AARE Presentation

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Asian Success in Our Schools - A Challenge?

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The research undertaken by John and Louise has been done as part of their studies for Doctorates in Philosophy at Curtin University in Perth. They are both interested in the same issue of the success of Asian students in Mathematics within New Zealand. However, their research methodologies and focus have been quite different. John has used qualitative research to look at the early success of Asian students learning mathematics. He has looked at factors linking early learning of mathematics and the Chinese language. Whereas, Louise has used a mixture of qualitative and quantitative methods to research into Asian high school students; their attitudes to maths and preferred learning styles. Their independently gained results seem to show some interesting correlation and to dovetail quite neatly. As they are currently writing their theses some interesting questions have arisen and they would like to present some of the points we have discussed. The area that they are going to focus on in this presentation is that of attitudes to the learning of mathematics and the importance of early success as a factor in later success.

It has been established and accepted that in the development of language we go through set stages. The first stage is over the first six years of a child's life and here there is rapid language acquisition. In the early language development of children all over the world we see similarities. In the first year, the young baby already knows a number of frequently repeated words. In the fourth year of life these words have moved through a number of stages and the young child is able to ask questions, give commands, report real events and create imaginary stories - all of these with correct grammatical constructions. As this acquisition advances the child's knowledge expands.

But, importantly, through these stages of language acquisition the young child is learning basic mathematical concepts in the actual learning process. These skills include grouping, ordering, similarities, differences, addition and subtraction.

In Asian languages, naturally, this also occurs. However, mathematical concepts are exposed to the young child in greater depth and clarity than in the English language. Therefore, when these young children begin their formal education, and progress through the education system, we see the more-than-apparent success of the Asian student in mathematics. This is quite evident in our own education system in New Zealand.

I have observed that many Asian children educated in their own languages appear to have gained a greater understanding of mathematical concepts than English speaking children. I believe that this is because these concepts are embedded in their language at a very early stage in the language acquisition process.

I have narrowed my research to compare the differences between New Zealand English speaking children and Chinese speaking children in Hong Kong.

The research background, so far, has been a comprehensive literature review with ongoing qualitative research. Parents of a small group of Hong Kong students are being interviewed for their views on their children's mathematical acquisition skills. This is to be followed by interviews of a group of New Zealand parents. Tests to ascertain numerical and decimal concepts will be conducted on these groups from Hong Kong and New Zealand.

What are the differences?

1. In counting verbally a child quickly learns to count to ten. We have symbols for these and they are used frequently in our environment. However, after ten, language changes present problems. The English speaking child has to acquire new vocabulary that is not easily associated with the first ten words. For example: eleven, twelve, thirteen etc. and: twenty-one, twenty-two etc.

2) In comparison the Chinese speaking child moves on from ten - and this is in translation - to: ten-one, ten-two, ten-three etc. Then: two-ten, two-ten-one, two-ten-two etc.

Thus even before the child is introduced to the written word the concept of the decimal system may be set. With no extra learning effort the Chinese speaking child may now be well advanced in this first developmental stage.

3) As the Chinese child becomes aware of written symbols, the very first numbers: 1, 2, and 3 - are direct representations of what the child sees. In English these is no relationship between the written symbol and what it is representing. This is another association that the Chinese speaking child may have in advance of the English speaking child.

4) Written Chinese is a system of pictographs, each originally representing an object or a concept The written language system is introduced at a much younger age for Chinese speaking children than for English speaking children.. Often at the age of three Hong Kong children are already in kindergarten. Not just for play - in fact not for play - but for the development of language skills. As Chinese is pictorial and not alphabetical - and each word in the language has a different pictorial representation, there is a great deal to learn if the child is to be able to read and write effectively. So, a child begins learning what we refer to as Chinese characters. It is important to note here that it is writing as well as reading that go hand-in-hand with learning the written language - not just reading as in the early stages of a English speaking child's education.

5) The Chinese child starts learning the characters. Each character has its set manner of being written. As each character is made up of strokes, the stokes are counted as they are written. Thus, the child from this stage has continual practice in counting. In Chinese language this is extremely important for a working understanding of the language. One, it helps in remembering the character and at a later stage it helps to group words as they are grouped by the number of strokes they have - e.g. Chinese dictionaries.

6) As the Chinese child is learning characters, and thus numbers, the decimal number system is reinforced by the format that the numbers are written in and grouped. Apart from the first ten symbols these is nothing new to learn either verbally or in the written form in

order to count (at least to a hundred). In our number system there is no relationship between the written and the spoken as we move past ten. Thus, there is no reinforcement for the English speaking child in establishing an understanding of the decimal system and further mathematical concepts.

7) As the Chinese child (still not 6 years of age) progresses through the learning of the written language further mathematical concepts are introduced. A Chinese character may contain one complete representation for a concrete or an abstract idea. Or the character may be a combination of two (or more) other characters in order to get this representation. Thus what is introduced to the Chinese speaking child are the concepts of addition and subtraction and the basis of algebra: a + b = c.

To conclude, through all of these processes in the early language acquisition of the Chinese speaking child and in the early introduction to formal education, there is a strong component of what we may refer to as ‘rote learning’. Rote learning is often seen as mechanical memorisation. However, Chinese educators view it as memorising with understanding. (Biggs, 1996). Thus, the young Chinese speaking child comes to his first year of school at the age of six accepting that through meaningful repetition (not rote) comes the understanding of the written language. The Chinese speaking child may have learnt basic mathematical concepts that are embedded in the language and been taught the mechanical writing skills through repetition. Through this process the child has achieved understanding and highly developed memory skills

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The understanding that success promotes success is not new, but is, perhaps, easy to forget in our role as educators. In the case of the success of Asian high school students in mathematics it does seem to be a major factor. As John has illustrated children arriving at school are usually already confident in their basic skills in mathematics and have a positive view of their own abilities in the subject, which encourages a positive view of the subject itself.

The research, which I undertook with high school students, looks at "Language or Learning Style Factors Affecting the Mathematics Achievement of Asian Students". As part of this research I developed a survey of Views on Mathematics in Schools, based on TOSRA (Test of Science Related Attitudes) by Professor Barry Fraser at Curtin University. It uses the format of a series of statements about mathematics, with which students agree, disagree or remain neutral. These statements were developed from preliminary conversations with high school students and their comments about maths.

The survey was conducted in eight different high schools and involved 455 students. One half of these students was from Asian countries where education has a Confucian tradition: China, Korea, Taiwan and Hong Kong. For comparison New Zealand students of European origin formed 18% of the survey sample group, Maori 2% and Pacific Islanders 4%, with the rest being made up from various immigrant nationalities. Factor analysis of the responses to statements allowed the creation of two main scales (Enjoyment) and (Value). Other items were more usefully dealt with separately. Further feedback and insights were gained from an open-ended question at the end of the survey, together with taped interviews with students

concerning their experiences of learning mathematics in their own countries and New Zealand.

The research focused on two main areas, the attitudes of students to Mathematics and learning preferences. Regarding attitudes, the survey seems to show that Asian students have a far more positive attitude towards mathematics than their New Zealand counterparts. The scale described as Enjoyment, incorporated items relating to confidence in mathematics as well as a positive attitude towards the subject. Asian students seemed to perceive themselves as being competent in mathematics, and, in the open-ended question and interviews, expressed a genuine satisfaction in being able to work through problems and reach solutions.

The concept of fun and enjoyment regarding mathematics may need some elaboration here. Whereas New Zealand students would often suggest that the teacher should be making lessons more fun and enjoyable, the Asian students placed no such responsibility on the teacher. They seemed to regard the fun as being intrinsic to achieving success in mathematics. They were also more likely to take responsibility on themselves for success in the subject. When asked for means of achieving success they would cite factors such as working harder and going over and over problems until they understood them.

Probably a more accurate way to describe the attitude of Asian students to mathematics is that they lack the anxiety that seems to hamper the steps of New Zealand children. This anxiety has been proven to be a major hindrance to learning. The questions relating to the factor of valuing mathematics seemed to show fewer differences than those concerning enjoyment and confidence. Both Asian and New Zealand students could see that maths is important and useful, but problems for New Zealand children seemed to be linked to a lack of confidence. This lack of confidence has also been identified as being a problem for many New Zealand parents trying to help their children with mathematics. The reasons for this could be their own feelings of inadequacy with the subject and the regular changes of the New Zealand curriculum.

It has been suggested that the success of Asian students is due to rote learning of formulae and that they lack real understanding of the subject. Educators in Western countries often hold the belief that rote learning is an inferior learning. However, research suggests that this is a simplistic understanding of the kind of learning promoted in many Asian schools. Rote learning is often interpreted as repetition and memorisation without understanding.(Biggs, 1996) It could be more accurate to say that memorisation can lead to a deeper understanding and higher learning. Dahlin and Watkins (1977) have posed the question as to how Chinese students achieve so well academically if they only rely on rote learning. Their comparison of interviews with 48 Hong Kong Chinese students and 18 Western students of high school age reveals that the two groups had quite different understandings of what repetition means in relation to memorising and understanding text. The Western students tended to regard repetition as a useful mental exercise and to associate it with memorisation without understanding. The Chinese students, however, described repetition as involving "focused effort". One in particular described it as something that created a "deep impression". They perceived it as an activity that is an important step in understanding. Indeed this activity was not regarded as passive, but one requiring effort on the part of the learner.

Rote learning has become associated in the Western system with "parroting" or mindless repetition of facts. It can be argued that it is in fact something that can require the learner to be actively engaged in learning material and that memorisation and understanding are not mutually exclusive. As with learning to read, learning mathematics involves both top-down and bottom-up processes that need to be developed and utilised at the same time. The

discipline of memorising basic facts gives students a sound basis and confidence in learning mathematics. The Confucian work ethic promotes a willingness to go over and over tasks until they are understood. The value or satisfaction expressed by many students was in the intrinsic enjoyment of gaining mastery of the subject and they were prepared to work hard in order to achieve it.

To underline the relevance of this, Asian students have a profound and embedded understanding of the concepts of mathematics resulting from the learning of the skills of mathematical manipulation at an early age. The close links between the learning of their language and mathematical concepts are a real advantage for them. In many Asian families parents as first educators regard the learning of mathematics as an integral part of the process of educating children. This is continued through to tertiary level. The role of repetition and memorisation is fundamental to this process. The willingness of Asian students to go over and over material could be utilised rather than discouraged. Our last point is that their positive attitude to learning is not just built on the Confucian work ethic, but on experiencing success. If students arrive with these positive views of work in the area of mathematics it could be translated into all areas of the curriculum.

REFERENCES

Biggs, J.B., & D.A. Watkins. (1996). *The Chinese learner: Cultural, psychological and contextual influences*. Hong Kong & Melbourne: CERC & ACER.

Dahlin, B., & D. Watkins. (1997, August). *The role of repetition in the processes of memorising and understanding: A comparison of the views of Western and Chinese school students in Hong Kong*. Paper presented at the 7th. Conference of the European Association for Research on Learning and Instruction, Athens, Greece.

Statistics New Zealand. (2001). Lightbown, P.M., & N. Spada (1999). *How languages are learned*. Hong Kong: Oxford University Press.

Ministry of Education (1999). *Information for better learning: National assessment in primary schools: Policies and proposals*. Wellington: Ministry of Education.

Ministry of Education. (2001). *Education Statistics of New Zealand for 2000*. Wellington: The Data and Analysis Division.

Miura, I.T., Kim, C.C., Chang, C-M., & Okamoto, Y. (1998). Effects of language characteristics on children's cognitive representation of number: Cross-national comparisons. *Child Development, 59*, 1445-1450.