6. INTERVIEWS WITH UNIVERSITY LECTURERS

6.1. Participants and procedure

Nine groups of university lecturers from three universities were invited to attend semi-structured interviews. Their fields of expertise were:

(a) Geography
(b) Accountancy
(c) Electrical and Electronic Engineering (a group of eight lecturers)
(d) Electronic Engineering (two lecturers)
(e) Civil Engineering
(f) Computer Science
(g) Mathematics
(h) Statistics
(i) Chemistry

The questions asked in the interviews comprised (a) their satisfaction with and expectation of incoming students and (b) their comments on the current school mathematics curriculum. The interviews were audio-taped, transcribed and content-analysed.

6.2. Results

The study revealed that there was much commonality among the opinions of university lecturers from diverse fields. Of course, there were discrepancies too. The respondents were classified into three groups according to the mathematical requirements of their subjects, viz. (a) electrical and electronic engineering, (b) other engineering departments and pure sciences except chemistry, and (c) chemistry and arts subjects.

6.2.1. Perception of students' mathematical standards and performance

The highest demand for mathematics in its program of studies would be in the electrical and electronic engineering departments. In general, the mathematical standard of incoming students was above average. However, in recent years, there appeared to be a wider range of mathematical ability in incoming students. For instance, one intake could include students with 3 or 4 A-grade passes and others with E-grade passes in A Level mathematics. The general impression was that the mathematical standard of incoming students had fallen. Of greater concern was

that recent enrolment netted in students who lacked understanding of some very basic concepts and principles in mathematics and who were generally weak in abstract thinking. Moreover, there were students who had difficulty in tackling new problems and applying mathematical knowledge and skills in new situations.

Programmes of studies in the departments of mechanical engineering, computer science, statistics and mathematics were still mathematics-oriented, but the amount of mathematics required was not as high as that of electrical and electronic engineering. The mathematical standards of incoming students ranged from poor to average, except for statistics. Normally, students who had not studied A Level Pure Mathematics would not be admitted to the statistics department. Major weaknesses were found among those whose minor subject was statistics; generally they did not have a strong mathematics background in the sixth-form. Their major weaknesses appeared in combinations and permutations. Students of other departments were generally weak in areas such as not knowing how to tackle new problems, inability to apply knowledge and skills in new situations, poor study attitudes (e.g., not working seriously in academic work, losing focus), unsatisfactory language skills, and inability to think in the abstract. For mechanical engineering in particular, students lacked insights in physical situations and were unable to solve real life problems with mathematics.

The departments of chemistry, accountancy and geography required the least amount of mathematics in their programs of studies. Students with basic mathematical knowledge and skills were generally able to handle the requirements of their courses. The mathematical standard of incoming students was fair. The department of chemistry reflected that they had faced a declining standard of mathematics in incoming students in recent years.

6.2.2. Expectations of students' mathematical standards and performance

University lecturers from the electrical and electronic engineering departments looked for conceptual clarity and understanding in their students. Moreover, they expected students to learn the principles behind mathematical computation and understand why particular methods were used in solving problems. This would help students develop a sense of direction and to know where to start thinking about ways to tackle new problems. Pure mathematics and statistics were considered important pre-requisites because they were required in almost all areas of studies in these departments. On the whole, they expected students to have a good solid foundation so that the students could build up their mathematical knowledge and

skills at the university level.

The departments of mechanical engineering, computer science, statistics and mathematics expected their students to possess, on entry, a good solid foundation in secondary level mathematics. For all these three departments, Pure Mathematics is a primary pre-requisite. Computer studies, in particular, required students to possess creativity, good language ability and independent thinking. In mechanical engineering, Applied Mathematics was an important pre-requisite. The lecturer from mechanical engineering expected their students to have a solid grounding in calculus and complex numbers, two topics which had a lot of applications in engineering. The lecturer from the department of statistics considered public examination results as a reliable indicator of students' competence and the students were expected to have a strong background in calculus, probability, real analysis, combination and permutation.

Geography and accountancy required incoming students to have basic mathematical knowledge and skills. The Geography Department required students to attain E grade or above in HKCEE Mathematics, whereas Accountancy required students to have C grade or above in HKCEE Mathematics. At the undergraduate level, the amount of mathematics required varied with different courses. In geography, GIS (Geographic Information System) and climatology needed more A level mathematics, particularly calculus. In Accountancy, although Pure Mathematics was not necessary, knowledge of statistics was preferred. Moreover, higher mathematical standards would be helpful for some electives, project work and graduate studies, whereas some research-oriented courses would require statistical skills (e.g., multivariate analysis). The interviewee from accountancy expressed the view that as the subject revolved around numbers, it was essential for their students to be particularly sensitive to numbers. As for chemistry, it was reflected that AS Level Mathematics and Statistics were adequate in serving as a foundation to their courses but it seems that many incoming students did not do well in this AS subject.

6.2.3. Comments on the current school mathematics curriculum

Lecturers from the departments of electrical and electronic engineering considered it important for students to attain a solid foundation in mathematics during their secondary level studies. The present curriculum should put more emphasis on understanding and training of the mind rather than mechanical drilling and the quantity of materials to be covered. They suggested putting more emphasis on

such topics as set theory and plane geometry because these were great tools to train students' logical thinking. They also suggested incorporating project work in the curriculum as a way of developing students' understanding of important mathematical concepts and principles, their thinking skills and their interest in the subject matter. Apart from the above, they also suggested including more statistics in the curriculum because it had a lot of applications in engineering.

University lecturers from the engineering and science departments generally perceived the curriculum as being very long, and containing a lot of materials. The lecturer from the computer science department further commented that the curriculum was so abstract as to be remote from real life. They saw the importance of emphasising the training of logical thinking and understanding of concepts and principles in school mathematics.

When asked how the curriculum should be improved, their views were not entirely similar. The statistics department lecturer rated calculus as very important but, coordinate geometry and complex numbers only relatively so. They also suggested that more weight should be given to probability, statistics, combination and permutation. An interesting point made by the statistics department lecturer was that random variables, statistical inference, and hypothesis testing could be trimmed down since they would be taught in first year statistics anyway.

The lecturer from the mechanical engineering thought that some of the topics could either be reduced or taken out of the curriculum altogether (e.g., polynomials, inequalities, numerical methods). The lecturer from mathematics suggested that there should be a better linkage between students' secondary level studies and university level studies. The lecturer from accountancy wanted to see more statistics to be included in the secondary level curriculum, perhaps as early as S.4 and S.5. The chemistry specialist favoured broadening the sixth-form curriculum so that students from the biology stream could also have some mathematical background. He even suggested that all sixth-formers should study mathematics. However, the lecturer from the mathematics department thought that topics in the present curriculum were essential and of equal importance; as such they formed a sound basic foundational curriculum.

6.3. Discussions

Results revealed that most of the university lecturers interviewed saw public examination results as a reliable indicator of students' performance and they were

basically satisfied with the mathematics performance of incoming students. Nevertheless, some noted a decline in the standards in recent years. Departments of higher mathematical orientation such as electronic and electrical engineering were still able to recruit students with good results in A Level mathematics, whereas departments such as chemistry took in students with AS Level Mathematics and Statistics. It was unlikely for someone without A Level Pure Mathematics to enter the statistics department. The only exception was the department of mathematics. The mathematical maturity of undergraduates in the mathematics department has been declining. From an academic point of view, mathematical maturity is required in students reading for a mathematics degree but it is least likely to attract many students of the required calibre. A fact was stated in Wong (1995) which forewarned that if the mathematically less able and less interested students entered the mathematics department, the result would be an impoverishment of the quality of our future school mathematics teachers.

The demand on the school curriculum varied across departments and some suggested broadening the scope of contents while others suggested narrowing it down for more in-depth treatments. Nevertheless, they unanimously pointed to the importance of a firm foundation of what was learnt at the school level as opposed to a superficial skimming of a large number of topics. Such a firm foundation (and a right attitude to learn) made it possible for students to acquire new knowledge at the university level and to re-learn what was omitted at their school level.

However, it is noteworthy that the competence of mathematics of incoming students did vary greatly across departments and the requirement was particularly high in the departments of electronic and engineering. We should be aware that any sizable cuts in the content of the sixth-form curriculum (if this were our decision) might arouse objections from these departments. Is the creation of different programmes, modules or papers at the sixth-form level a possible way out ?

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