

PERSPECTIVES ON ACTUARIAL EDUCATION

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1. INTRODUCTION

THE education of actuarial students has been a problem for the profession almost since its inception. Despite considerable efforts to seek improvements, difficulties have repeatedly arisen in the examinations, the syllabus and the teaching.

Over the past five years the profession has identified four major areas of concern:

- The average time to qualification of those who complete the exams is too long.
- The proportion of entrants who never qualify is too high.
- It is becoming difficult to recruit enough students to produce the required number of qualified actuaries 4–10 years later.
- There are insufficient actuaries available to fulfil the tutoring and examining duties required by the education service.

The first three of these points can be illustrated by considering a single cohort. In 1980, 289 students enrolled in the Institute. Only 5% of these had completed the exams within 4 years, and only 14% within 5 years. It is unlikely that more than about 30% of this cohort will ever qualify. Incidentally, much of the careers literature available to these students indicated that a diligent (but not extraordinary) student could expect to qualify in 3 or 4 years.

These are problems now recognized by the profession, and which have been considered by working parties of senior members of the profession, most recently the Kennedy committee (Kennedy, 1984) and the Education Working Party of the Institute's Futures Committee (EWP, 1987).

There are other problems though, problems which we have identified from a survey of current and recent students, but which do not seem to have been openly acknowledged by the profession. Perhaps the two most important are:

- The perceived unfairness of the exams. Many students felt that they had failed exams for which they were well prepared;
- Inadequate standards of teaching: Students complained of uninterested tutors, and of teaching materials which were out of date or inappropriate.

More detailed results of the survey of students and new fellows are presented in § 3. First though we consider a different perspective. Problems such as how to set exams which are fair, or how best to teach under a correspondence course structure, are not unique, and have been much researched by education experts.

In the next section we investigate briefly whether aspects of the theory of education could be applied to improve the actuarial education system.

2. THE EDUCATIONALISTS' PERSPECTIVE (SOME APPLIED EDUCATION THEORY)

Introduction

Education theory is concerned with the application of various other disciplines—psychology, sociology, philosophy and history—to the processes of teaching and learning. Its omission from investigations of actuarial education indicates that actuaries have felt that it is not applicable to teaching beyond school level. In fact there is a large body of work on the teaching of adults, much of which is directly applicable to professional education. In addition there are some important areas where the theory is applicable to all education, regardless of the ages of the learners.

Curriculum Development

The curriculum is not synonymous with the syllabus, but covers all the processes of education, including the development of teaching and assessment methods and their subsequent evaluation and alteration. A model that demonstrates relationships between these processes is that of Cowan & Harding (1986). The model, simplified slightly, is displayed in Figure 1.

This model is appropriate both for the development of individual courses, and for the development of the complete course of actuarial education. It demonstrates several very important points:

- That an explicit determination of aims and objectives is essential, and should be central to all deliberations and decisions.
- That assessment, learning and teaching are all interrelated. They must be considered as an entity, alterations in any one element necessitating changes in the others.
- That the development or alteration of the curriculum should be ongoing, logical and explicit.

Central to the development of the curriculum are the aims and objectives of the course, and these continually influence all other elements. It is important therefore that the profession identifies the aims of its education programme. Broadly these might be

- (i) To enable the profession to recruit and retain high quality students.
- (ii) To train students to perform to a high standard the work required of a qualified actuary.

It is more difficult to identify the detailed objectives designed to achieve these

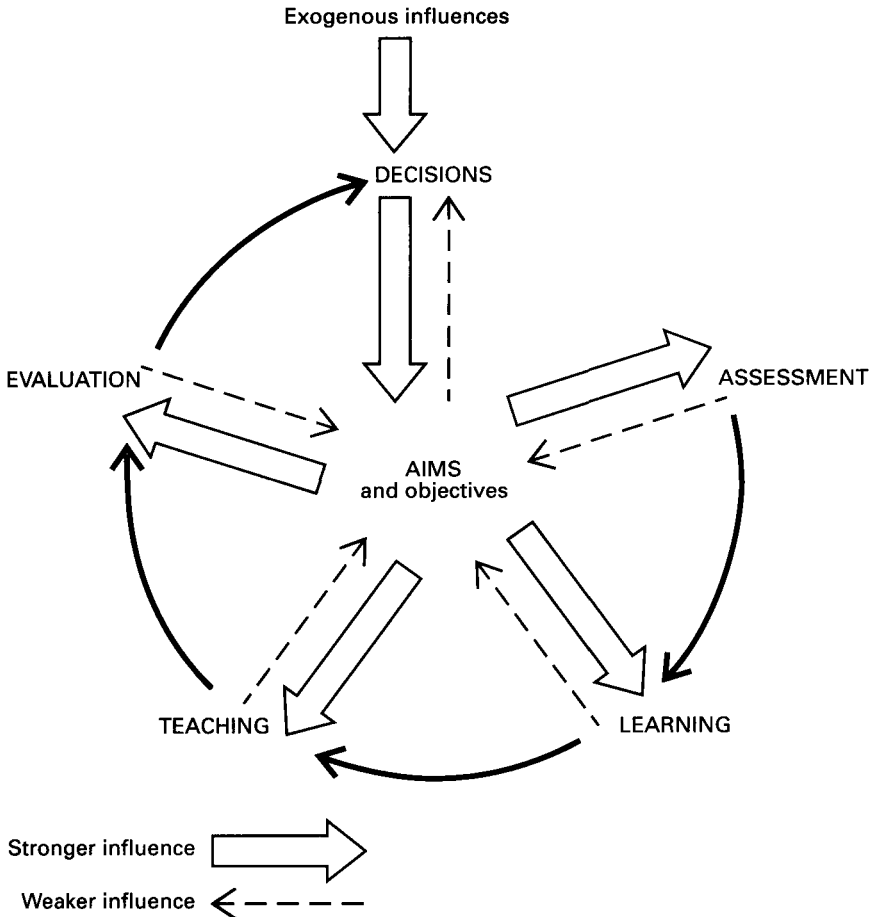


Figure 1. *Model of educational process after Cowan & Harding (1986)*

aims. In particular, course-specific objectives can be contentious, and do not appear to have been clearly conceived. For example, it might be thought that the major objective of the course in Mathematics of Finance is to enable the student to understand and apply the theory of compound interest at the level required of an actuary. In that case it is difficult to justify the more complicated, and entirely unrealistic, examples that commonly appear in Faculty exam papers. There must be some other objective for these, and we discuss this further in § 4.1. Whatever the objectives of a course are, they should be explicitly determined rather than implicitly assumed, and should be referred to whenever an exam question is set, or an AES course revised, or a test attempt marked.

The outer stages in the curriculum development model must be approached in some determinate order. Whilst some models do so chronologically—teaching, learning, assessment, evaluation—Cowan & Harding use what they call a ‘logical order’ which begins with assessment.

Assessment

Assessment is considered first in the model, since the type and content of the exams exert a powerful influence on material learnt, and learning methods. This is particularly true of actuarial education, where exam success is the students’ major goal, so that it is unlikely that they will learn more than they need to achieve this.

Actuarial exams in the United Kingdom appear uniform. All are closed book, last for 3 hours and offer no choice of questions. Most students agree that time pressure is considerable, although examiners claim this merely reflects students’ inability to distinguish what is relevant.

Nevertheless, there are differences. Consider for example the Life Office Practice exams. In the Institute there are 2 papers, each with 4 questions. Most of these are open-ended, and individual questions are very rarely repeated. In the Faculty there are 3 papers, usually with 5 questions on each. These tend to be more closed or structured, that is more questions that start ‘List’; ‘Define’; ‘State’ where the Institute questions use ‘Explain’; ‘Discuss’; ‘Suggest with reasons’. Also the Faculty frequently re-uses old questions. As model solutions are widely available, these repeated questions, which ostensibly test applications of principles, actually test rote-learning.

The curriculum model requires us to use our central aims to decide on the purposes of the assessment, before deciding whether either of the examination types described is appropriate.

The purposes of examining are divided by Thyne (1974) into two categories. ‘Content purposes’ are expressed in terms of the taught course and explicit syllabus. Thus possible content purposes of the life office exam are:

- (i) To test knowledge at the taught level of life office practice as presented in the course of reading.
- (ii) To test memory of life assurance legislation.

‘Criterion Purposes’ are expressed in terms of the use that is to be made of the results of an exam, for example:

- (i) To ascertain whether a student has the required knowledge of current life office practice.
- (ii) To predict candidates’ potential to deal with life office work.

Content purposes are introspective of an individual course; criterion purposes are externally determined.

The extent to which an exam achieves the content and criterion purposes is

called the “content or criterion validity”. Content validity is a crucial element of students’ perception of examination fairness, and is the extent to which an examination corresponds in content and in level with what has been taught in the course.

Ideally, to achieve this correspondence, the teachers should also be the examiners. Yet the Institute prides itself on keeping these roles separate. One examiner recently declared proudly that he had never read the AES tuition material of any course he examined. He cannot therefore know if he is examining what has been taught—or if he is examining at the taught level. There is nothing incommendable in separating the activities of tutoring and examining; they are inextricably connected.

The major criterion of actuarial exams is to identify accurately those students who have reached a specified standard of ability. There are two elements of this criterion, the requirement to find which students have reached a given, externally determined standard, and the requirement to do this accurately. To achieve accuracy the exams should be designed to be ‘reliable’ and ‘precise’. To be reliable an exam must give results which could be repeated in other, comparable circumstances—for example a retest of the same candidates. Precision requires that as far as possible the marks should be spread out—at least around the pass level. There should be a real difference between a narrow pass and a narrow fail.

The Institute’s exams, on the limited evidence available, apparently fail to achieve reliability or precision. The pass rates for some subjects have, in the past few years, jumped from around 20% to more than 40% despite consistently high numbers of candidates. The bunching of marks is also disturbing. David Purchase’s disquieting paper (Purchase, 1982) demonstrated that in the Institute’s B2 exams in 1978 and 1979, 40% of all candidates achieved marks lying within 5% of the pass mark. He also disclosed that the average mark of the top 10% of candidates may commonly be as little as 8% away from the pass mark. This lack of precision threatens to turn the exams into a lottery.

The ‘specified standard’ referred to above demands that what is assessed is modelled on the activities of qualified actuaries. Yet the discrepancies between the examinations and practical actuarial work seem to be increasing. These discrepancies arise both in respect of the material covered and the levels at which that material is covered.

One scale of levels of ability is Bloom’s Taxonomy (Bloom, 1956). Widely used in education, it is relevant to all stages of curriculum development. We can use this to compare the levels of ability taught, the levels examined, and the levels used by working actuaries.

There are 6 main classifications. From lowest to highest:

- (1) Knowledge—recall of material.

Problems involving recall of legislation, for example, would fall into this category.

- (2) Comprehension.

This covers, for example, questions that start “Write brief notes on”.

- (3) Application—remembering principles, and bringing them to bear upon given material.

This steps beyond comprehension as it requires knowledge of what is to be applied. Most of the non-bookwork questions in Mathematics of Finance and Life Contingencies are designed to fall into this category.

- (4) Analysis—the breakdown of material into its constituent parts and detection of the relationship of the parts.

Bloom emphasises that the quality of the analysis is important, and that simple wrong/right judgements are inappropriate. Many of the questions from the later exams attempt—but often fail—to test analysis.

- (5) Synthesis—The putting together of elements to make a whole; to be creative. Rarely covered in actuarial exams.

- (6) Evaluation—The making of judgements about the values of ideas, works etc.

The later parts of the exams attempt to test evaluation. Questions that require a discussion of a quotation from a student, a trustee or an actuary would fall into this category, but for the fact that most students are trained by the AES to answer by repeating received information, rather than making their own evaluation.

Most actuaries would agree that much of their work lies at levels (4), (5) and (6), and that the amount of rote learning required is minimal. While the earlier exams concentrate on the lower levels of the scale, the later subjects demand, in addition to large amounts of rote-learning, the ability to answer questions involving analysis or evaluation. The problem with this is that it is very difficult to teach these levels using the current methods and impossible to test them fairly in traditional exams. It would be irresponsible for a working actuary to make an evaluation of, for example, a life office merger after only 10 minutes consideration of the problem, with no access to additional information, with no practical experience of this area of work, and whilst in a state of acute anxiety. Yet these questions are included in exams on the grounds that they are 'realistic'. That students deal with them less than satisfactorily is demonstrated by the examiners reports, for example:

"As with other questions of this nature, there was very little attempt by the candidates to do more than reproduce what had been learnt."

(Institute Examiners Report, 1981)

The dilemma we are faced with then is this. Criterion validity demands that some attempt is made to examine the higher levels, because these are the levels that will be encountered by a qualified actuary. Content validity on the other hand demands that these higher levels are examined only if they are taught—and they are not. Indeed the inadequacy of much of the reading and the long-distance nature of the teaching make it very difficult to train students in these higher levels. Currently the only access to exercises in analysis, synthesis or evaluation is through the practical office work which students encounter. This is why life office

students find the pensions exam considerably harder than the life office exam, while the converse is true for pension fund students.

Projects and dissertations are the only effective ways of learning or assessing at the higher levels. Students baulk at evaluation and analysis in subjects in which they have no practical experience, because the tuition does not give them sufficient relevant information or insight to make responsible judgements. If it is essential that students demonstrate the higher levels, then the profession must be prepared to introduce project-based methods of assessment.

Learning

The theory of learning is made more accessible for us by Miller (1964), who, during investigations of learning methods amongst mature students, developed the following 'Six Crucial Conditions for Learning'.

Condition 1: The Student must be adequately motivated to change behaviour.

A look at withdrawal rates demonstrates clearly that for about half of the students enrolling, the original motivation to qualify has dissipated by the fourth year of entry. Ultimately, around two-thirds will withdraw. Many of these could, with a little more perseverance, have completed the exams. What are the demotivating factors?

Certainly failure is painfully demoralizing. For many students actuarial training provides the first experience of examination failure—often inexplicable to the students themselves, as our survey demonstrated. Perhaps some prefer to withdraw rather than to risk future humiliation.

The original motivation to study arises from the expected reward of qualification. Perhaps this reward becomes too distant, or too costly in terms of family or social life foregone. Some students also become bored by the study, finding it irrelevant to the office work.

Motivation could be improved then by improving the curriculum design to reduce failure rates and qualification times, and by using up-to-date, relevant syllabuses and study materials.

Condition 2: The student must be aware of the inadequacy of her or his present behaviour.

"As in previous years, the general standard of answers was poor."

(Institute Examiners Report, 1981)

Miller does not mean that this kind of disparaging generalization is justified. A student should, as part of the learning process be made aware of the weaknesses in her or his performance, specifically and constructively. Too often at present the inadequacies of the exams, the teaching and the syllabus are confused with inadequacies of the students.

Condition 3: The student must have a clear picture of the behaviour which is to be adopted.

Here we return to the contradiction faced by every student—that what is taught, and the level at which it is taught, differ from the content and level of the examinations, and from the work required of a qualified actuary.

The tutorial solutions give some indication of what is required of students, but the tutorials are often very different in style to the exams, and the Institute's refusal to circulate model solutions to the exams makes it difficult for students to identify how their answers should be constructed.

Students also face the problem that it is unclear how much energy should be channelled into study, away from office work. Many students in the survey mentioned that it was rare to be able to take their full allotted study time: clearly office work is being given priority.

Students at all stages should be made aware of what is expected of them, with reference both to the specific learning needed to pass the exams, and to their attitude to study and its relation to office work.

Condition 4: The student must have opportunities to practice the appropriate behaviour.

Psychologists agree that learning is an active process. They question the efficacy of the practice of handing out information for the student to accommodate passively, and regurgitate. For full assimilation, students need to have the time and opportunity to make mistakes as well as to analyse the material and relate it to their own prior knowledge and experience.

This assimilation is hampered for actuarial students by the vast quantity of material that must be covered and the part-time nature of the study. While discovery learning is the most effective in the long term, the only way of working through the syllabus in a reasonable time is by short-term rote learning of received information—often forgotten soon after the exam.

Condition 5: The student must get reinforcement of the correct behaviour.

'Reinforcement', as a technical term, arose as a substitute for the word 'reward'. Students need to have external recognition of what is correct or creditable about their work, as this increases the likelihood of the behaviour being repeated.

In actuarial education this condition is often not satisfied. Although many tutors are excellent, most students have experienced one whose assessment of a question consists of a tick and '10/25'. This discourages students from submitting subsequent tests, and there is then no access to reinforcement during learning—and the students are criticized for having a 'poor study record'.

Condition 6: The student must have available a sequence of appropriate materials.

Under this final condition Miller emphasises that it is not adequate to import

materials from other contexts and expect the students to learn efficiently from them. In other words, students should not be expected to learn from old papers originally designed to be read and discussed by experienced actuaries. Far preferable are the specially commissioned study notes now used increasingly by the AES. The writers of these should be encouraged to include examples and exercises, as in any normal text book, to enable students to adopt a discovery approach. Textbooks which are out of date are also undesirable, causing unnecessary and unreasonable confusion for those students without relevant practical experience.

Teaching

Teaching may be didactic or facilitative. The didactic teacher is exemplified by the old fashioned lecturer; the facilitative is described by Kidd (1959) as “he-who-assists-learning-to-happen”. The advantages of discovery or active learning have led most theorists to favour a facilitative approach. Didactic teaching however, retains many adherents as it is straightforward, quick and generally adequate for getting students through traditional exams, involving only the first three levels of Blooms scale. The correspondence course is ideally suited to facilitative teaching, but is constrained by the need to cover a large syllabus in a short time—often with inadequate materials.

The Correspondence Course

Correspondence course students are directed by two teachers. The first is the anonymous author of the course, the second the tutor who marks the student’s test attempts. Teachers at both levels should have some knowledge of the basic functions and methods of teaching, and a firm understanding of its objectives.

Some approaches to teaching are described by Burgess (1977), who describes the three main functions of teachers of adults.

First, the teacher should give confidence to the learner. The AES course author is in a position to provide confidence by designing the material in such a way that the student is led gradually through it. Questions should be relevant and graded—a test might start with straightforward questions, and build up to exam standard. Students should not be presented with questions which cannot be answered using the information provided by the course at that stage. Self evaluation tests, to be completed before attempting the tests, might be introduced to help build the confidence necessary for the tests themselves.

The tutor also plays an important role in instilling confidence, in particular by responding constructively to test attempts. Tutors who are dismissive, or who concentrate on and exaggerate students’ errors, will find a high proportion of their students falling behind in their study, as the students’ motivation is eroded with their confidence.

The second task of the teacher, as described by Burgess, is to “give access to learning”. This is the major role of the AES course author. It does not mean

simply access to information, but access to learning at whatever level of Bloom's scale is appropriate, and is to be examined. Unfortunately, in some subjects, lack of suitable materials is a serious constraint. Because of this, and because every student's needs are different, it is beneficial if the tutor is also prepared to help. Part of the tutor's function could be to interact with the student, responding to questions, suggesting remedial work for areas of difficulty, or extra background reading.

The third role of the teacher is to criticize—the major role of the tutor. Burgess explains what this does not mean:

"A student writes an essay and gets a B+ with a few comments if he is lucky. This is a travesty. There is academic vulgarity at its very worst in that B+. It assumes the correct response to a serious piece of work is a label. What the student needs is . . . shrewd critical comment. If a teacher cannot offer that, he had better not offer anything."

The function of criticism is to help the student to improve. It should increase the student's self criticism, and should direct the student to an understanding of her or his own strengths and weaknesses. It should also reward work that is good or improving.

Tutorial Classes

Many home students will, at some time, have the opportunity to attend tutorial classes. These work best if they "avoid being simply a lecture in disguise and start instead from the students and their work" (Burgess, 1977). Unfortunately the natural feeling of many students who embark on a course of tutorials is, as far as possible, to avoid active participation. If the students' defenses can be lowered, so that their input is high, the real value of tutorials will emerge.

In the first tutorial the tutor, implicitly or explicitly, lays down ground rules. The atmosphere should be controlled to enable students to feel free to contribute—and to make mistakes. If possible there should be an opportunity at an early stage for some social interaction, to assist group cohesion. Evening tutorials suffer from the added disadvantage that most participants, including the tutor, are tired, hungry and preoccupied. If tutorials are to be active and effective, they would be better held during the day. They could form part of the students' normal study leave, and only the tutor would be affected by office time lost.

Evaluation

Evaluation is a process of assessing the extent to which an activity succeeds in what it was intended to do. Any evaluation therefore depends on there being previously determined specific and measurable objectives. The actuarial educators do not seem to have procedures for systematic evaluation, but instead instigate major evaluation exercises only when problems have accumulated. In contrast, Cowan & Harding's curriculum model advocates a dynamic system,

each stage continuously under review, with a full evaluation exercise each year. Such an evaluation of the actuarial curriculum might make use of:

- Questionnaires to students. These could help indicate areas of the reading that need improving, the effectiveness of tutors and tutorials and the quality of the examinations.
- Information from tutors.
- An analysis of common errors in the exams.
- The results of the exams.

Decisions

Decisions may emerge from the evaluation, or may be generated by exogenous influences, such as constraints of manpower, recruitment problems or external pressure to change the syllabus. All such factors must be translated into a restatement of aims before being allowed to influence other elements of the cycle.

3. THE STUDENTS' PERSPECTIVE (RESULTS OF A SURVEY OF STUDENTS AND RECENTLY QUALIFIED FELLOWS)¹

Attitudes to the examination system

Dissatisfaction with the examination system is widespread. In response to question 13 about fairness, 21% marked the 2 points at the 'unfair' end; a further 26% inclined slightly in the same direction. The existence of such a large dissatisfied group is more troubling than the fact that some people regard the system as fair. An ideal system would be perceived to be fair by everyone.

Students were considerably more likely than fellows to describe the system as unfair. Those who have surmounted all the barriers seem more favourably disposed towards the system than those still struggling.

Yet students who had been taking the exams for a long time were no more likely to regard the system as unfair than those who started recently; indeed the recent entrants are actually less content. Neither did the number of examinations still to pass seem to influence students' attitudes to their fairness.

The data offers one explanation of why some people regard the system as unfair. Students who expected to take a long time to qualify were more likely to regard the exams as unfair: one third of those who expected to take longer than 8 years scored the fairness question as 1 or 2, compared with only 17% of those who expected to take 7 years or less. Eventually qualifying however seems to overcome this negative attitude. The fellows who did in fact take more than 8 years to qualify were not much more likely than other fellows to feel that their experience had been unfair.

Thus it seems that the fact of completing the examinations tends to encourage

¹ A copy of the questionnaire is given in appendix 1. Further details of the survey are available from the authors.

a sense of satisfaction with the system, even though while actually progressing through it a student might feel rather differently. On qualifying actuaries seem to forget about the setbacks and injustices encountered as a student. Nevertheless, the demotivating effects of the students' perception of fairness should be of concern to the profession.

Changes in the Examinations

One of the reasons for dissatisfaction with the exams may be the absence of any choice of questions. Students were much more likely to be in favour of choice than fellows: once someone has successfully negotiated the exams without choice, they have perhaps less reason to favour a change. Moreover, students who saw the system as unfair were more likely to be in favour of choice than those who did not. Introducing choice, therefore, might be a way of reducing students' discontent (although it would tend also to reduce examination reliability).

The recent changes in the examination structure might help too, especially if they shorten the time taken to qualify, as is expected to happen by one third of the total sample—more in the Institute than the Faculty (respondents were replying about their own system). Students were less optimistic than fellows, being less likely to believe that qualification times would shorten.

Studying

How then do people cope with a system that takes up a large part of their lives for many years, and which is widely seen as unfair?

One thing they do is study hard, considerably harder than the fellows surveyed by Goddard (1979). Overall 68% of the sample claimed to study, or to have studied when they were students, 13 hours or more per week, over and above the normal study leave of 7 hours per week. Fellows remember student life as being harder than current students are finding it to be. Men and women had similar studying patterns.

Yet people do not seem to get discouraged. Even among respondents for whom qualification took, or is expected to take, more than 8 years, over half were still studying for more than 13 hours. This is only a slightly lower percentage than among people for whom qualification meant 7 years or less.

The time spent studying was not associated with attitudes to the fairness of the system, nor with conflicts between office work and study. There was some weak evidence that people who did not find studying intruded into their personal life were in fact studying less than others.

The Faculty respondents seemed, on the whole, to study longer hours than those from the Institute.

As well as studying for a large part of their week, respondents expected to study (or had studied) for many years, with 38% of students expecting to take longer than 8 years and 29% of Fellows having done so.

Despite expecting to take longer than men, women were no less confident about their changes of eventual success.

Satisfaction

We have seen that a sizeable proportion of the sample believed that the examination system is unfair, but there is other evidence of dissatisfaction.

There was much discontent with the tuition service: 30% of the sample marked the 2 points corresponding to 'unhelpful', while only 11% marked the 2 points at the other end. Specific comments mentioned unhelpful tutors, and problems obtaining tuition material at the start of the session.

Thirty-nine per cent of the sample experienced conflicts between studying and office work, and 33% felt that studying for exams intruded unreasonably on their personal life. Women were more likely than men to experience conflicts with their office work, but no more likely to find studying interfered with their personal life.

As a last resort a student can abandon the exams completely. One third of the sample had seriously considered doing so, and those who regarded the system as unfair were more likely to have considered giving up than others.

Faculty respondents seemed to be rather less likely to have considered giving up than Institute ones, and women seemed to be slightly more likely to have considered it than men. This is consistent with our observation that women are more pessimistic than men about the time they expect to take to complete the exams.

Why do people consider giving up? Interference of study with office work (or perhaps the stress caused by such conflicts) seems to be one reason. Another is the intrusion of studying on personal life. Both are associated with a greater likelihood of considering giving up.

Another reason for despondency among students is an expectation that qualification will take a long time—66% of students who expected to take 8 years or more had considered giving up, in contrast with only 19% of students who expected to take 7 years or less.

On the other hand, there was no evidence that intensive study patterns induced a desire to give up—if anything, harder studying is associated with greater determination to finish.

These findings about conflicts and the tendency to consider giving up are consistent with our earlier discussion of conflicts and a sense of unfairness. People who enter the long process of qualifying to be an actuary perhaps fail to complete it because they find the studying prevents them leading a normal working life. But that they are not lazy or unmotivated is shown by their protest against unfairness, and by their readiness to put in long hours.

It is also shown by the strong agreement that actuarial work, despite all the problems, was the right choice of career. Overall, 81% of the sample felt they were in the right job.

Some were less enthusiastic. Intrusion into personal life was weakly associated

with regrets about their choice of career: of those who experienced many intrusions, the proportion who had no regrets dropped to 68%. And, not surprisingly, among those who had seriously considered giving up, the proportion was only 67%. But, even in such groups, the remarkable fact is the nevertheless high proportion who were happy with their career.

Thus the findings of our survey are encouraging. The profession is recruiting people who are highly motivated to qualify, and who are prepared to make considerable sacrifices to do so. However it is important to avoid complacency. Unfair exams are demotivating students; the conflict between the short term demands of the office and the long term demands of study is very stressful; the requirement that students subordinate their personal lives for much of their twenties will certainly deter many first class potential recruits.

4. MISCELLANEOUS PERSPECTIVES

The Faculty View

Although the Institute and Faculty co-operate on such education matters as the commissioning of textbooks, or the use of some tuition courses, they diverge significantly on their attitude to the examinations. In his recent presidential address to the Faculty, W. M. Morrison highlighted the differences in the Institute and Faculty education programmes. The three major areas of disagreement are the standard at which the examinations in Mathematics of Finance and Life Contingencies should be set, whether students should specialize before qualifying, and whether students should be required to study General Insurance.

The Faculty sets an artificially high standard in Parts 3 and 4 (or at least sets artificially complicated questions), claiming that those who cannot pass these exams are unlikely to succeed as actuaries, and therefore should be discouraged from continuing at that early stage. But does success in this style of examination distinguish the potential actuaries? Certainly success in these papers is no guarantee of ultimately qualifying.

The figures in Tables 1 and 2 of Appendix 2 show that the success rate of candidates taking the Faculty's Mathematics of Finance exam is about the same as that of candidates taking the Institute's A2 exam over the period from April 1983 to September 1987. This is despite the different emphasis in the two exams. In contrast, the pass rate of Faculty candidates in Part 4 is much lower than that of Institute A3 candidates.

The pass rates in Parts 5 to 8 in the same period suggest that the earlier subjects are not good indicators of potential. Parts 5 and 6 have similar pass rates to part 4, while Part 8 has the lowest of all. It seems unsatisfactory that so many candidates fail at this stage, despite several years experience of the exams.

The pass rate for Part 7 was greater than for any other paper, Faculty or Institute. This, with the Part 8 pass rates, is consistent with our conclusion in §2

that practical office work provides access to higher levels of Bloom's scale that is unavailable from the tuition course alone. While the Institute data is confused by the mix of students from pensions/life office backgrounds, by far the majority of Faculty home students work in life offices. It is not surprising perhaps that in our survey, 34% of all Faculty respondents stated that they had failed Part 8, despite being well prepared (many of the remaining 66% will not yet have attempted this part).

Overall, although the Institute's pass rate in the A exams is slightly better than the corresponding Faculty parts, the pass rates in the B subjects is very poor, and rather worse than the corresponding Faculty parts. As described in § 2.3, the style of the B exams is quite different from these Faculty parts, with the Institute favouring unstructured questions, on which it is unusual to score highly.

Tables 3 and 4 in Appendix 2 show the distribution of times taken to complete the exams by recent candidates at home examination centres. A longer time period has been used for the Faculty in order to produce a population comparable in size to that for the Institute.

The figures show that, overall, the average time to completion for Faculty students is less than that for Institute students, a full year's difference in the medians. However, interpretation is complicated by the fact that some students enter the profession with several exemptions. Of the 101 Faculty students completing the exams, fourteen were Heriot-Watt graduates who were exempt from 4 or 5 exams. They had a median qualification time of 3 years. If they are excluded from the analysis of Faculty students, then the median time to completion rises to 6 years.

We do not have similar figures for actuarial mathematics graduates in the Institute, but if their experience is similar to that quoted in the Kennedy report (Kennedy, 1984), then their inclusion in the overall figures quoted above is unlikely to be pulling the median time down to any great extent. These figures suggest that the Faculty should be concerned about the time it takes their students to qualify, especially since in the past they have been taking, on average, 2 exams fewer than Institute students.

Experience Elsewhere: The view from abroad

A survey of the actuarial training around the world shows that the main difference between countries is the proportion of the training which is provided by the universities as opposed to the professional bodies themselves.

In the U.S.A., the professional bodies exercise control, conducting all examinations, although many universities offer actuarial science programmes. At the other extreme are Belgium and Denmark, where the entire education process is in the hands of the universities. In Germany and Italy, the professional bodies play a small part, relying heavily on the universities.

Are there lessons for the U.K. bodies in this? Although the profession in the U.K. is unlikely ever to support the idea of training being carried out wholly by

the universities, it might in the future prefer to give the universities more responsibility for teaching and examining in the early parts. This could ultimately lead to a situation similar to that in Australia, where the IAA conducts examinations only in the practical subjects.

The potential of the universities was recognized by the Kennedy report, which proposed that one year full-time postgraduate diploma courses covering the early parts should be established at Heriot-Watt and City universities. Although this has now been done, and the courses are in their third year, the numbers attending are considerably smaller than those envisaged in the report.

5. THE AUTHORS PERSPECTIVE (SOME CONCLUSIONS)

If this paper contains many criticisms and few solutions, it is because it was intended to be diagnostic, rather than to provide remedies. Nevertheless it seems appropriate to present some concluding suggestions for the professional bodies and the employers which, from the evidence of our research, we feel might be helpful.

The Professional Bodies

To the professional bodies we suggest the following:

- Determine explicitly the aims and objectives of the actuarial education programme, and of the individual courses which make up the programme.
- Employ a consultant educationalist, specializing in continuing professional education, to help design a curriculum which is consistent with these aims.
- Organize the training of tutors, to ensure that students receive the best possible support. A day would probably be sufficient.
- Organize the training of examiners, to ensure that examinations are valid and reliable.
- Cease using tutors who are uninterested, unhelpful and slow to return tests, however serious the manpower problems.
- Ensure that learning materials are appropriate, up-to-date and ready in time for the start of each session. Model solutions to past exams should be made available to students as a valuable learning aid.
- Hold resit exams in September. The single most common complaint volunteered by respondents to the survey was about the frustration of having to wait a whole year to sit the B exams, or Parts 7 and 8 in the Faculty. Autumn resits have been recommended by almost every writer on actuarial education since 1979.
- Investigate the use of projects, dissertations and continuous assessment. These are more suitable for teaching and examining at the higher levels of Bloom's scale, and more realistically simulate the work of a qualified actuary than traditional techniques.
- Reduce the syllabus. In particular, cut down on the rote element of the exams

(particularly in the Faculty, which does not even allow its students the few formulae in the 'Formulae and Tables').

Employers

Employers have much to gain from co-operating with the professional bodies to improve the education of their students. They will have better prepared actuaries, recruitment will be easier and the enormous financial investment in students will not be so often wasted. Some of the practical ways in which the employers could help are:

- Make qualification a priority for students. Cancelling study leave for office work creates undue pressure, and is not in the long term interests of the students or the employer.
- Use a 'carrot' rather than a 'stick' approach. Failure is painfully punishing in itself, and does not need reinforcement by an employer. On the other hand, success should be recognized and rewarded.
- Actively support the work of the professional bodies. For example, allowing tutors some time during office hours to mark or take tutorial classes would ease manpower problems. Perhaps also senior actuaries could be given some leave of absence to write text books.

6. ACKNOWLEDGEMENTS

We are very grateful to the many students and fellows who responded to our survey. Their comments were intelligent, stimulating and often very witty. We would also like to thank John Waugh at the Institute of Actuaries for his assistance with the survey.

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APPENDIX 1

STUDENT QUESTIONNAIRE

1. Name
2. Institute/Faculty (*delete as appropriate*)
3. Area of employment: (a) Life Assurance
(please tick) (b) Consulting Actuaries
(c) Employee Benefits Consultancy
(d) General Insurance
(e) Other (please specify)
4. In which year did you enrol as a student?
5. From how many exams were you exempted when you enrolled as a student?
6. How many subjects do you still have left to pass?
7. Approximately how many hours per week do you spend studying, outside office hours, in the months leading up to the exams?
8. Have you ever failed any exams for which you considered yourself adequately prepared? If so, which?
9. Would you favour the introduction of a choice of questions in the exams?
10. (i) Have you ever seriously considered giving up the examinations?
(ii) If you have, what kind of work would you consider moving into?
(iii) If you gave up the examinations, would you be able to continue working for your current employer?
11. Do you think the recent alterations in the examination structure will:
(a) Lengthen the time required to qualify as an actuary?
(b) Shorten the time required to qualify as an actuary?
(c) Not significantly affect the time required to qualify as an actuary?
(please tick)

In the following questions please circle the point on the scale which you feel most accurately represents your opinion.

12. How do you estimate your chances of completing the actuarial exams?

Certain to complete exams					Very unlikely to complete exams
1	2	3	4	5	6
13. How fair do you think the actuarial examinations are?

Not at all fair					Very fair
1	2	3	4	5	6
14. How helpful have you found the AES coursework and tutoring system?

Not at all helpful					Very helpful
1	2	3	4	5	6

15. Have you experienced any conflicts between your studying requirements and your office work?
- | | | | | | | | |
|--------------|---|---|---|---|---|-------------------|--|
| No conflicts | | | | | | Serious conflicts | |
| 1 | 2 | 3 | 4 | 5 | 6 | | |
16. How reasonable do you feel is the intrusion of your studying requirements on your personal life? You should consider both the intensity of the work and the probable duration. You might consult your spouse/partner, if appropriate, on this question.
- | | | | | | | | | |
|-------------------|---|---|---|---|---|----------------------|--|--|
| Very unreasonable | | | | | | Perfectly reasonable | | |
| 1 | 2 | 3 | 4 | 5 | 6 | | | |
17. How long do you think it will take you to complete the actuarial examinations, in years from your year of entry?
- | | | | | | |
|-------------|--------|--------|--------|------------|-------|
| Less than 3 | 4 or 5 | 6 or 7 | 8 or 9 | 10 or more | Never |
|-------------|--------|--------|--------|------------|-------|
18. Finally, with the benefit of hindsight, do you feel you made the correct decision in choosing an actuarial career?

We would welcome any other comments you may have regarding any aspect of actuarial education. Please feel free to use the reverse of the questionnaire for this. We would remind you that all replies will be treated in the strictest confidence.

Please return completed questionnaires to:

(Faculty of Actuaries students)
David Dickson at

Dept. of Actuarial Maths and Statistics
Heriot-Watt University
Edinburgh EH14 4AS.

(Institute of Actuaries students)
Mary Hardy at

APPENDIX 2

Table 1. *Pass rates in Faculty exams, 1983-1987*

The figures show the percentage of candidates passing each part from April 1983 to September 1987, and the overall percentage passing in this period.

	<i>Part</i>						
	2	3	4	5	6	7	8
April 1983	64	48	40	37	36	31	33
Sept 1983	50	27	37	22	25		
April 1984	53	42	40	35	48	45	40
Sept 1984	50	34	27	29	43		
April 1985	25	41	37	37	39	46	35
Sept 1985	0	38	22	39	28		
April 1986	48	43	44	52	30	49	30
Sept 1986	44	34	34	37	40		
April 1987	40	38	32	33	29	40	33
Sept 1987	22	29	39	31	36		
Overall	41	39	36	36	36	43	34

No figures are given for Part 1 because of the small numbers sitting this exam.

Table 2. *Pass rates in Institute exams, 1983-1987*

The figures show the percentage of candidates passing each subject from April 1983 to September 1987, and the overall percentage passing in this period.

	<i>Subject</i>								
	A2	A3	A4	A5	A6	B1	B2	B3	B4
April 1983	40	43	21	53	33	25	35	24	33
Sept 1983	43	42	47	34	43				
April 1984	42	45	39	63	29	20	27	29	28
Sept 1984	34	38	42	42	38				
April 1985	36	37	43	33	39	20	31	30	29
Sept 1985	35	42	44	50	41				
April 1986	40	46	40	41	48	29	31	27	36
Sept 1986	51	47	45	43	35				
April 1987	33	44	41	57	49	31	34	33	32
Sept 1987	35	43	43	38	39				
Overall	39	43	40	44	40	25	32	29	32

The Institute's new numbering system started in April 1987, so that the figures for A5 refer to the new Subject 1. As in Table 1, no figures are given for A1 (Basic Statistics).

Table 3. *Distribution of qualification times—Faculty*

1. The figures relate to qualification times of FFA's who qualified at U.K. examination centres between 1983 and 1987 inclusive. Qualification time is defined as year of completing the exams minus year of entry to the profession.

<i>Years to qualification</i>	2	3	4	5	6	7	8	9	10	> 10
Number qualifying	4	10	20	18	9	15	9	4	2	10
Cumulative percentage	4	14	34	51	60	75	84	88	90	100

2. The figures are as in the above table except that the fourteen Heriot-Watt graduates who entered the profession with more than two exemptions have been excluded.

<i>Years to qualification</i>	2	3	4	5	6	7	8	9	10	> 10
Number qualifying	1	6	17	16	8	14	9	4	2	10
Cumulative percentage	1	8	28	46	55	71	82	86	89	100

Table 4. *Distribution of completion times—Institute*

The figures relate to times taken at U.K. examination centres to complete all the Institute's exams by those who completed them between 1985 and 1987 inclusive.

<i>Years to completion</i>	2	3	4	5	6	7	8	9	10	> 10
Number completing	4	23	33	35	44	35	23	20	11	33
Cumulative percentage	2	10	23	36	53	67	75	83	87	100

Note: The above tables are based on information contained in the Institute and Faculty Yearbooks.