ASIAN/AUSTRALIAN PERCEPTIONS OF ASIAN SUCCESS IN MATHEMATICS

Paul Layres
University of W. Sydney, Nepean

1994 AARE CONFERENCE, NEWCASTLE, NSW.

Faculty of Education
UWS (Nepean)
PO BOX10
Kingswood
NSW 2747
Tel 047 360 784
Fax 047 360 400
Email p.ayres@nepean.uws.edu.au

Abstract
In Experiment 1, Australian and Asian students from a Sydney girls school were asked to rank particular attributes which might explain why Asians do well in mathematics. Significant differences between the two groups were found on attributes of age, luck, parental pressure and quality of teaching. In Experiment 2, a group of Australian university students in Education were given the same task. Differences within this group were found which suggested that mathematical experiences and gender were factors in formulating perceptions of Asian success in mathematics. All groups in the study ranked work as the most likely reason for Asian success.

A vast quantity of cross-cultural research which has compared educational issues between Western countries and East Asians countries has now been conducted. A wide spectrum of issues has been investigated, encompassing such areas as educational expectations (Wong, 1980), problem behaviour (Langfeldt, 1992) and creativity (Rudowicz, Kitto & Lok, 1994). However, much of the research has been concerned with mathematics education. In particular, studies have focused on mathematical comparisons between the United States and East-ian countries. Over the last fifteen years extensive studies have investigated a multitude of mathematical disciplines such as number (Miura & Okamoto, 1989), pattern recognition (Yoshida, Fernandez & Stigler, 1993) and problem solving (Mayer, Tajika & Stanley, 1991) for a variety of school groups. In most cases, the conclusions are always the same: US students perform badly on mathematical tasks compared with their Asian counterparts (see Stevenson, Lee & Stigler, 1986;
Although comparative studies of this nature have attracted some criticism (see Chen et al., 1993), there has been wide concern in the US over these findings. This concern has initiated many studies to find out the reasons why Asian students perform so comparatively well in mathematics. Mayer et al. (1991) proposed two major explanations for these differences: an exposure hypothesis and an ability hypothesis. The former is based around cultural values for education and mathematics in particular, whereas the latter assumes innate differences in the ability to learn mathematics. Most researchers favour the former. Studies which have investigated cultural differences have often focused on the factors. Two such studies by Crystal and Stevenson (1991), and Hess, ChiiMei & McDevitt (1987) have looked at the role of mothers in their children's mathematics education. Crystal and Stevenson (1991) found that American mothers tended to hold lower standards than Asian mothers; whereas Hess et al. (1987) found significant differences in cultural beliefs about success and failure. In the Hess et al. study, Chinese and American mothers were asked to rank five attributes in the order they considered important for success or failure in mathematics. Significantly different profiles emerged. Chinese mothers believed success in mathematics was highly dependent on school training, whereas failure was attributed to lack of effort. American mothers tended to be less specific by ranking the attributes more evenly. Surprisingly there has been little cross-cultural research conducted into mathematics education between Australia and Asia (see Bell, 1993). This is surprising because modern Australia is a multicultural society which includes many Asian communities. Furthermore, in recent years many Asian students have come to Australia to study for the HSC (in NSW) and attend university. Throughout Australia, Asian and Australian students are observing each other in an educational setting every day. It is an environment rich in potential to study similarities and differences. An ideal situation for a comparative study exists in schools in NSW which have Asian students who specifically join the school in Year 11 to sit the HSC. These students have been previously taught mathematics in their own countries and can directly compare new and old experiences. Equally, the Australian students will form perceptions about Asian learning methods and
expertise directly from their own experiences. In this study, Australian and Asian perceptions were compared on Asian success in mathematics. In Experiment 1, a school in NSW which receives a group of Asian students in Year 11 was selected.

Experiment 1
Subjects
One group of subjects consisted of fifty seven students, studying Year 12 mathematics, from an Independent Girls Schools on Sydney’s North Shore. The school was non selective and non denominational. All subjects were Caucasian. Most were born in Australia, those who were born elsewhere had lived in Australia for at least nine years. The second group consisted of eighteen Asian students from Years 11 and 12 of the same school, who were mostly in Australia to complete the HSC. All students had been in Australia for less than three years. Most would have been in the country for one or two years. Consequently all subjects would have been primarily educated in their countries of birth. All subjects in this group were from one of four countries: Hong Kong, Taiwan, Korea and China.

Materials and Procedure
Australiansubjects were asked whether they believed that Asians performed better than Australians in Mathematics Exams. Fifty seven students (77%) thought that they did. These subjects (11 studying Mathematics in Society, 19 2nd and 14 3rd Mathematics) were then asked to complete a survey (see Appendix). The survey asked subjects to rank, on a scale of 1 to 7, the possible reasons (attributes) why they thought Asians perform well in mathematics. The eighteen Asian subjects also completed this survey. The survey (see Appendix) was composed of nine attributes which may be perceived as contributing towards mathematical success. Five of these attributes were adopted, with slight variations, from the Hess et al. (1987) study which focused on natural ability, working hard, good training in mathematics at school, good training in mathematics at home, and previous experience of the work, rewards for doing well, pushed more by parents. In addition, the following four attributes were included: previous experience of the work, rewards for doing well, pushed more by parents, and age. An age attribute was included because many of the Asian students were older than the Australian students. For example, one Australian in the 3rd Mathematics class, who had been radically accelerated, was only 14, compared with a 20
year Rd student from Hong Kong. The perception that the Asians may have done the work before might easily occur because they are both older and come from a different educational system. The final two attributes, which anecdotal evidence had suggested could be a factor, were included to explore the **me_factor** further.

### Results and conclusions

The Australian subjects were grouped according to the level of mathematics studied (MIS, 2^\text{it} & 3^\text{it}). Although the school allowed some freedom of choice, the particular level of study was a reliable indicator of mathematical ability. This grouping allowed differences in perception across mathematical ability to be examined for this population. Mean scores for each attribute per group were calculated (see Table 1). One ANOVAs were also conducted for each attribute (see Table 2). Significant differences were found on two attributes: luck and rewards for doing well. Post hoc procedures indicated that the Mathematics in Society (MIS) group had different perceptions to the other groups on these two measures. To analyse these differences further, each attribute was ranked according to its order of importance. The attribute with the highest mean score was ranked first, and the lowest mean score was ranked last (see Table 3). It can be seen that the luck attribute for each group was ranked ninth (last) indicating that, overall, each group did not consider luck to be a factor in Asian success, even though the MIS group scored it higher.

In contrast, the **wards for doing well** attribute was ranked third (mean score of 3.1) by the MIS group, but seventh (mean score of 1.8) by the 3^\text{it} group. Clearly this attribute is rated differently and may indicate a real variation in perception according to mathematical ability. In spite of this difference, overall results suggest a fairly homogeneous group of Australian students. Therefore, all three groups were combined together to form one group, and their responses compared with the results of the Asian students. An attribute scores for the Australian group (combined) and Asian group are shown in Table 1. Comparisons between groups were conducted for each attribute, ANOVA results are given in Table 4.
investigatethese differences with respect to the value of the attribute, each attribute was ranked from first to last in order of perceived importance. Ranks for both groups are shown in Table 5.

Apart from the luck attribute which both groups rank lowly, ranks for the other three attributes suggest real effects. The greatest difference in ranks was found with age. Although the Australian students did not consider this very important (mean score of 2.5, rank 4) it was given more credence than by the Asians (mean score of 1.2, rank 9). As the Asians ranked luck higher than age it might suggest a sensitivity on their part about their age, which in most cases was comparatively older. On the other hand it may just be the perception that age is not a factor in mathematical ability. For the parental pressure attribute, the Australian subjects perceive this to be a real factor. It is ranked second with a mean score of 3.6 suggesting that there is a strong belief about the influence of the parents. The final attribute, quality of teaching, which produced a significant difference is the most interesting. Consistent with the Hess et al. (1987) study, this group of Asians perceived teaching as a highly important factor in success in mathematics. In contrast, the Australians, all of whom acknowledged that Asians do well in mathematics, did not rank teaching as such an important attribute.

It should be noted that two factors approached significance: natural ability (p=0.06), and work ethic (p=0.08). In the former case, Asian responses suggested that ability could be a factor. However, for the latter attribute, both groups considered that the work effort is the premiere factor for Asian success in mathematics. This comes as no real surprise, as the Asian work ethic is perhaps the most universal stereotype applied to the Asian countries. Certainly the Australian students in this study perceive that Asians work very hard. Their personal experiences may make this more of a judgment than a perception. Similarly, the Asian students have made the same decision. Finally, both groups ranked (third) prior knowledge as a medium factor in Asian success.

**EXPERIMENT 2**

* Experiment 1, the subjects were taken from a very narrow section of Australian society: all girls from a high socio economic area of Sydney. In this experiment the perceptions of a different section of Australian society were
canvassed. Although the survey of Experiment 1 (see Appendix) was designed specifically for those subjects, it was thought robust enough to be used elsewhere.

Subjects
Forty four education students from a University in Sydney participated. This sample included twenty nine students (18 Female and 11 Male) in the 3rd year of a B. Teaching (Primary) degree, and fifteen students (6 Females and 9 Males) enrolled in either a Dip. Ed or B. Ed (3rd year) Secondary Mathematics course. Subjects were grouped (four) according to gender and the degree studied.

Materials and Procedure
The students were asked to fill in the survey, as shown in the Appendix. No other questions were asked. Subjects indicated whether they were male or female.

Results and Conclusions
Group mean scores for each attribute are shown in Table 6. Separate 2 factor (degree_nder) ANOVAs were conducted for each attribute (see Table 7).

Twosignificant differences were found within each main effect. To put these results into perspective each attribute was ranked (in the same fashion as Experiment 1) in order of importance within the groups (see Table 8). For the gender factors, females scored both natural ability and parental pressure higher than the males. Each of the four groups ranked parental pressure as one of the top two attributes, however, gender differences are clearly present in the natural ability rankings. An explanation for this second result may be found in the difference of confidence levels in mathematics between males and females. Much of the modern debate into the mathematical education of girls has focused on their lack of confidence in mathematics. In particular,

Southwell and Khamis (1994) found from a study of 2000 secondary students that females are more likely to rate themselves as having average mathematical ability than boys. This lack of confidence may influence their general perceptions of mathematical ability. The two degree effects were found on the attributes of age and work ethic. All four groups ranked the work ethic as the most significant factor in Asian success in mathematics. However, rankings for the age attribute varied. One explanation for these differences may be found in the past experiences of the subjects. It is
highly likely that students who have had at least three years studying a mathematics degree would have had more direct contact with Asian students, in both their university and school courses, than subjects pursuing the primary degree course, as very few Asian students are enrolled in the latter course at the University sampled. These personal experiences within the mathematics classes may have been influential in their responses. The subjects in this study varied considerably in their ages and personal experiences, as well as gender. They could not be considered a very homogeneous sample. However, they were all Caucasian and studied education degrees at the same University, therefore there were some common traits. Furthermore, each group ranked the two most important attributes as work ethic and parental pressure. In spite of some main effect differences it was considered of interest to combine these four groups together (see Table 8) as one group and make some tentative comparisons with the group responses of Experiment 1. Mean scores for the three major groups in this study are displayed in Figure 1.

Insert Figure 1 here

The graph illustrates quite clearly that the two most dominant Australian perceptions about Asian success in mathematics is the work ethic and the parental pressure factor. Although the Asian students agree with the perception of hard work, they rank the quality of school teaching as the second most important attribute. The graph also illustrates that there may exist some significant differences between Australian groups as well as between Asians and Australians.

General Discussion

In Experiment 2 it was discovered that perceptions about Asian mathematical success are influenced, to some extent, by gender and a student’s own mathematical experiences. As perceptions are influenced by our beliefs this was not a surprising result. However, the cross-cultural comparisons of Experiment 1 were more interesting.

Experiment 1, significant differences were found in ranking the four attributes: age, luck, parental pressure and quality of teaching. Whereas, there may exist genuine differences in perception between the groups on ranking the first three attributes, the finding concerning the quality of teaching could have more far-reaching implications. Obviously one can not generalise too much from a study in one school. The quality of mathematics teaching in that school may be poor, although HSC results suggest otherwise. However, perceptions of the
Asian students would not be totally formed by their experiences at the school. They would have friends in other schools, brothers and sisters in Australian universities; all factors which would help formulate perceptions. Therefore, although the results should be treated cautiously, it is an area which should be researched further. Hess et al. (1987) found that Asian mothers attribute success in mathematics to the quality of teaching. The results of this experiment are consistent with those findings. A future study is being designed to discover possible cross-cultural differences into what is considered good mathematics teaching.

References


Langfelt, Hb (1992). Teachers’ perceptions of problem behaviour: A cross-cultural study between Germany and South Korea. British Journal of Educational Psychology 9 62, 217


Southwell, B and Khamis, M (1994). Affective Constraints on

