

# IMPROVING UNIVERSITY ACTUARIAL EDUCATION

by

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## **1 Introduction**

In the past, discussion of actuarial education has focused on curriculum content (what is to be learned) and mode of delivery (university course versus part-time correspondence course). Little attention has been paid to how students learn, and how that learning can be facilitated to develop actuaries with the knowledge, skills and values the profession needs.

This paper deals with the university-related content of a more comprehensive paper prepared by the authors for the 1993 Convention of The Institute of Actuaries of Australia (Bellis and Shepherd, 1993). It concentrates on students' learning in the undergraduate actuarial program at Macquarie University in Sydney, Australia, but it is likely that many of its findings and conclusions would apply equally to university actuarial courses elsewhere.

## **2 Acknowledgements and disclaimer**

A number of people commented on this paper in draft form and we thank them for their contributions. The views expressed in this paper are however those of the authors and do not necessarily represent the views of The Institute of Actuaries of Australia nor of the Department of Actuarial Studies and Demography at Macquarie University.

This paper suggests some radical changes. This does not imply any criticism of the individuals involved in actuarial education in Australia, either as members of the Institute of Actuaries of Australia or as actuarial faculty at the universities.

In particular, the authors concentrate on the actuarial degree course at Macquarie University, but the problems we identify can be found in a wide range of professional courses at institutions across the country (and globe, we suspect). Many successful actuaries and others have gained a great deal from the Macquarie course since its inception in 1968, and the authors are proud to be themselves graduates of the program, as well as having been involved in the teaching of the course for a combined total of eleven years.

We are also proud that Macquarie was the first university in the world to be recognised by the London Institute of Actuaries for

exemption from the full set of its "technical" subjects, and we are grateful to our UK colleagues for the trust it has placed in Macquarie and for its leadership.

### **3 Structure of this paper**

We begin with a brief description of the background to actuarial education in Australia. We then propose features which are desirable in a professional education program, discuss how the current system measures up, and make some recommendations for change.

### **4 Actuarial education in Australia**

#### **4.1 Becoming an actuary in Australia**

At the moment, the Australian actuarial education syllabus is notionally made up of ten subjects, each of which must be satisfied by examination or by exemption in order to qualify (after reaching age 23 and participating in a professionalism seminar) as a Fellow of the Institute of Actuaries of Australia (FIAA). (Alternatively, certain overseas actuarial qualifications may also be recognised.)

The ten subjects comprise six "technical" subjects (covering such areas as maths of finance, maths of contingent payments, graduation, construction of life tables, economics, accounting, statistics, etc.) followed by four "professional" subjects (life insurance, pensions, non-life insurance, finance and investment) of which two must be completed at ordinary level and two at specialist (i.e. more advanced) level.

Each of the six "technical" subjects may be completed by passing the equivalent subject from the UK syllabus, or by being granted exemption on the basis of having completed, at a sufficiently high standard, an equivalent course or courses at a university. For each of the six subjects, exemption is automatic upon completion, at a certain minimum standard (e.g. A or B grade on a scale of A, B, C, CQ, F at Macquarie) of a specified subject, or set of two or three subjects, in the actuarial program at Macquarie University (and now also at Melbourne University and ANU).

The Institute of Actuaries of Australia conducts its own examinations for the four professional subjects (each at two levels). Automatic exemption may be obtained from one or two of the ordinary level professional subjects on the basis of results in the actuarial Masters program at Macquarie University.

#### **4.2 Routes to qualification**

The various routes to qualification as an Australian actuary are set out in Table 1 (Bellis and Shepherd, 1993), with the numbers shown being the number who entered each stream in 1993. A total of 161 Australian students entered the full-time university route for the "technical" subjects. By comparison 79 Australian students who had not done an actuarial degree joined the UK Institute during 1992. Only 17 of these students applied for any exemptions from the Institute subjects based on their university studies.

The dominance of the university route is greater than the intake ratio of 161:79 if we allow for the higher success rate through the universities. It is only within the last couple of years that the university intake has approached the level of the correspondence route intake, and yet of the 55 students who completed the Australian fellowship examinations in 1992, 33 (60%) had studied the "technical" subjects through the Macquarie undergraduate degree. In addition, one student had taken the Melbourne-based degree. We estimate that the proportion of those qualifying who have taken the university route for the "technical" subjects will rise to over 80% once the full Melbourne enrolment numbers flow through the system.

Since most future Australian actuaries will take the university route for the "technical" subjects it is important to consider what students learn as they pass through this system. We draw on our experience of the program at Macquarie University, but what we say would be equally applicable to Melbourne University and the externally taught ANU program.

#### **4.3 Student background**

**Routes to Qualification for Australian Actuaries with the numbers entering in 1993**

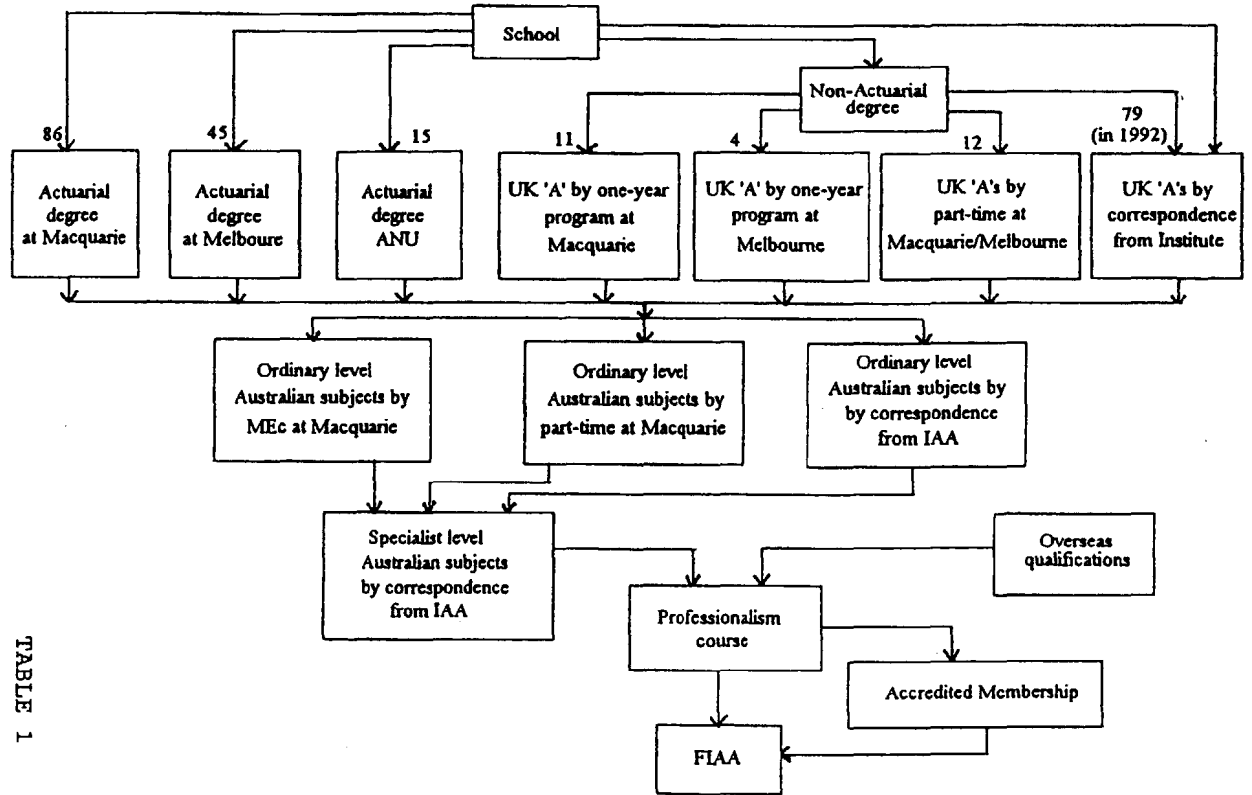


TABLE 1

At present, the Macquarie undergraduate program has an intake quota of 80 local students and 5 overseas students. The 80 local students have in recent years been ranked in the top 3% to 4% of NSW school leavers, and typically have excellent results in the highest level mathematics course. Program entrants have thus demonstrated a capacity for achievement in formal examinations and a high level of mathematical potential.

In common with students across most university programs and all institutions, those in the Macquarie program have been found to be poor written and oral communicators. In some cases (by no means all), this lack of fluency in English expression is related to a non-English speaking background.

#### **4.4 The Macquarie program**

The actuarial degree at Macquarie is a three year program which covers the "technical" actuarial subjects and, in third year, offers an introduction to the issues covered in the Australian fellowship subjects.

The first year program is broad, and includes accounting, economics, statistics, mathematics, computing as well as introductory actuarial subjects. This general approach in first year makes it possible and fairly easy for students who decide before second year that actuarial studies is not to their liking, or who are unable to meet minimum standards for progression, to change to another stream.

Second year contains a heavy concentration of actuarial exemption subjects. There is little scope for elective subjects here.

Third year offers some room for non-actuarial subjects, but the choice is limited to subjects for which students have completed the necessary pre-requisites.

Thus the actuarial degree program :

- (a) has a heavy workload;
- (b) offers very little choice; and
- (c) is dominated by the subjects giving exemption from the UK "technical" subjects.

## 5 Insights from educational research

The actuarial profession has always been concerned to retain control over the process of educating its future members. The authors do not argue with the belief that only experienced actuaries can decide what a new actuary must know and be able to do. The briefest experience of teaching, however, reveals that placing a topic on a list of items making up a syllabus is no guarantee that students will end up "knowing" it in the sense of being able to apply that knowledge in new situations, or even in the sense of remembering anything about it a few months after the examination has passed. The authors believe that while what is to be learned is important, how it is to be learned is at least equally important, and has lacked due consideration in previous discussions of and planning for actuarial education. Some relevant findings from higher education research are summarised below.

### 5.1 Approaches to learning

A body of educational research has been built up over the last 15 years or so which sheds considerable light on the nature and quality of student learning in higher education. Marton and Saljo (1976a, 1976b), investigating the process by which university students learned from reading an academic text, identified two distinct approaches to learning. Qualitative differences were found in the extent to which students understood the meaning the author of the text sought to convey. These qualitatively different learning outcomes were found to be associated with different approaches to learning adopted by the students.

Full understanding was associated with a deep approach - an intention to understand what the author was trying to communicate, coupled with a strategy characterised by attempts to relate the ideas in the text to existing knowledge, to distinguish the author's message from supporting evidence, and to relate the concepts involved to the student's own experiences (Ramsden, 1988).

A poor understanding and knowledge of detail was found to follow from a surface approach, in which the intention is simply to complete the task at hand, satisfying any external requirements associated with it. There is no intention to personally "take on board" the

author's message, but rather an emphasis on memorising the material, typically for a limited period, to satisfy a task perceived as an external imposition (Ramsden, 1988).

The surface/deep terminology originated with Marton and Saljo (1976a, 1976b), but the phenomenon has been recognised by several researchers (such as Biggs, 1987a and 1987b, Entwistle and Ramsden, 1983), who confirmed the relationship between learning approaches and outcomes; and identified a third approach - achieving. Here the intention is to obtain high marks or grades or other qualifications, and the strategy with which it is combined involves making the best use of time and other resources. Systematically making, reviewing and summarising good notes, scheduling time between subjects and tasks, and, generally, practising good "study skills" are characteristic of this approach (Biggs and Telfer, 1987).

The deep and surface approaches are such that they cannot be combined simultaneously. They can, however, be utilised by the same student on different tasks or on the same task at different times. The achieving approach, which relates less to cognitive processes and more to the context of learning, can be combined with either a deep or a surface approach. In other words, students who rote-learn can do so in a systematic or a haphazard fashion, while those who search for meaning can be organised and efficient or disorganised and inefficient.

Surface and deep approaches to learning have been demonstrated at all levels and in many disciplines of institutional learning, and in a range of learning tasks, including essay writing and reading. Of particular relevance for the actuarial studies program is the finding that students' approaches to problem solving can be classified in terms of deep or surface orientation (Laurillard, 1984).

The reason for adopting the approaches to learning framework is that researchers have consistently found strong correlations between quality of learning outcomes and approaches to learning (Marton and Saljo, 1976a and 1976b; Van Rossum and Schenk, 1984; Watkins, 1983). Students employing a deep approach to learning have consistently exhibited higher quality learning outcomes than students taking a surface approach.



Researchers have also identified factors over which the teacher has some control which influence the students' choice of approach. Three critical factors are :

(1) The effects of a heavy workload

Students feeling the pressure of a heavy workload will tend to fall back on a surface approach, often resorting to rote learning and memorisation rather than pursuing the time-consuming search for understanding and personal meaning (Entwistle, 1991).

(2) Assessment procedures

In a variety of studies (e.g. Newble & Jaeger, 1983; and Thomas, 1986), assessment procedures have emerged as critical influences on approaches to learning. If students perceive that an assessment task calls for the regurgitation of material encountered in lectures or in textbooks, or the recall of facts, details, formulae, procedures, etc., then they are more likely to adopt a rote learning strategy. If the assessment task is perceived to require understanding, or demonstration of a grasp of meaning, then a deep approach may be used.

The same assessment task may be perceived in quite different ways by different students, and students' perceptions may differ markedly from that of the teacher (Entwistle & Tait, 1990).

(3) Freedom in learning

Entwistle (1991) identified degree of freedom in learning as a key element of the learning context in terms of influence on choice of approach to learning. Greater freedom in learning (i.e. freedom to choose what is to be learned, and how and when it is to be learned) encourages the adoption of a deep approach, while lack of choice is associated with a surface approach.

## 5.2 The nature of learning

The research also shows that better quality learning is more likely if the learner is able to relate new knowledge to existing knowledge, to relate theoretical ideas to everyday experience and to organise and structure content into a coherent whole (Ramsden, 1992, for

example). From this it follows that it is desirable for learners at the beginning of an actuarial program (for instance) to have a framework of knowledge of what actuarial practice means. Even if that framework is frail or sparse to begin with, it will at least provide some existing foci to which new knowledge can be connected as it is encountered.

Teachers at first year level often feel uneasy when responding to students' questions about relevance of content by saying "This is something you need to learn now so that you can use it next year in subject XYZ", or "Don't worry if this doesn't make complete sense now, it will all become clear to you later in subject ABC". Of course, the teachers of subjects XYZ and ABC then lament that these students have difficulty recalling and utilising what they were expected to have learned in earlier subjects. Educational research suggests that the earlier knowledge is more likely to be understood and retained, if it is encountered and engaged within a meaningful context by self-directed, motivated learners.

### 5.3 The nature of professional education

Barnett (1992) identifies four key areas in which professionals must develop the ability to be critical :

- (1) core knowledge : the knowledge fields, or mix of knowledge fields, which are unique to the profession;
- (2) contextual knowledge : firstly, the operational context (for example, in actuarial studies this would include accounting, computing, economics, law, etc.), and secondly, the broad liberal studies context (philosophy, psychology, sociology, politics, etc.) which promotes the development of an ability to critique the nature and activities of the profession and the practitioner's own behaviour as a member of that profession;
- (3) professional action : the integration of theory and practice; not just a repertoire of standard techniques, but also the ability to develop strategies for dealing with novel situations not previously encountered, to which the profession's currently developed body of theory and technique cannot be readily applied (i.e. "true" problem solving);

(4) professional values : the internal structure of and values within the profession, its role in society and the character of relationships with clients.

If a practitioner is to accept his/her professional responsibilities along with any rewards which may attach to his/her status, s/he needs to develop a reflective, self-critical attitude to his/her practice; to be able to stand back from day-to-day activities and to view them in the context of a wider framework, to evaluate them and to envisage possible alternatives. In this way the development of a professional discipline's core knowledge is facilitated, and practice keeps pace with the ever-changing requirements of a dynamic environment.

Many of the problems encountered in professional practice fall outside the well-defined boundaries of "exercises" typically used as learning or assessment activities in formal education. An effective practitioner needs to be adaptable; to be able to go beyond previous experience by identifying the new problem, interpreting the client's requirements, making sense of the problem within existing knowledge and skills, devising alternative solutions, evaluating them (without necessarily being able to put them into effect), explaining the possibilities to the client, implementing the chosen solution and monitoring its progress.

The practitioner needs to be able to identify "gaps" in his/her knowledge and skills, and to take appropriate steps to fill those gaps. Most professions formally recognise the importance of continuing professional education, but few attempt to develop its practice until after full qualification is attained.

These professional attributes of reflection, self-criticism, self-appraisal and adaptability will be more likely to develop in the practitioner if they have always been an integral part of the process of education for the profession. If professional education is to be integrated and holistic, all of the key areas must be incorporated at all stages.

Other attributes that the authors believe the actuarial profession should be fostering are a sense of ethics and an interest in carrying out research.

(5) ethics : the business world is coming to accept the importance of ethics; to quote the managing director of BT Australia :

"We can all see the wreckage of collapsed companies, the debt overhang and the suffering this has brought. We are questioning what went wrong ... the overriding issue revolves around the timeless question of ethics." (Ferguson, 1992)

Robert Solomon, a US scholar of business ethics, argues that the best way to develop in students a sense of ethics is to incorporate the issues into the approach to every subject rather than (as is frequently the case) isolating ethics into a separate subject at the end of the professional education. His view is that business people have much to gain from a study of ethics :

"The aim of ethics, whether for students or seasoned executives, is not to teach the difference between right and wrong, but to make people more comfortable facing moral complexity." (Solomon, 1992)

(6) research : the authors have not at this stage made a detailed study of what is needed to stimulate an interest in research; we suspect that an open-ended syllabus, and the option for interested students to take some courses in research methods, are among the things that would help.

## **6. What employers want**

A few years ago the demand for actuaries in Australia was such that the possession of an actuarial degree with the "magic" six exemptions was sufficient to open doors. This is no longer the case. At the time of writing one or two of the students who graduated at the end of 1992 with six exemptions are still looking for work. Several others have entered the Master of Economics in Actuarial Studies as a result of failing to find actuarial employment at the end of their actuarial degree.

It may be argued that some graduate unemployment is inevitable in the context of a recession and 10% unemployment nationally. After all, 18% of all students completing undergraduate degrees at Macquarie in 1992 were still looking for full-time work at the end of

April 1993. It should be borne in mind, however, that the students completing the actuarial degree in 1992 were in the top 4% of NSW school leavers when they entered the program in 1990, and only 31% of those select few gained all six exemptions.

The Institute of Actuaries of Australia has not tried to limit the supply of actuaries, in the belief that a greater supply will strengthen the profession in the long run by enabling a move into non-traditional areas (see for example Champion, 1992). The members of the profession who seek non-traditional work will not typically be drawn from the ranks of experienced and flexible mature actuaries. Those people are busy in their current jobs. It is more likely that the task of beating a path into the "wider field" will fall to the newly qualified actuaries and partly qualified actuarial graduates when they are unable to find work in the traditional areas. The profession therefore has both a responsibility and an opportunity to ensure that actuarial students acquire the skills which will enable them to make the move successfully.

From a study of surveys of actuarial employers in Australia, the UK and the USA, from a perusal of job advertisements (both actuarial and non-actuarial but related) and from discussions with employers and employment consultants, the authors believe that employers are looking for the following attributes in the graduates they recruit (not in any particular order) :

- (1) relevant technical skills;
- (2) communication skills;
- (3) personal qualities - the ability to work with other people, to meet deadlines, to cope with pressure;
- (4) creativity and flexibility;
- (5) the ability to identify and solve the critical problems, a sense of proportion.

A key requirement for getting a job at the present time, when the traditional market for actuarial graduates is more or less saturated, is a student's ability to recognise the skills s/he possesses, recognise their relevance to non-traditional employers, and then convince the non-traditional employers that these skills are indeed relevant. This is a large task to set someone who has spent the last three years with eyes fixed on the goal of obtaining six exemptions.

It must also be recognised that the world is now a place of rapid and continuing change, in which skills and knowledge soon become out of date. Adaptability and commitment to continuing education are vital.

## **7. How the existing program measures up**

We now consider how well the actuarial undergraduate degree program at Macquarie measures up in terms of the desirable features of education described above.

### **7.1 Does the program foster "deep" as opposed to "surface" approaches to learning?**

We mention above that key factors found to influence the choice of approach which are under the teacher's control include workload, the method of assessment and the extent of self-direction. None of these factors are actually entirely under our control as teachers at Macquarie, because of the need to cover the UK syllabus and meet their exemption standards. All three factors, in our view, are contributing to the encouragement of surface learning.

#### **(1) Workload :**

We know from the regular feedback we seek from our students that they find the workload in the exemption subjects heavier than in other university subjects of a comparable level, and that the program overall is very hard work, particularly in the second year. There are strong indications that this interferes with their ability to assimilate the material. For example, the actuarial lecturers have noticed in the actuarial students a general dislike of statistics, amounting in some cases almost to a fear of the subject. We find that when we ask students to apply the statistical theory they have supposedly learned in previous subjects they are often unable to do so. Enquiries among the students suggest that the main reason is that they do not have time to absorb the theory or to understand its relevance - the usual response is along the lines "It would be all right if I had more time to think about it, but there just isn't enough time". To quote one of our students :

"There are (sic) too much work - assignments and tests. Barely I have any time to do my own reading, although I desire to do

so. I feel like a study machine or an examination machine."  
(written response to survey quoted in Shepherd, 1992)

(2) Assessment :

For most of the exemption subjects, assessment of the students' grasp of the material is based entirely on their performance under examination conditions. Typically about 85% of the marks are based on a final three-hour written examination and the remainder on one or more shorter tests during the semester. Naturally, with so much of their future depending on the results of the examinations, students - or at least successful students - are concerned with what will be required of them in examinations, often to the point of obsession. The hint that a particular topic is on the examination is guaranteed to reduce the most unruly lecture theatre to hushed attention; the comment that something, while of great value, is not examinable, has the reverse effect. Another manifestation of this is that students will choose for their non-actuarial electives not those which interest them but those which are perceived to require least effort, allowing them to concentrate on the exemption subjects. (The employment situation has had an effect here; students now look also for the subjects with names which they believe will appeal to employers. Anything with "finance" in the name is now much more likely to be chosen over, say, philosophy.)

It is difficult to set tasks that can be performed within a three hour examination which encourage a deep approach to learning, although the authors (and others) have tried. It is even more difficult when constrained by the standards set by the UK Institute - for example, in some subjects we feel that the students waste a lot of effort on rote learning, and can be heavily penalised in an examination for temporary memory blanks, and that this could be obviated by open book examinations. The students' obsession with examinations is contagious : most of the lecturers will find themselves at times teaching examination technique or stressing the need to be able to reproduce certain items simply to meet the examination requirements.

The response to the examination pressure by even the most successful students is captured in this quote :

"I do all the questions in the book, and sometimes, if it's a difficult topic, I'll do it twice ... I suppose in my approach to

exams, I see it as a whole pile of drill. You know, the more questions you get through, then when you sit the exam paper, there's no surprise, it's the 35th exam paper or something you've done, it becomes quite easy then." (Excerpt from interview, quoted in Bellis, 1991)

### (3) Freedom in learning :

There is little scope for student self-direction at the global level of deciding which subjects to study. There is similarly little scope for us to offer options within the exemption subjects. Instead there is almost total reliance on an externally-imposed syllabus and standards.

The authors believe that not only does the loss of freedom in learning encourage a surface approach, but it also fosters an unquestioning acceptance, a belief that if a topic is on the syllabus it must be important, and if it is not then it can be safely ignored. The attitude is typified by the following remark of one student on the notes provided for external students :

"It's like having a perfect set of lecture notes and saying learn it - whatever is in here will be on the exam, which is good."  
(quoted in Bellis, 1991)

and by another student on the relevance of the introductory accounting subjects :

"If you're going into the business area you're obviously going to come across accounts at some stage. I don't know if you come across them much as an actuary or not. They are there so I suppose you have to know something about them." (quoted in Bellis, 1991)

## **7.2 Do students acquire, at an early stage, a framework of knowledge?**

We referred above to the relationship between better quality learning and a holistic approach in which new knowledge is related by the learner to existing knowledge, new theory is linked to the real world and content is seen as part of a coherent whole. These desirable characteristics are often lacking for students in the Macquarie program.



The actuarial profession in Australia is small and not well-known. Most people pass a lifetime without any direct contact with actuaries and with virtually no idea of what actuarial practice entails. It is not surprising then that students who decide to enrol in the Macquarie actuarial degree tend to have a much fuzzier concept of what actuaries do than they have of what doctors, or lawyers, or engineers, do.

The actuarial degree at Macquarie, founded as it is on the UK syllabus, is structured in a similar manner to a traditional medicine or engineering program. The hierarchy of knowledge, which is taught "bottom-up", is, paraphrasing Schon (1987) :

- 1 Underlying foundations
- 2 Distinctive applications
- 3 Skills of day-to-day practice

In the case of university actuarial education, the "underlying foundations" dealt with in pre-university education and in the first year at university include mathematics, economics, accounting and statistics. "Distinctively" actuarial applications are met in second year, in the form of financial mathematics, mathematics of contingent payments and risk theory. In the third year, and in the final four professional subjects, the "skills of day-to-day practice" are developed - premium rating, reserving, assessing solvency, and so on.

The bottom-up, hierarchical structure of the university actuarial program makes it very difficult for students straight from school to develop even the vaguest conception of what actuarial practice entails before they reach the second half of their second year (at best), or even the third year, of their studies. The fact that, when they begin the program, their idea of what actuaries do is usually very hazy, makes it even more difficult for them.

Reflection on the learning experiences of one of the authors supports this theoretical proposition. When this author began the undergraduate actuarial program at Macquarie (some years ago!), it was after spending two post-school years working full-time in the Actuarial Department of a small Australian life office. Although the work consisted primarily of low-level, routine calculations and other clerical tasks, whose significance and theoretical justification were

often not understood, the author did develop a framework of knowledge of the practice of life insurance. Seeing new policies issued, premiums billed and collected, policies lapsed and surrendered, and claims paid, meeting agents and corresponding with policyholders, provided a practical, real-world background which significantly facilitated assimilation of the basic and applied content in the first couple of years of the program.

Another advantage of giving students such a framework as early as possible is that it would help them to decide if they do in fact want to become actuaries, and to assess whether they have the innate ability to do so. Most actuaries know people who have started the actuarial examinations but who fail to qualify despite years of struggle. In many cases these "failed actuaries" have the mathematical skills, which tend to be tested in the early subjects, but cannot master the "professional" subjects. Perhaps it is only fair to warn people what will be expected of them before they devote years of life to a fruitless attempt to qualify? On the other side of the same coin are people who qualify successfully but then find themselves in a job which doesn't satisfy their interests.

### **7.3 Does the program foster professional attitudes and values?**

In the terms used by Barnett (1992) described above, the Macquarie actuarial degree certainly covers the core knowledge (as defined by the UK "technical" subjects) of the actuarial profession, and also deals with the operational contextual knowledge in the fields of accounting, economics, computing, etc. Where it is lacking in our view, however, is in the other two key areas - professional action and professional values.

"True" problem solving - that is, confronting a situation which is problematic and which is NOT such that "the solution" will become clear after a relatively short period of analysis and deduction - is not a major feature of the existing program. Most of the "problems" that students "solve" are merely exercises.

Students have little opportunity to become reflective (for they are too busy to stop and reflect on what they have done or are doing), to become self-critical (for their work is always assessed for them by their teachers, and because, at least in students' perceptions, it is

their teachers who define what is superior, or acceptable, or mediocre), to be adaptable (for they are confronted with only a narrow range of well-defined, easily-managed "problems"), and to take responsibility for their own learning (for what they will learn, and how and when they will learn it, is tightly defined within the constraints of the exemption structures).

So, in the areas of professional action and professional values, there is considerable need for improvement, but the requirement to cover the content of the core and contextual knowledge areas has squeezed out any significant attention to them.

There is no systematic treatment of professional ethics in the program. Issues may arise from time to time, but the responsibilities of a profession to the community at large is not recognised as a theme over the whole program.

There is little room for students to pursue their own interests within the program in a way which would lead to a desire to undertake further research, nor does the course place much emphasis on encouraging students to question the material presented to them.

#### **7.4 Does the program meet the employers' requirements?**

It is clear that some of the requirements listed in Section 6 above are not being met :

(1) Actuaries have technical skills but not the overview which would enable them to see how their skills are relevant to non-traditional problems. Furthermore, actuaries do not always know when their skills are deficient or outdated. The desire to fit more and more content into the actuarial program tends to produce a pre-digested version of knowledge, where the students can easily assume that the small fraction of a topic presented is all there is to know on the subject.

(2) Communication skills in the profession are widely acknowledged to be weak.

(3) Actuarial graduates are often seen to be arrogant. If some actuaries do have the ability to work with other people, they did not acquire it through the university actuarial program, which tends to

bring out the worst of the students' competitive tendencies, because students perceive (despite assurances by staff to the contrary) that there is a limit on the number of exemption grades available.

(4) There is little opportunity for students to explore their creativity or develop flexibility.

(5) For a profession which prides itself on its "problem solving" skills it is disappointing to find a number of employers saying that actuaries tend to be sidetracked by minor issues, and place undue emphasis on scoring points for cleverness. Even the Prime Minister has said it is time for actuaries "to stop sitting in the corner being clever with themselves".

### **7.5 What does the program achieve?**

After three years of a difficult program and more than sixty hours of examinations, actuarial graduates have certainly demonstrated diligence, thoroughness, short-term memory skills, the ability to work under acute pressure in three hour bursts and enormous perseverance. These qualities are all valuable - for example a good memory is a big help in meeting clients to discuss their superannuation arrangements. If, however, a program was designed to instil and test these qualities in the most efficient way we doubt that it would turn out looking much like the actuarial program.

The authors have not overlooked that the program also covers a lot of material and techniques. We leave it to our readers to reflect on how much they retain and can apply of what they learned in their study of the "technical" subjects.

## **8. Recommendations**

We feel that major changes are needed in actuarial education and that the current system of using the UK syllabus stands in the way of the required changes. So long as the current nexus is maintained, it is pointless to attempt to develop a firm blueprint for change, but we do have some suggestions.

Some of our recommendations can be fairly readily implemented within the framework of the current system. Others are more radical.

### **8.1 Recommendations to improve the students' knowledge of the contextual framework**

(1) Shift as much as possible of the sort of material covered in the existing third year subjects on actuarial management into the existing first year subjects, so that students get an idea of what being an actuary entails earlier rather than later. The technical material currently covered in the first year subjects could be deferred until second year or later.

(2) Form closer links between the students and the profession. Invite senior actuaries to address the first and second year students, not just the third years as is the case at the moment. Divide the students into groups of say half a dozen for regular sessions with an actuary or partly-qualified actuary to discuss practice issues.

(3) Form closer links with the traditional employers. While this may be difficult in the current economic/employment situation, it may be possible to convince employers to see our students as both a resource and an investment.

(4) Encourage students to carry out research into non-traditional employers, to identify new areas where actuarial expertise could be applied.

### **8.2 Recommendations to encourage self-directed learning**

The unfavourable employment climate presents a golden opportunity for changing our students from passive recipients of a syllabus agreed by others into active self-directed learners. In the past, most students were content to apply themselves to overcoming the series of hurdles represented by the actuarial exams without questioning their relevance. Now that an actuarial degree with six exemptions is no longer any guarantee of a job, students have a vested interest in finding out for themselves what skills and knowledge they need and working to acquire them. Instead of the current recommended program, this could mean that, some time during their first semester

in the university program, students map out their own program for using the university subjects on offer as a resource in obtaining the desired skills and knowledge. Some time (and credit) might be offered in Actuarial Studies I for this task, to ensure that it receives the attention it deserves. The chosen program would be reviewed each semester as the student progressed. To gain an idea of what subjects contain beyond brief descriptions in the University Calendar, students might do some work on study guides and reading lists and also draw on the experiences of senior students who have already completed those subjects. This activity could be further encouraged by giving credit to the senior students who spend time sharing their knowledge with the first year students.

This process would have the spin-off benefit of encouraging reflection by the senior students on the nature and usefulness of what they are studying, and improve their understanding of the material - the authors can testify that teaching a subject to someone else is a wonderful way of discovering gaps in one's own understanding!

We believe that designing their own program would encourage students to follow their interests and target their weaknesses : for example, by enrolling in writing classes. We could facilitate the process by offering catch-all actuarial units in which the students could demonstrate and receive credit for the skills obtained in ways which did not otherwise lead to completion of university subjects. (The practicalities of this would have to be negotiated with the University.)

### **8.3 Recommendations for a review of the forms of assessment**

Some of the following are already used in the Macquarie degree to some extent. The authors believe more use should be made of :

- (1) open-book examinations;
- (2) take-home examinations;
- (3) collaborative projects;
- (4) self- and peer-assessment;
- (5) student design of learning and assessment tasks;
- (6) more open-ended individual items in tests and exams;
- (7) assessment schemes which target quality rather than quantity.

## 8.4 Problem based learning

One approach to teaching and learning which is worth consideration is problem based learning (PBL), a very significant phenomenon in professional education (especially in medical and related fields) in recent decades, which incorporates concepts of using problems for the purpose of learning. Woods (1985) describes PBL thus :

"In 'problem based' learning a situation is presented before any knowledge is given. Then once the knowledge is acquired, it is applied back into the problem. The students are in control because they must select the knowledge needed to solve the problem, learn that knowledge and relate it to the problem. They select their own pacing and sequencing. Often they evaluate themselves."

Barrows, one of the pioneers of PBL, defined it as (Barrows and Tamblyn, 1980) :

"... the learning which results from the process of working towards the understanding of, or resolution of, a problem."

Although many different conceptions of PBL have been developed and implemented, the essential idea is that learning starts with a problem that the learner wishes to solve. PBL is not claimed by its supporters to be new (Boud and Feletti, 1991) since it approximates the way in which learning took place before formal and institutional education was introduced.

Certain practices and strategies tend to be common to PBL courses, but most are not unique to PBL. For example, concentration on a real-life problem (which also features in case study methods), the use of peer- and self-assessment, the organisation of students into small groups, emphasis on students taking responsibility for their own learning (especially in identifying what skills and knowledge are needed to solve the problem) and drawing on more than one academic discipline, are features found in many situations, but likely to co-exist in a PBL course.

To use an example from medicine, the field in which PBL is regarded as having had its origins (Boud and Feletti, 1991), a small group of

(even first year) students will be supplied with details of a patient presenting at a surgery with a health problem, manifesting certain symptoms. Probably with the support of a tutor, who acts as a facilitator helping them to ask appropriate questions and identify and access needed resources, the students work together to identify the kinds of knowledge and information required to make a diagnosis and formulate a treatment plan. The students decide which knowledge they will all seek, and which they will allocate to individuals who will subsequently "teach" it to the rest of the group. The skills and knowledge acquired are then applied to the original problem, to assess whether a "solution" can be developed or whether further inquiry is indicated.

PBL enables greater emphasis to be placed on the development by students of :

- problem-recognition, problem-solving and decision-making skills;
- capacity for self-directed learning;
- integration of knowledge and skills within the context of professional practice;
- greater motivation for learning;
- capacity to see beyond one's own preconceptions, in order to be able to be both creative and critical.

PBL is not a new development. Pioneered at medical schools in North America in the 1960's, it spread world-wide by the late 1970's, initially in medical education and related health areas, but later in other professional and non-professional fields. Experiences with PBL have been documented (Boud and Feletti, 1991) from Australia, Britain and North America in health sciences (medicine, nursing, optometry), agriculture, social work, mechanical engineering, communication studies, management, business studies, architecture, computer science, law, biochemistry, psychology, and chemical engineering.

## **8.5 Recommendations to remove structural impediments**

Students' obsession with the six exemptions, and the marks and grades which are the key to gaining them, are, in our opinion, a major impediment to quality learning outcomes (in the sense in which we have discussed "quality" in this paper). We therefore advocate the abolition of the direct exemption links between the



undergraduate actuarial degree program and the UK syllabus for the "technical" subjects.

What we suggest is that the completion of an actuarial degree at Macquarie in itself should qualify the student for exemption from the first six Australian subjects.

This means that some students may be accepted as exempt from all six "technical" subjects at a lower "standard" than before. We do not make this suggestion lightly. We have considered alternatives, such as requiring say a B average grade over the whole degree. The problem with this is that it is likely to encourage behaviour by the students which runs counter to our educational aims. For example, students who found themselves slipping below a B average would seek to enrol in subjects in which A and B grades were perceived to be easier to obtain, and in subjects which drew on their strengths and their existing knowledge, rather than tackling subjects which would address their weaknesses and extend their knowledge. In other words we would end up with some of the same disadvantages of the existing system.

We do not see that there are dangers in our suggestion, although we expect it to be controversial. Exemption from the "technical" subjects does not convey the right to practise as an actuary - even qualification for the AIAA (Associateship) requires the passing of a professional subject at specialist level. There are still plenty of hurdles to be negotiated before the FIAA is achieved.

If we had the freedom to teach the course differently, students would not be forced to go at a pace which meant their only chance of understanding the material would come from repeating subjects in which they gained a grade of C or worse. We hope that students who are towards the slower end of the range of abilities in particular subjects (remembering that these are the "slower" members of a very select group, and also that such people may well bring other valuable talents to the actuarial profession) will recognise this fact and be motivated to spend more time on the material, perhaps spend four years on the undergraduate degree, in order to achieve the level of understanding they can see is necessary. Perhaps it is idealistic to expect this quality of self-appraisal from our students. If these people become actuaries, however, they will be expected to carry out this self-appraisal and continuing self-development for the rest of their professional lives. We believe that people who have been

expected to do this from the undergraduate level onwards are more likely to be willing and able to continue with self-development than students who have been forced by externally imposed standards to go back and jump the hurdle again until they are deemed to have cleared it.

## 9. Conclusion

The actuarial profession, employers of actuaries, and actuarial students themselves, have been well served by the existing program of university actuarial education in Australia. We have found, however, that there is considerable scope for improving the program, when it is examined in the light of educational research findings, our experiences as teachers, our students' experiences as learners, and the skills, qualities and attitudes needed by a professional, employable actuary.

We have identified shortcomings in curriculum structure, in the nature of students' learning, in assessment methods and in the availability of opportunities for students to develop the attitudes and values expected of professionals. Our recommendations for change hinge on removing the exemption link with the UK "technical" subjects, and we suggest that completion of an Australian actuarial university degree should replace the current six exemptions.

Although we have restricted our recommendations to the "technical" subjects, we believe that our findings also have relevance to the "professional" subjects.

We hope that this paper will stimulate thought and discussion, and we welcome comments, criticism and suggestions from our readers, and particularly from the students with whom we have had the privilege of working at Macquarie University.

## REFERENCES

- Barnett, R. (1992) *Improving higher education : total quality care*. London : SRHE and Open University Press.
- Barrows, H.S. and Tamblyn, R.M. (1980) *Problem-based learning : An approach to medical education*. New York : Springer.
- Bellis, C.S. (1991) 'Actuarial students' approaches to learning', unpublished working paper, Macquarie University.
- Bellis, C.S. and Shepherd, J.A. (1993) 'The Education of Australian Actuaries : Improving the Quality of Learning', to appear in *Transactions of the Institute of Actuaries of Australia* 1993.
- Biggs, J.B. (1987a) *Student Approaches to Learning and Studying*. Melbourne : Australian Council for Educational Research.
- Biggs, J.B. (1987b) *Study Process Questionnaire Manual*. Melbourne : Australian Council for Educational Research.
- Biggs, J.B. and Telfer, R. (1987) *The Process of Learning* (Second edition). Sydney : Prentice-Hall.
- Boud, D. (1985) (ed) *Problem-based learning in education for the professions*. Sydney : HERDSA.
- Boud, D. and Feletti, G. (1991) (eds) *The challenge of problem based learning*. London : Kogan Page.
- Champion, R. (1992) '*Presidential Address 1993*'. Sydney : The Institute of Actuaries of Australia.
- Entwistle, N.J. (1991) 'How students learn, and why they fail', in Radford, J. (ed), *Talent, teaching and achievement*. London : Jessica Kingsley.
- Entwistle, N.J. and Ramsden, P. (1983) *Understanding student learning*. London : Croom Helm.

- Entwistle, N.J. and Tait, H. (1990) 'Approaches to learning, evaluations of teaching, and preferences for contrasting academic environments', *Higher Education* 19, 169-194.
- Ferguson, R. (1992) 'Managing director's comment', in Annual Report of BT Australia Limited.
- Laurillard, D.M. (1984) 'Learning from problem-solving', in Marton, F., Hounsell, D.J. and Entwistle, N.J. (eds) *The Experience of Learning*. Edinburgh : Scottish Academic Press.
- Marton, F. and Saljo, R. (1976a) "On qualitative differences in learning : I - outcome and process", *British Journal of Educational Psychology* 46, 4-11.
- Marton, F. and Saljo, R. (1976b) "On qualitative differences in learning : II - outcome as a function of the learner's perception of the task", *British Journal of Educational Psychology* 46, 115-127.
- Newble, D. and Jaeger, R. (1983) 'The effects of assessment and examinations on the learning of medical students', *Medical Education* 17, 25-31.
- Ramsden, P. (1988) (ed) *Improving Learning : New Perspectives*. London : Kogan Page.
- Ramsden, P. (1992) *Learning to teach in higher education*. London : Routledge.
- Schon, D. (1987) *Educating the reflective practitioner*. San Francisco : Jossey-Bass.
- Shepherd, J.A. (1992) 'Investigating actuarial students' perceptions of assessment', unpublished working paper, Macquarie University.
- Solomon, R.C. (1992) *Ethics and excellence : Cooperation and integrity in business*. New York : Oxford University Press.
- Thomas, P. (1986) 'The structures and stability of learning approaches', Ph.D. thesis, University of Queensland, cited in Entwistle, N.J. and Entwistle, A. (1991) 'Contrasting forms of understanding for degree examinations : the student experience and its implications', *Higher Education* 22, 205-227.

Van Rossum, E.J. and Schenk, S.M. (1984) 'The relationship between learning conception, study strategy and learning outcome', *British Journal of Educational Psychology* 54, 73-83.

Watkins, D. (1983) 'Assessing tertiary study processes', *Human Learning* 2, 29-37.

Woods, D. (1985) 'Problem-based learning and problem-solving', in Boud, D. (ed), *Problem-based learning in education for the professions*. Sydney : HERDSA.

