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ATTITUDES TO MATHEMATICS SHOWN
BY
STUDENTS ENROLLED IN UNIVERSITY MATHEMATICS COURSES

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fulfilment of the requirements for the degree
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ABSTRACT

Attitude has long been a central concept in the area of learning and academic performance. This study was designed to investigate the attitudes of undergraduates at different levels, taking different degree courses, toward value of theories, value of applications, enjoyment of theories and enjoyment of applications of mathematics.

The setting of the study has been Massey University at Palmerston North, New Zealand. The subjects were 203 Students enrolled in "60.101 Algebra and Calculus", "60.203 Calculus" and "60.303 Calculus and Differential Equations".

The problem was threefold:

- (1) The development of an instrument to assess attitudes toward value of theories, value of applications, enjoyment of theories and enjoyment of applications of mathematics.
- (2) To use the inventory to measure differences in attitudes of (i) male and female students; (ii) mathematics majors and nonmathematics majors; (iii) mathematics majors at different stages.
- (3) To find the degree of association between the different attitude measures.

A 32-item attitude instrument of Likert-type was specially developed and administered to the sample population. They were tested in the Autumn of 1980 with the instrument. A pilot study was carried out to assess the effectiveness of all measures before the actual study. The principal function of this pilot study was to assess the adequacy of the measuring instrument and the administration procedures. Using a 0.05 level of significance the results showed a difference between first year male and female students in their attitudes toward enjoyment of theories. No other significant sex-related difference or mathematics majors/non-mathematics major difference was found. Furthermore, first year

mathematics majors and second year mathematics majors differ significantly in their attitudes toward enjoyment of theories. The attitude towards value of theories was positively and significantly correlated with attitude towards enjoyment of theories and the attitude towards value of applications was positively and significantly correlated with attitude towards enjoyment of applications. The attitude towards value of theories was not significantly correlated with attitude towards value of applications and the attitude towards enjoyment of theories was not significantly correlated with attitude towards enjoyment of applications.

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CHAPTER 1

THE RESEARCH ISSUE

STATEMENT OF THE PROBLEM

Attitude has long been a central concept in the area of learning and academic performance. Several years ago, an excellent review of research on attitudes toward mathematics was published (Aiken, 1976). During the four years since that article was published, more articles in this topic have appeared than in the entire preceding ten years. Despite the general achievement in this area, very few investigations have been conducted in New Zealand (NZLA, 1956, 1963, 1969, 1972, 1976). It was hoped that the investigation would shed light on the following questions:-

1. Are there differences due to sex in attitudes held toward value of theories, value of applications, enjoyment of theories and enjoyment of applications in mathematics at all levels of university instruction?
2. Do mathematics majors and nonmathematics majors differ significantly in their attitudes toward value of theories, value of applications, enjoyment of theories and enjoyment of applications of mathematics in all levels of university instruction?
3. Do mathematics majors at different stages differ significantly in their attitudes toward value of theories, value of applications, enjoyment of theories and enjoyment of applications of mathematics?
4. What relationship, if any, is demonstrated between a student's attitude towards value of theories and his attitude towards value of applications of mathematics?

5. What relationship, if any, is demonstrated between a student's attitude towards value of theories and his attitude towards enjoyment of theories of mathematics?
6. What relationship, if any, is demonstrated between a student's attitude towards value of applications and his attitude towards enjoyment of applications of mathematics?
7. What relationship, if any, is demonstrated between a student's attitude towards enjoyment of theories and his attitude towards enjoyment of applications of mathematics?

THE BACKGROUND AND SIGNIFICANCE OF THE RESEARCH

The importance of affective factors in partially explaining individual differences in the learning of mathematics is well recognized and the attitude towards mathematics appears to have a special status among instructional objectives in mathematics. This special status derives from a widespread belief that a student's attitude towards mathematics is a critical factor in determining his success in the subject and his readiness to pursue it to higher level. A widely held belief is expressed by Kinney & Purdy (1960):-

'Because learning is coloured by emotions, consideration of feelings toward the subject is particularly important in establishing a desirable learning situation. Favourable attitudes are, of course, a necessary but not a sufficient condition for learning. In other words, although desirable attitudes do not guarantee successful experience, learning takes place only if the pupils develop favourable attitudes toward the subject.'

Developing a positive attitude towards mathematics maximizes the possibility that a student will willingly learn more about the subject,

remember what he has learned, and use what he has learned.

'Attitudes influence behaviour and hence act as motives.

They are learned and, in turn, they often make new learning easier or harder to acquire. One of the chief obstacles to the effective learning of mathematics is the unfavourable attitude toward the subject which has been acquired by many students.'

(NCTM, 1953)

Kac (1968) has observed that the ideal preparation in mathematics, especially for non-mathematicians, should focus not on acquiring skills but on acquiring certain attitudes:-

'The ideal preparation in mathematics, for most people should focus not on acquiring certain attitudes; the most important one being a certain courage to sit down and try to figure something out even though it is not completely familiar.'

Another significant comment is:-

'It is necessary to give non-mathematicians 'an understanding, a feeling, a familiarity and a certain comfort' with mathematical methods of thinking to enable them to recognize when mathematics can or cannot be applied. They do not need great skill or to really 'know' Calculus, Matrix Algebra, etc.'

(Kochen, 1972)

The general attitude of students to mathematics has been the subject of much discussion in the literature but Aiken (1970), in his excellent review of research on attitudes toward mathematics, identified no studies dealing with specific mathematics topics and concluded in his suggestions for further research:-

'...that the concept of a general attitude towards mathematics should be supplemented with that of attitudes toward more specific aspects of mathematics...'

Aiken (1974) called for further investigation into his finding that enjoyment and value are independent and significant domains of the attitudes toward mathematics held by college freshmen. USMES data on attitudes support Aiken's (1974) results closely (Shann, 1977a 1977b). Aiken (1976) in a more recent review suggests that the need to separate these two domains still exists.

Furthermore, at all levels of university instruction, there has appeared in the recent literature an increasing concern over the relative positions in the curriculum of theories and applications of mathematics. There is no published evidence of students' attitudes to these specific aspects of mathematics.

If attitudes are important objectives of mathematics instruction, then such attitudes must be given deliberate and separate attention, both in the development of mathematics curricular and in curriculum evaluation. Likewise, lecturers can give systematic attention to classroom activities that develop desirable attitudes.

Since attitudes are learned, they can also be unlearned. The first step in determining how to change the attitudes of students toward mathematics was to find out the differences in attitude between people with what we consider to be 'initial attitude', so that it could be known in what directions a change should go. Thus the primary purpose of the study is to investigate the students' attitudinal differences among assigned groups.