ABORIGINAL STUDENTS AND MATHEMATICS

PART 2

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In Part 1 we looked at the systems of thought in the Aboriginal culture as they affected understanding of mathematical concepts. It was agreed that Aboriginal thought is largely non-scientific; this is the major premise upon which reasoning that is frequently different from one a European would accept is based.

It was pointed out that, due to their environmental background, many Aboriginal students do not achieve all the aims at a level comparable with that obtained by European students. For example, the aim 'facility, with accuracy, in computational skills', is frequently not achieved at a level which enables students to add, subtract, multiply and divide vulgar fractions.

Having examined the situation in the primary school range, what should be the aims of mathematics in the post-primary school? It follows that these aims should be complementary to those observed in the primary school curriculum and should form the basis for any development of a curriculum for students entering the post-primary school. These should be:

1. consolidation of the understandings, skills and attitudes acquired in the primary school;
2. application of mathematics in the world post-primary students encounter, and in the world they are likely to encounter on leaving school.

The first aim stresses consolidation and does not mention new learnings in 'pure' mathematics. During the trial of the Revised Curriculum in 1973 it may well happen that teachers will challenge this aim to determine whether it is tenable. In effect, the aim says that if a student is unable to do long multiplication on entering post-primary school, then no attempt

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should be made to teach him long multiplication. This does not prevent an alternative and mechanical means of acquiring the skill being pursued. He could, for example, be trained to operate a calculator or adding machine and thus short circuit the necessity to learn the operation as a 'pure' exercise.

The second aim indicates that such a student should be taught to handle mathematical problems using the skills and knowledge he has already acquired. He will therefore need to learn how to make do without being able to calculate a long multiplication sum as an exercise with purpose, and, instead, learn to manipulate a mechanical device to achieve the same end.

The reasons for accepting the aims are based on purely practical considerations:

1. Unless new theoretical learnings are consolidated effectively in the post-primary school, they will be forgotten very quickly when students leave school and use the skills infrequently.

   Teachers who studied differentiation and integration in a calculus course at secondary school would be well aware of their present lack of understanding of these processes. There is considerable evidence to support the fact that many new concepts and processes in mathematics are not being mastered by primary and post-primary students and that valuable time can be wasted in producing a facade of skills.

2. In the time available for teaching mathematics each week in the post-primary section of the school, it is more important to concentrate on teaching applied mathematics rather than attempting to help the students to master new concepts and processes in 'pure' mathematics. If the student can gain confidence in handling mathematical problems by applying the knowledge and skills he has learnt in primary school, he is more likely to maintain his present level of mathematical competence. The basis upon which he can build is retained and mathematical understandings and skills are available for development as he matures. Further, he is more likely to recognize the relevance of mathematics to his immediate needs or perceive where further development could lead him in the achieving of his objectives.

3. The post-primary curriculum aims to give all students a general education. If a particular vocation calls for an advanced knowledge of some aspect of mathematics, then the training course for entry into that vocation should provide the specialized instruction.

4. The final reason for accepting the aims is based on a realistic acceptance of technological advances and materials available. In this day and age when statistical tables, calculating machines, ready reckoners, cash registers, and even mini=computers are accessible, a student can deal with complicated computations without necessarily knowing the method used or how the end product is obtained. For example, a student who has a basic understanding of 'squares' and 'square roots' need not be taught the involved method of calculating a square root. All he needs to do to find a square root is to consult a set of mathematical tables.

The terms 'pure' and 'applied' have been used in this discussion to divide mathematics into arbitrary categories. It is necessary to use the terms, however unpopular with mathematicians, because in developing a curriculum for post-primary Aboriginal students the emphasis is, and must be, on the 'applied' component of mathematics relevant to the students' needs. Emphasis is placed on consolidating understandings and skills acquired in the primary school and applying this knowledge to life situations. If the student perceives that mathematics is useful in everyday living, in *his* everyday living, we have a starting point for motivation; the incentive to continue will come partly from the skill of the teacher in interpreting the course in meaningful terms, with meaningful objectives, related to his daily performance in life situations. If this incentive is strong enough he will practise mathematics, maintain his mathematical competence and develop new understandings, skills and attitudes in his growing maturity.

If the curriculum is to be meaningful and useful in real life and thus satisfy the original aims it becomes necessary to arrange it in such a way that it is able to deal with segments of organized activity in real life. What are some of the activities of real life with which Aboriginals can be expected to come into contact or to which they can relate? In the situation of the Northern Territory they will use the services normally available to any European community. These uses will be of direct or indirect nature and will not be generally understood. But by taking the

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service and extracting the basic mathematics component from it and determining the social and applied aspects of it, we can present a series of topics. Thus we deal with such matters as 'banking', 'shopping', 'taxation', 'carpentry', 'tourism', 'P.M.G. services', 'budgetting', etc. It is important to understand the rationale behind the method of presenting a topic and to deal with the practical aspects - aspects which will determine just how much knowledge ought to be included in the topic and the precise skills the student ought to obtain in relation to that knowledge.

In a taxonomy of educational objectives developed by Bloom, Krathwohl and Maria, knowledge and skills are described in the following manner.

Knowledge involves the recall of specifics, universals, methods, processes, patterns, structures or settings. Basically it deals with remembering. Aspects of knowledge may be classified as follows:

1. Knowledge of specifics, for example, meat is 95c per kilogram to purchase.
2. Knowledge of terminology, for example, metre, litre, gram.
3. Knowledge of ways of dealing with specifics, for example, the way of computing the cost of 3 metres of rope at $1.60 per metre with $5 available.
4. Knowledge of trends and sequences, for example, understanding the continuity and development of Australian culture.
5. Knowledge of conventions, for example, conventions used in banking.
6. Knowledge of classifications and categories, for example, sets of things.
7. Knowledge of criteria, for example, testing for accuracy.
8. Knowledge of methodology, for example, setting out a sum.
9. Knowldege of the universals and abstractions in a particular field, for example, recalling major generalizations such as the laws of operation for real numbers.

It is frequently difficult to differentiate between 'knowledge' and 'skills'. Both are aspects of what the taxonomy of objectives calls the 'cognitive domain'. Intellectual skills

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may be classified as follows:

Comprehension: When an individual comprehends he knows what is being communicated and can make use of the idea or material being communicated without neccarily relating it to other material. It is the lowest level of understanding and involves:

a. Translation, for example, changing from verbal to numerical form and vice versa.

b. Interpretation, for example, interpreting a graph.

c. Extrapolation, for example, working out the next numeral in a series - 2, 4, 6, 8, ...

Application: This aspect goes beyond comprehension and involves the use of abstractions in particular and concrete situations. For example, it involves using mathematics to solve problems in the environment.

Analysis: This involves breaking down a communication into its constituent parts. It entails:

a. the analysis of elements, for example, recognizing unstated assumptions;

b. the analysis of relationships, for example, checking hypotheses or predictions;

c. the analysis of organizational principles.

Synthesis: This aspect involves the putting together of elements and parts to form a whole.

Evaluation: This involves both quantitative and qualitative judgements about the value of material and methods for given purposes.

The development of attitudes and values in students, advocated by Bloom, Krathwohl and Maria is analysed as:

a. Receiving which, basically, involves attending.

b. Responding, which demands motivation of the student to the point where he responds. He could, for example, respond to reception with sufficient motivation to attempt to solve a mathematical problem.

c. Value. This refers to the worth of things, phenomena

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or behaviours.

d. Organization. Values may, in turn, be organized into a system.

e. Characterization. This element goes beyond 'organization'. When a student has internalized values, he can be described or characterized as a person by reference to his values or previous controlling tendencies. He integrates beliefs, ideas and attitudes into a total philosophy or world view.

With all this in mind we must now examine the ways and means of achieving an understanding of a topic and developing the requisite knowledge and skills. How can we develop a topic to take account of the need to develop desirable attitudes and values which we hope will result from involving students in interesting and motivationally structured learning activities?

To begin with, the teacher will need to plan well. He must decide on his priorities and make sure that whatever else he wants to achieve, the development of intellectual skills will not be easily or quickly achieved in the ways he might use with a European student.

The Aboriginal student reacts differently to demands made on his intellectual ability in the field of mathematics. To the European student relevance in any subject study is *important* and can be expected to affect attitudes towards and values in that subject. To the Aboriginal student relevance is *vital*. If the subject or topic is not relevant, he is not interested in it, will not use it and cannot be expected to respond to it. It must be relevant to his interests or, at least, have a potential for relevance. It must have a practical application which is relevant to his needs. Only then can he be expected to respond to the subject since sufficient motivation has, by then, been established. The incentive to continue lies in other areas - the strategies employed by the teacher, the intrinsic and relevant properties of the subject, the practical applications in real life situations, the continuing use able to be injected into everyday life which will establish retention and so form a reliable basis for future knowledge and skills.

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The outcome in the school in past years should be a guide to future planning in curricula, strategies and values by educationalists. With the Aboriginal student, particularly at the post-primary level, there has been real conflict. The frustrations experienced in attempting to adjust to or overcome a clash in cultures has led to various attitudes being adopted. These range from complete apathy to very real antagonism. Absenteeism has become a problem because of lack of interest or perceived purpose in school. The influence of the older student on the work and attitudes of younger students has been disastrous in many cases.

These problems are very difficult to overcome. They can, however, be reduced. Each student must be treated as an individual with specific strengths and weaknesses. The course the student is to follow *must* cater for his needs. He must be given the opportunity to gain confidence in himself; this will be influenced by his acquisition of increased skills. Because of the individual characteristics of students it stands to reason that it will be necessary to accept an individual standard from each student. Realistic, individual goals will need to be set in each skill - a built-in 'success component' if you like to call it that. Once the initial goal is reached the student can be encouraged to aim for a slightly increased goal, having received the possibly unknown pleasure of achieving a goal set by his teacher whereas, in the past, he has failed or lost incentive because individual problems have been ignored or by-passed. Achievement of realistic goals and opportunities for expression and motivation for learning are more important than any arbitary standard of work.

Low general ability was not necessarily the cause of student failure or drop-out in the past. The student may have started at a great disadvantage, started late or suffered from communication problems by his use of an Aboriginal language only. There were many reasons for failure in the past. In a new situation, where increasing use of materials, aids and special courses are making changes a possibility, the causes for failure should diminish.

Whatever else happens, to be accepted for future employment, the teenage Aboriginal must be able to speak and comprehend English, have a satisfactory appearance or concern for personal hygiene, and possess satisfactory social adjustment. The last qualification is becoming necessary even for pastoral work because of the

involvement of overseas companies in the pastoral industry and the standards they require for employees. If the education of the Aboriginal is to be an effective instrument in equipping him for entry into society he must be so equipped that he is acceptable for employment.

In the Watts/Gallacher Report, the comment is made -

> "A common complaint of tradesmen has been that many Aborigines are unable to comprehend work instructions. This is due, partly, to an inadequate level of aural comprehension, partly to feelings of insecurity and partly to lack of knowledge of terms relating to specific work instructions."

The vocational future for many Aboriginals is not promising unless society as a whole can prepare them for new employment opportunities. One of the aims must be to prepare them to be economically competent.

The command of language, the possession of adequate social habits and knowledge of various vocations are vital to allow an Aboriginal teenager a choice of a future life. Without these skills, the future life for the majority will be frustrating and, to a lesser extent, a drain on the economy of the nation. In helping these teenagers to acquire these skills, teachers will make a vital contribution to their future.

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