of students from school to university; and finally effective use of electronic technologies to enrich the student learning environment.

---

<sup>1</sup> These are where students are presented with a scenario and asked if there is sufficient, insufficient or superfluous information provided in order to answer the questions. This type of question has been found to be more challenging and tests for a deeper level of understanding than is typically possible using multiple choice questions.

<sup>2</sup> This strategy which is now used in all the Departments first and second year subjects is explained in more detail in Johnston, James, Lye, McDonald (2000).

## **Workplace skills**

A number of reports from around the world indicated the growing perception that investment in workforce skills is becoming equally important as investment in capital and infrastructure, if countries and companies are to maintain a competitive edge<sup>3</sup>. Currently there is a perceived mismatch between skills taught in our educational institutions and the requirements of the labour market. The skills that have been identified as important in the workforce of the future are<sup>4</sup>: 1) good communication skills; reading, writing, speaking listening, 2) ability to learn independently, 3) social skills: ethics; positive attitudes; responsibility, 4) teamwork, 5) ability to adapt to changing circumstances, 6) thinking skills; problem solving; critical/ logical/ numerical, 7) knowledge navigation: where to get/ how to process information

In response to the changing demands for workplace skills post secondary educational institutions are also changing their focus. The Department of Economics at the University of Melbourne has sought to combine the skills required for the workforce of the future with the characteristics of the new learning environment. The CALM project places particular emphasis on independent learning and critical thinking skills as well as on the development of confidence in using the new electronic teaching and learning technologies. The emphasis has been on improving the quality of both the level and the type of learning outcomes.

## **Approaches to learning**

Educators have been keenly aware for at least the last decade that student learning outcomes are enhanced when there is a recognition of the interrelatedness of teaching methods employed with the learning styles and approaches to learning of students, Entwistle and Ramsden 1983, Kolb 1984. Qualitative differences in student learning can result from students' personal attitudes towards a learning task and the context in which the learning occurs. Marton and Saljo (1976) first articulated differences between deep and surface learning. Students who use a deep approach are personally involved in the learning task and seek to obtain some underlying meaning. In addition they aim to understand relationships between the immediate task and other tasks or contexts. Such students are likely to read extensively around a given topic, are motivated to discuss the topic with others, and ultimately achieve higher grades on assessment tasks (assuming the assessment instrument is designed to assess more than a simple recall of facts) than students who use a surface approach (Biggs, 1987).

A surface approach to learning on the other hand, arises when the student sees learning as a means to achieve a short term goal which may be simply to do enough work to pass an assessment hurdle. Students who adopt this approach are motivated by an extrinsic objective and will commit unrelated facts to their short term memory, but are unlikely to be able to establish meaning or relationships between or within given tasks. The student is dependent on the teacher and is unlikely to achieve highly on assessment tasks that are designed to test higher order thinking (Biggs, 1987).

Biggs (1979; 1987) and Entwistle and Ramsden (1983) have proposed a third approach to learning, the so-called 'achieving' approach. The student using this approach is motivated extrinsically and creates a highly organised, productive approach to their learning. These

---

<sup>3</sup> Dearing report (1997), DETYA (2000) British Columbia Labor Force Development Board (1995)

<sup>4</sup> Conference Board of Canada 1991 Employability Skills Profile: The Critical Skills Required of the Canadian Workforce, Ottawa, Ont. The Conference Board of Canada.

students work to achieve grades that fit in with their egos or career aspirations. They have studied the game carefully and adjust their learning according to the rules as they perceive them.

The relationship between these three types of learning and the study habits that accompany them are complex. Ramsden (1992) notes that while a surface approach will inevitably lead to poor understanding and a deep or achieving approach to a high level of understanding, it should not be assumed that a surface approach is necessarily adopted by weaker students and a deeper approach by highly competent ones. Furthermore, the three approaches to learning are not mutually exclusive. Students may adopt different approaches according to the task, the course or the teaching style. Nevertheless, it might be expected that graduates who have become adept at analysing and synthesising knowledge to solve practical problems are more likely to have adopted a deep approach to learning during their undergraduate work, one which has involved them intimately in the learning process. Their approach to learning is likely to be more sophisticated than that of a student who has learnt to jump over various hurdles but has not retained and cannot use much of what has been 'learnt'. Assessment a powerful tool to stimulate the type of approach to learning that will encourage deeper approaches to learning. If the economics curriculum and teaching styles encourage surface learning then this would be a loss, to the community and to the students themselves. The Department of Economics through the CALM project uses assessment as one vehicle for the encouragement of these deeper approaches.

### **Lifelong learning**

The development of lifelong learning skills is related to the development of deep approaches to learning in students and the propensity and capacity for lifelong learning has in recent years become an overarching goal of higher education. The lifelong learner is a graduate with an inquiring mind (a love of learning), helicopter vision (a breadth of vision), information literacy (the ability to locate, retrieve and decode information using a variety of media), a sense of personal agency (a positive self-concept) and a repertoire of learning skills (Candy et al, 1994). The question is how universities can develop curricula to improve the conditions under which this kind of learning can occur. The fundamental shift that is required, it would seem, is towards approaches to teaching and learning that target students' ways of thinking and reasoning, accompanied by reduced concern for knowledge accumulation. For university teachers this means an emphasis on how students learn as much as what they learn.

### **Critical thinking**

Critical thinking encompasses a number of key elements, among them a capacity to work with ambiguity and to recognise that issues can be viewed from many different perspectives'. Individuals who have developed the capacity for critical thinking are predisposed towards independence and autonomy. These individuals are able to apply principles and theories learned in one context and to apply them to another.

Critical thinking is a key pedagogical goal of the CALM project however explaining to students what we mean when we use the concept is problematic. There has been a plethora articles that attempt to define critical thinking (see for example Johnson 1992, Feeley 1976, Feiner and Roberts 1995) each of which emphasises different aspects of the concept. The CALM project broadly adopted an operational approach in so far as the following elements of critical thinking were used in assessing student work. The students should be able to 1) distinguish between positive and normative statements 2) determine the reliability of a source 3) determine the factual accuracy of a statement 4) distinguish the relevant from the irrelevant, 5) identify unstated

assumptions 6) identify inappropriate use of assumptions and ambiguous arguments 7) recognise logical inconsistencies in the line of reasoning 8) determine the strengths of an argument

A critically reflective learning strategy such as CALM was seen as one which could encourage deeper learning and the development of higher order thinking skills sustainable in the longer term, and would provide an avenue for improving written communication skills. The project design was based on the assumption that deeper learning is more likely when students reflect on their own learning, the stimulus for learning is real world problems and issues, and assessment rewards the ability to analyse, synthesise and critically evaluate complex material.

### **Transition**

The early experiences of undergraduate students are important in terms of establishing attitudes outlooks and learning that they take with them throughout their course and into their work environment. The losses incurred when students do not make this transition successfully are great. McInnis and James (1995) report in their study of Australian first year students that of those that were school leavers 82percent do not seek advice or assistance from academic staff, 39percent did not find staff approachable, 79percent did not believe that staff took an interest in their progress and 74percent did not agree that staff gave helpful feedback. They also found that managing the workload was a key factor in contributing to a satisfactory transition and that feedback on progress was of crucial importance to all first year students. These issues were addressed in the design of the CALM project through an increase in the amount of feedback and an increase in the variety of forms in which feedback is provided. In addition the availability and forms of assistance to students were also increased.

Studies by Slavin (1990) and Palinscar and Brown (1984) show that an individual student's achievement is consistently positively related to the level of help that the student gives to others. The CALM system provides the opportunity to interact in a structured way with peers through reading their work and commenting upon it. This process compels students to externalise their thoughts and make their ideas explicit. Enhanced understanding results because students must think about the material, develop and structure explanations Other benefits of students interacting directly with their peers about their learning in a subject include improved communication skills, increased in individual self-confidence and new levels of openness to ideas. Strategies for active learning of this kind have been widely documented (see, for example, Meyer & Jones 1993).

### **Internet-based teaching technologies**

Face to face teaching is only one of the means by which learning is brought about and is decreasing in importance with the rise of more flexible, more electronically distributed, more open, more learner controlled forms of learning. In order to encourage students to see the world differently that is to learn, a wide variety of forms of delivery should be employed. Some of the advantages of on-line delivery of elements of subjects as identified in a study by Harasim et al (1997) are the increased interaction between students and other students and students and staff in terms of both the quantity and intensity of the interaction; better access to group knowledge and support, a more democratic environment where students respond to content rather than personalities; convenience of access and for many increased motivation. The asynchronous nature of on-line interactions allow students time to reflect on a topic before completing an on line task.

## THE CALM PROJECT

Introductory Macroeconomics is taught in two, one hour lectures per week and one tutorial typically of 18 students. There are approximately 1200 students enrolled each year. The lectures are taken by the same lecturer, are repeated three times on the same day and each lecture commonly has 400 students attending at a time. The tutorials are organised on a Collaborative Problem Solving (CPS) basis whereby students are further divided into groups of 4 students to solve previously unseen problems based on pre-reading exercises. Assessment comprises examination 60 percent, tutorial participation and attendance 10 percent and CALM responses and critical comments 20 percent.

The CALM system is a new approach to subject delivery and assessment in Introductory Macroeconomics that was trialed in the Department of Economics at the University of Melbourne in Semester 2 1999. The system requires students to apply the economic theory that is developed in lectures and tutorials to current real world economic issues and to reflect on their own work and to critically analyse and reflect on the work of their student peers. Given the large numbers of students involved in the subject this approach would not have been possible in a paper based environment. Internet technology was used to facilitate the delivery of this element of the subject.

There are several ideas that underlie the CALM approach. Firstly we have assumed that students learn more effectively and at a deeper level if they work consistently throughout the semester rather than cramming for an examination at the end. Continuous learning aids in the establishment of deeper learning where material is remembered over a longer period. Secondly we responded to the view that students require earlier, more detailed feedback on their progress. Student quality of teaching questionnaires indicates that students feel that they do not receive sufficient feedback early enough in the semester to be helpful to their study. Elements of the CALM Internet delivered system have been designed to provide this feedback in an interactive, resource efficient manner. Thirdly we assume that students require a variety of learning experiences in order to develop deeper learning approaches and critical thinking skills. They require practice in applying economic principles to a variety of contexts so that they will be able to use these principles to new situations in their future work. Fourthly we have responded employer criticism of a lack of critical thinking skills in graduates and our own academic view that critical thinking skills are important to the learning process. We aimed to contribute to the earlier development and enhancement of these skills through the new form of assessment. Fifthly we recognised the need to develop in our first year students confidence in their computer related and Internet related skills that they use in later years of study and in the workplace.

### Objectives

This new approach to assessment and learning in Macroeconomics (CALM) aims to:

- to encourage more consistent study patterns in first year students
- to encourage students to reflect on their learning as a way of encouraging a deeper approach
- to introduce students to constructive critical analysis of others work. Students are required by the tasks to seek meaning in order to apply economics theory to new situations and they also have to reflect on their own learning in order to be able to critically comment on others work.
- to provide students with early detailed feedback on their understanding in which they are active, reflective participants in the feedback process.
- to introduce students to the practical application of theory to real world economic issues

- to understand and appreciate the reasons for uncertainty in relation to real economic issues
- to enhance student confidence in their use the electronic learning technologies.

### **Components**

The CALM system comprises several interrelated components. The issues page, the tutorial groups responses and comments pages, the on-line tutor and the individual students page for private messages from the ‘on-line’ and ‘live’ tutors and assessment results and comments.

### **Process**

In the first week of the 12 week semester all students are assigned to a ‘live’ CPS tutorial as well as a CALM on-line tutorial composed of the same students. Three macroeconomic issues are posted to the on-line tutorial ‘Issues’ page over the course of the semester; one at week, two one around week 5 and one at week 8. Each student is required to answer questions associated with each issue. This requires the student to apply the economic theory developed in lectures and ‘live’ tutorials to the issue. This is termed a ‘response’. All responses are electronically submitted to the CALM ‘Responses’ page. Students can edit and change their own responses up to the submission date. After this date all students in their tutorial can view all responses derived from that tutorial. All student identification is removed when responses appear on the responses page to allow for student privacy concerns. The display of the tutorial members responses provides students with useful feedback on the standard of their own work in relation to others in the tutorial and also allows them to see the range of responses to the same issue that are possible.

The next stage in the process is designed to develop reflection and critical thinking skills in students. Students read the responses posted for their tutorial group and select and reserve one response on which to critically comment. Students are provided with a list of criteria on which to base their comment and a sample critical comment on which to model their work. This form of ‘scaffold’ to support student learning was thought to be necessary for first year students who had not attempted a critical comments previously in their undergraduate study. The comments that students make on other student’s work provide peer feedback and stimulate reflection on the students own work. Following final submission all responses and comments are available for all CALM tutorial members to view. This process is repeated for each of the three issues.

A general feedback report is posted by the on-line tutor to all CALM on-line tutorial groups that summarises key strengths observed in the responses and critical comments and outlining common misconceptions in relation to each issue. The On-line tutor also posts a model response and a model critical comment to each issue so that students can compare their own responses and comments with other students and with the model.

The CALM feedback system is designed to provide more feedback and to encourage students to take a more active role in the feedback process through their own reflection on their work. Feedback is provided in a number of forms. Students receive a mark on their response and comment, are able to view other students work in their own tutorial; can view the model responses and comments provided by the on-line tutor; are provided with the on-line tutors overview report at the end of each issue; and can obtain individual personal comment from their tutor who has assessed their work.

During the semester students submit in total three responses and three comments at roughly two week intervals. This process aimed to encourage more consistent study habits as students had to

develop a sound understanding of the material before they could respond or comment on the issues raised.

At the end of each issue all responses and comments are assessed and results posted to the students individual CALM page so that student's have a record of how well they are performing. The first issue carries less weight to allow students to become familiar with the system.

Through their interaction with the CALM system students reflect on their understanding, develop critical thinking skills, learn to appreciate the relevance of economics and are provided with earlier and more detailed feedback than would be the case without the use of the CALM assessment module.

### **The On-line tutor**

The On-line tutor is an integral component of the CALM system. The On-line tutor enables students to ask questions of an appointed tutor via the Internet . Students can ask questions of the On-line tutor at any time and these will be answered within a 24 hour period. The questions and answers are posted to a CALM bulletin board for all students to see. This allows all students to have access to the information not just the student who posed the question. Questions are sorted by topic so that student's can refer to the On-line tutor bulletin board when they are revising for examinations or completing an assignment. This aspect distinguishes the On-line tutor from an email tutor. Students can ask questions when they think of them at any time of the day or night and it does not require them to come into the university. The On-line tutor can also post messages to individual students as well as to all students in the subject. The appointed On-line tutor also takes a live tutorial in the subject and is encouraged to attend all lectures so that he/she is familiar with all aspects of the subject delivery.

### **Assistance to tutors and students**

Students require information on how to use the software in a variety of forms. Paper copies of instructions are provided to students at the start of semester and Internet help instructions are available at each step of the CALM system. In addition a short demonstration of the system is provided at the start of lectures in the first week of semester. A more detailed demonstration is conducted a week later at lunchtime for students who feel that they need further illustration of the system. In addition a tutor was made available for those students using the computer laboratory on the day of submission of responses and comments in case students experienced difficulty. All 'live' tutors are trained in the use of the system from the administrative point of view particularly in relation to their submission of marks and comments to individual students.

## **EVALUATION OF THE CALM STRATEGY**

Continuous evaluation of CALM was considered a priority in the design stage of the project. The new strategy is evaluated in a variety of ways. Students complete an attitude survey at the start and end of the semester, they complete two university wide questions related to their use of the Internet and its use, tutors are interviewed in the middle of the semester and are surveyed at the end and an examination question, worth 40 percent of the final exam mark, is set that is designed to pick up on the skills that are developed through the CALM system. We report briefly on each of results of each of these forms of evaluation based on the first semester's operation of CALM (Semester 2, 1999).

## Attitude survey

Students completed the first survey in tutorials in the first week of the semester and the second in the tenth week. Completion of the survey was voluntary. Total enrolment in the subject was around 1174 students. Approximately 70percent of students completed the first survey and 57percent completed the second. In both surveys, students from non-English speaking backgrounds (NESB) comprised about 40percent of the cohort.

We asked students about their language background, whether they had completed Introductory Microeconomics, a pre-requisite subject for Introductory Macroeconomics, in the previous semester, their intentions in relation to part time work and their use and perception of the Microeconomics subject home page on the Internet. The second survey differed only in so far as we asked whether students had actually worked, how much they had worked and their use and perceptions of the Introductory Macroeconomics home page. Results of the first section of both surveys are reported in Table 1.

	Pre		Post	
	Total	NESB	Total	NESB
Total respondents	848	343 (40%)	681	265 (39%)
1. Male	432 (51%)	136 (40%)	357 (52%)	115 (44%)
Female	416 (49%)	207(60%)	324 (48%)	150(56%)
2. ESB	505 (60%)	-	416 (61%)	
NESB	343 (40%)	-	264 (39%)	-
3. Did Intro Micro in Semester 1 1999	768 (91%)	310 (90%)	627 (92%)	245 (92%)
4. Intend to work/Worked part time ( <i>did not work 326</i> )	522 (61%)	168 (49%)	358 (53%)	94 (35%)
<10 hours per week	226 (43%)	90 (54%)	143 (40%)	51 (54%)
10-20 hours per week	265 (51%)	73 (43%)	188 (53%)	40 (43%)
>20 hours per week	31 (6%)	4 (2%)	26 (7%)	3 (3%)
5. In Semester 1 used Into Micro home page. (In semester 2 used intro macro Internet home page)				
Never	233 (28%)	70 (20%)	18(3%)	4 (2%)
Sometimes	529 (62%)	232 (68%)	257 (38%)	95 (36%)
Regularly	86 (10%)	44 (13%)	406 (60%)	167 (63%)
6. If you used the Introductory Microeconomics (Macroeconomics) home page did it improve your perception of subject delivery?	615	276	679	266
Yes	320 (38%)	152 (44%)	503 (74%)	203 (76%)
No	295(62%)	124 (56%)	176 (26%)	63 (24%)

Gender, language background and completion of Introductory Microeconomics was similar for both groups of respondents. Of interest is the lower percentage of students who actually worked and work relative to the intention to do so at the start of the semester. The percentage of non English speaking background (NESB) students who intended to work and who actually did work was much lower than for English speaking background (ESB) students (Table 1. Item 4 ). We were interested in the amount of part time work students were doing as we suspected that part time work was occupying a significant proportion of student time and could be impinging on their study. The results indicate that over 50 percent of our students work part time and that of these 60 percent work more than the recommended maximum of 10 hours per week.

Student use of the Internet increased in second semester relative to first semester and students were much more likely to report that use of the subject home page improved their perception of subject delivery.

The second section of the survey asked students to rate their confidence in relation to key skills. Results of this section are reported in Table 2

1) Rate your confidence in relation to the following skills:												
Skills	Always Confident		Generally Confident		Sometimes Confident		Generally Not Confident		Never Confident		Mean	
	pre	post	pre	Post	pre	Post	pre	Post	Pre	Post	pre	post
<b>ALL STUDENTS</b>												
<i>Pre-N = 848; Post-N=681</i>												
a) Computer related skills	155	156	405	360	202	126	69	32	13	7	3.7	3.9
b) Internet related skills	164	170	402	338	200	136	68	31	14	6	3.6	3.9
c) Critical thinking skills	59	40	351	275	329	288	97	71	8	5	3.4	3.4
d) Problem solving skills	58	46	329	246	355	303	94	77	8	9	3.4	3.3
<b>ESB</b>												
<i>Pre-N = 505; Post-N=416</i>												
a) Computer related skills	111	107	247	227	109	60	35	19	1	3	3.8	4.0
b) Internet related skills	105	111	242	206	109	77	39	19	10	3	3.8	4.0
c) Critical thinking skills	44	34	263	184	169	166	25	29	4	3	3.6	3.5
d) Problem solving skills	47	37	244	172	183	170	28	33	3	4	3.6	3.5
<b>NESB</b>												
<i>Pre-N = 343; Post-N=265</i>												
a) Computer related skills	45	49	159	133	94	66	35	13	10	4	3.6	3.8
b) Internet related skills	59	59	160	132	91	59	29	12	4	3	3.7	3.9
c) Critical thinking skills	16	8	89	91	161	122	73	42	4	2	3.1	3.2
d) Problem solving skills	12	9	86	74	173	133	67	44	5	5	3.1	3.1

*ESB English Speaking Background*

*NESB Non-English speaking Background*

Looking first at the results for the entire class (i.e., English and non-English speaking backgrounds combined), the table shows that students reported high levels of confidence in their computer related and Internet related skills and these appear to have improved over the course of the semester. Mann-Whitney tests for the equality of the pre and post means easily reject the null hypothesis for both computer and Internet related skills. For the computer-related skills, the test statistic is  $-4.063$  while the test statistic for Internet confidence is  $-3.885$ .<sup>5</sup> These results also extend to the English speaking and non-English speaking background students when each group is analysed separately.

These results are supported by the university wide Quality Assurance survey. Towards the end of each semester as part of its quality assurance programme the university surveys students in relation to a number of key issues. The results in relation to the statement “The multimedia based technology helped me to learn effectively” recorded a mean of 3.7 for semester 2 1999 in which CALM was conducted compared to 3.3 for the same semester the previous year. Similarly in relation to the statement “I regularly made use of the information and materials made available by teaching staff on the Internet” recorded a mean of 4.2 in 1999 compared to 2.8 in 1998.

What is surprising in the CALM survey results is the stability in the critical thinking and problem solving skills confidence for the entire class. The Mann-Whitney test statistics are, respectively,  $-0.498$  and  $-1.020$ . However, this masks important differences between the experiences of the English and non-English speaking background students. For the former group, confidence in their own critical thinking and problem solving skills actually went down (the Mann-Whitney

<sup>5</sup> Under the null hypothesis of equality of the means, the Mann-Whitney test statistic has the standardised normal distribution.

test statistics are respectively, -2.82 and -3.00). However, this result did not extend to the non-English speaking background students where confidence in critical thinking skills increased significantly (the Mann-Whitney test statistic is -1.93), although there was no significant change in problem solving skills.

We had anticipated that all students would have increased their confidence in relation to these skills, particularly as marks awarded by tutors for the students' critical comments improved over the three issues by more than 9 percent. One factor that might explain why the questions relating to computer and Internet skills produced such unambiguous results relative to the critical skill and problem solving questions is that students may have had a relatively more clearer indication of their own computer and Internet related skills as these skills are concrete and operational. Confidence in critical thinking and problem solving may not have been previously tested in other courses and the concepts may have needed to be explained more fully to students in the questionnaire. The differences between students of English speaking and non-English speaking background might be a reflection of the previous educational experiences of this particular cohort of students. The English-speaking background students are almost all drawn from the top 1 to 2 percent of domestic high school leavers students and it may be that they have based their initial confidence in critical thinking on their overall previous performance. CALM may have caused these students to re-evaluate their own abilities.

It is also important to keep in mind that the surveys results relate to the students' own perceptions of their abilities. The objective indicators that we have, such as the improvement in marks over the course of the semester and the students performance in the final examination indicate the development of a relatively sophisticated set of problem solving and critical skills over the course of the semester.

Section three of the survey asked students to report on their perception of their use of the CALM system. Items 1-8 were included only in the post survey. The results of this section are reported in Table 3

<b>Statement</b>	<b>Mean All Students n=681</b>	<b>Mean ESB n= 415</b>	<b>Mean NESB n=266</b>
1. I found CALM easy to use	4.1 (0.76)	4.0 (0.79)	4.2 (0.68)
2. Help with CALM was easily available	3.4 (0.90)	3.3 (0.92)	3.6 (0.83)
3. The Webmaster comments were valuable	3.7 (0.96)	3.5 (0.98)	3.9 (0.86)
4. CALM helped me to work consistently through the semester	3.6 (1.02)	3.6 (1.07)	3.7 (0.92)
5. I learned from reading the responses of my peers	3.3 (1.03)	3.2 (1.05)	3.5 (0.96)
6. I have improved my critical analysis skills as a result of commenting on the responses of my peers	3.4 (0.95)	3.3 (0.95)	3.5 (0.93)
7. I valued the feedback I received from my peers	3.3 (0.99)	3.2 (0.98)	3.4 (0.99)
8. I received sufficient feedback on my progress via the CALM system	2.9 (1.07)	2.8 (1.10)	3.1 (0.99)

Of note in this section is that 55 percent of responding students agreed or strongly agreed that their critical thinking skills had improved as result of commenting on the responses of their peers, item 6, while 17 percent either disagreed or strongly disagreed. Students were reporting on their perceived improvement rather than on their level of confidence as they had done in section

2. Over 50 percent also agreed that they had learnt from reading the responses of their peers (item 5) with only 22 percent disagreeing. In addition 63 percent of students agreed that CALM had assisted them to work consistently throughout the semester (17 percent disagreed). Overall NESB students were more positive in their response to the system than were ESB students.

### **On-line tutor interaction.**

Over the twelve week period in which the CALM system operated in 1999 the On-line tutor answered a total of 661 questions. Students clearly found the facility useful. The impression reported by the On-line tutor in an interview at the end of semester was that the majority of these questions were generated by students from non-English speaking backgrounds. It may be that students from South-east Asia, where the faculty draws most of its international students, are less confident about asking question directly from the tutor or lecturer and that they feel more comfortable asking questions on-line. In addition the tutor noted that the quality of the questions was higher in terms of being clearly thought out and reflecting an attempt to grapple with the concepts than face to face questions posed in tutorials. As anticipated questions related to the CALM system as a percentage of total questions decreased over the semester as students became familiar with how the system worked. The number of questions related to the economics raised in the issues had increased as a percentage of total questions by the third issue indicating either that this was a more difficult issue or that student thinking had become more sophisticated. As results on issue 3 had improved over the previous two issues it seems likely that students were thinking about the issue than that it was more difficult.

Issue	Economics questions related to the issue itself	Questions related to the operation of the CALM system	Total questions
1	50%	50%	208
2	56%	44%	187
3	72%	28%	221

### **Tutor Interviews**

Semi-structured interviews with 9 of the 18 tutors teaching in the subject were conducted after the first issue had been marked by tutors in week 5 of the 12 week semester. The nine tutors interviewed took a total of 48 tutorials between then each week. Tutors were asked about their experience with CALM, specifically about their perceptions of the quality of both the responses and the critical comment made by students and how they felt the students were coping with the new system. Tutors were also given the opportunity to make additional comments or suggestions on any aspects of CALM

Tutors reported on their perceptions of the quality of the students' response to the first issue. "Given that a lot of them were unsure about process, most of them did a reasonable job. Very few were way off, everybody seemed to have the idea that you needed to use the theory - that was good. A lot of them were unsure though and not very confident." Another tutor commented "they are learning well, I strongly feel this is a good way to learn - by the time they do the comment they know a bit more than when they do the response. I think they enjoy it...the issue is real for students".

Tutors were asked to comment on the quality of the critical comments students had made on the work of their peers. This is the first time in their undergraduate degree that students have been called upon to comment in this way; or that tutors have had to mark this type of work. A member

of staff from the Faculty Teaching and Learning Unit had conducted a lecture for students on how to critically comment on other students work. Tutors reported that they were generally well pleased with the efforts students had made in approaching the critical comment task. "One student said that having to write a comment on someone else's work made her realise the mistakes she'd made". "Students like the opportunity to look at others work – it's always on their mind, 'if I knew what the others were doing'.....I think their critical and reflective skills are good. They say 'now I know where I went wrong'". Most tutors reported that students tended to write supportive comments about the work of their peers. However in the first issue tutors noted that a problem for some was that students would say a piece of work was 'good' or 'bad' but not explain why this was the case. Tutors reported that students tended to write supportive comments about the work of their peers. Several tutors mentioned that they felt students were initially reluctant to be overly critical but felt that this reluctance would dissipate as students became more familiar with the process.

Tutors reported their perceptions of students' use of theory and their grasp of the relationship between theory and real world problems. They indicated that the use of real world problems helped students grasp the theory and that some students were beginning to develop the analytical and application skills necessary for a sound understanding of the subject. Another commented "They are OK with the theory, their comments show that they understand it but they don't apply it well in their own response. I think they get it with hindsight". Another tutor made a similar remark – "It's too early to tell yet.....it takes longer to assimilate it – sometimes six months! Down the track the way they think will change".

With regard to feedback, most of the tutors interviewed felt that there was less opportunity for them to comment in depth on the work of individual students. This was a concern for some tutors - "I would like more time to give individual students comments for their work"; but was not a concern for other tutors "students don't get scribble all over a page – the process is streamlined which I think is good". Tutors acknowledge that students were now receiving feedback from a variety of sources; their peers, the webmaster and the tutor. Furthermore, the model answer and the general summation of features of the responses and comments provided by the On-line tutor were seen to be useful features of the CALM system. Student questions to tutors were predominantly about the economics related to the issues and the assessment procedures and were not operational in nature.

The initial training of tutors in relation to CALM was seen as helpful. The fortnightly tutor's meetings were reported as a good forum for exchanging views and comparing notes on how the various tutorial groups were progressing, as well as seeing how other tutors dealt with problems. The meetings were productive in building a sense of collaboration and working as a team and this was thought to be especially important in such a large subject as Introductory Macroeconomics. Tutors reported that they felt comfortable raising concerns at the tutors meeting.

In late October 1999 after the third CALM issue had been completed and assessed tutors in Introductory Macroeconomics were contacted by email and asked to complete a survey of their perceptions of the effect of the CALM initiative on student approaches to learning now that the whole process had been completed. Of the 18 tutors tutoring in the subject 9 responded to the survey. All tutors thought that the quality of student responses to the issues had improved over the semester. They reported that the students had become better at understanding and applying economic concepts, had a better grasp of economic reasoning, were more adept at recognising

the real world application of economic theory, were thinking more deeply and were more likely to learn from tutors comments on their work. Student expression of arguments was thought to be more precise and questions were answered more thoroughly and accurately than at the start of the semester. Eight of the nine tutor responses thought that the ability of students to productively comment critically on other student's work had improved. They thought that students were more aware of the role of assumptions, were more skilled in identifying flaws in economic reasoning, were applying their understanding of theory and had shifted their focus from commenting on the structure of the responses to commenting on substantive macroeconomic aspects of the responses. Student improvement in this aspect was reflected in a 9percent improvement in their marks over the three issues. While international students were perceived to be less at ease with commenting on others work this unease was no longer apparent by the time students had completed the third issue. All students were seen to be increasingly comfortable with commenting on others work and also more adept at judging the validity of the comments made by their peers.

While 6 tutors felt that the form of feedback was appropriate, one tutor noted that as this was a new form of feedback for students they were not making full use of it. Another felt that the benefits of this form of feedback needed to be 'sold' more clearly to the students.

Tutors felt that CALM assisted students to work consistently were better prepared for tutorials than similar level students that tutors had taken in the past. "It helps them to think, to see what other students can do" and again "Students get to see a sample answer from the lecturer. They get to look at other students' work, which is a chance to see what the standard is like for the subject – a rare opportunity at university. The comment component helps them to understand their own work as well as (and perhaps even more than) benefiting a peer student and to prepare more than

### **Examination Performance**

The introduction of the CALM system into Introductory Macroeconomics was associated with an improvement in the students' performance on the final examination relative to previous years. A significant component of the exam comprised a CALM style question (worth 40 percent of the exam mark). The question involved a detailed critical analysis of a published newspaper article concerned with central bank intervention in currency markets. Without the development of the critical and analytical skills obtained through the CALM system, it would not have been possible to ask this question of the students. The fact that the exam performance represented an improvement on previous years' results suggests that CALM was successful in raising students' abilities to think critically and analytically about complex real world economic issues.

## **CONCLUSION**

The objectives of the CALM project were to provide students with skills that they would use later in their employment (computer, Internet, critical thinking, problem solving) to improve study habits, to provide more effective feedback to students and to assist students to establish the framework for life long learning. Preliminary evidence from the evaluation indicates that these objectives were met. Student confidence in their computer and Internet related skills significantly improved. In addition there were many indications that critical thinking skills had improved including tutors observation and assessment results. More consistent work habits were reported and there was a positive change in student perceptions of feedback on their work.

Much has been gained in using the CALM system, most importantly in relation to the encouragement of deeper approaches to learning and in relation to the development of skills required in later working life. The Department of Economics at the University of Melbourne has chosen to take skills development as a focus of its curriculum. Fostering these skills and devising evaluation instruments that adequately measure the outcomes has proven to be challenging. It is clear that persistence and a willingness to listen and to adjust are important elements in the introduction of new methods of student support and assessment. We have found evidence that the CALM system is a productive way in which to assist students to learn and in which to start to build the skills required of graduates.

## BIBLIOGRAPHY

Biggs, J., (1979) Individual differences in study processes and the quality of learning outcomes. Higher Education, 8, pp.381-394

Biggs, J., (1987) Student approaches to Learning and Studying. Australian Council for Educational Research, Hawthorn, Vic.

Biggs, J., (1989) Approaches to Enhancement of Tertiary Teaching. Higher Education Research and Development, Vol 8, No. 1, pp. 7-25

Biggs J. (1999) Teaching for Quality Learning at University: What the student does. The Society for Research into Higher Education and Open University Press. Buckingham

Bowden, J. (1988) Achieving change in teaching practices, in Ramsden, P., (ed), Improving Learning: New perspectives. London, Kogan Page, pp 255-267.

Dearing, R. (1997) Higher Education in the Learning Society: Report of the National Committee of Inquiry into Higher Education London: HMSO and NCIHE Publications

Department of Education Training and Youth affairs. (2000) Employer satisfaction with graduate skills, Evaluations and Investigations Programme, Higher Education Division, Research report 99/7 Australia February.

Entwhistle, N. & Ramsden, P. (1983) Understanding Student Learning. London: Croom Helm.

Feeley, T. (1976) Critical thinking towards a definition, paradigm and research agenda, Theory and Research in Social Education 1V August.

Feiner, S & Roberts, B. (1995) Using Alternative paradigms to teach about race and gender: A critical thinking approach to introductory economics American Economic Review May: 367-371

Harasim, L. Hiltz, S. Teles, L. Turoff, M. (1997) Learning Networks: A field guide to teaching and learning online. MIT Press: Cambridge, Ma.

Hounsell, D. (1984) Understanding teaching and teaching for understanding in Marton, F., Hounsell, D., Entwistle, N., (eds) The experience of learning . Edinburgh: Scottish Academic Press. pp189-210

Johnston, C. (1995). Peer Tutoring in Economics at the University of Melbourne, in Students as Tutors and Mentors, ed S. Goodlad, Kogan Page: London.

Johnston, C. & James, R. (1995). The New Directions in Teaching and Learning in an Economics Department in eds. P. Little, M. Ostwald, G. Ryan, Research and Development in Problem-Based Learning, vol. 3, Sydney: Australian Problem-Based Learning Network.

Johnston C. James, R. Lye J. McDonald I. (2000) An evaluation of the introduction of collaborative problem-solving for learning economics. Journal of Economic Education Winter.

Johnson, R.H. (1992) The problem of defining critical thinking in The generalizability of critical thinking: Multiple perspectives on an educational ideal, SP Norris Ed Teachers College Press NY

Laurillard D. (1993). Rethinking University teaching: A framework for the effective use of educational technology. Routledge. London, reprinted 1997

Marton, F. & Saljo, R. (1976) On qualitative differences in learning:1 - Outcomes and process'. British Journal of Educational Psychology 46, pp. 4-11

McInnis, C. & James, R. (1995) First year on campus study, Australian Government Printing Service.

Meyer, C. & Jones, T. (1993) Promoting Active learning: Strategies for the College Classroom, San Francisco: Jossey-Bass.

Palinscar, A. & Brown, A. (1984). Reciprocal Teaching of Comprehension-Fostering and Comprehension-Monitoring Activities, *Cognition and Instruction*, 2, 117-175.

Ramsden, P. (1992). Learning to teach in higher education. Routledge London, reprinted 1998.

Slavin, R. (1990). Research on Co-operative Learning: Consensus and Controversy, Educational Leadership, Dec/Jan 52-54.