Students' Attributions of Success and Failure in Mathematics: Findings in China and Australia

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By using a questionnaire previously used in Australia, we examined students' attributions of success and failure in mathematics in the People's Republic of China, and the results were compared with the previous results from Australia. Differences were found in the attribution patterns between students from China and students from Australia. Students from China view environment and effort as important factors of success in mathematics, while students from Australia regard task and environment as important for their success in mathematics. Students in China attribute their failure in mathematics to lack of effort more than to other factors, while students in Australia attribute their failure in mathematics to task difficulty more than to the other factors. Boys and girls both demonstrate between-country differences in their attributions. The role of values and beliefs in the two societies is discussed, as are the variables that affect the attribution differences.

International studies on students' achievement in mathematics indicate that students from some Asian countries had generally good performance. For example, China achieved the highest score in the 1992 IEAP(international Assessment of Education Progress) mathematics study, Taiwan and Korea achieved second (Lapointe et al.,1992); Hong Kong scored the highest in the Second IEA Mathematics Study, and Japan was second (Robitaille & Garden, 1989). The results from the Third International Mathematics and Science Study show that Australia performed better in mathematics than most western countries: it was only outscored by 4 countries at the lower grade level of primary students and by 8 countries at the upper grade level of secondary students, Singapore, Korea, Japan and Hong Kong being among them (Lokan et al., 1996a. 1996b).

Researchers have tried to find the causes as to the Asian students' excellent performance in mathematics. Stigler (1982) suggested that the results could be due to the students in Asian countries spending more time in school, and also to the comprehensiveness of their mathematics curriculum. Hess et al. (1987) studied mothers' beliefs about the causes of success of failure in school, and found that mothers in China attributed their children's failure in mathematics more to lack of effort than the mothers in the United States did. Biggs (1992) analysed the learning approaches of Asian CHC (Confucian-Heritage-Culture) students, and pointed out the existing "repeat learning" which was used frequently by CHC students was not the same as rote learning. Rothstein (2000) remarked that Japanese mathematics teachers spent less time teaching and more time meeting to compare strategies than their American counterparts.

However, in terms of the countries studied, most of the studies focused on the comparison of Asian countries with U.S.A., whose students performed not so well as many western countries in international studies on mathematics. In contrast not so many studies dealt with comparisons between an Asian country and Australia, and even fewer studies involved the comparison of students' attributions of success and failure in mathematics and interpreting the results from cultural perspective, even though it has been suggested that cultural factors play an important role in mathematics education (Bishop,

1988; Mandler, 1989), and attribution as one aspect of motivation may influence behaviour (Weiner, 1979). Therefore the knowledge regarding the differences of students' attributions of success and failure between an Asian country and Australia is little.

Among the literatures dealing with attributions from a cultural perspective, Leder et al. (1997) studied students' attributions of success and failure in mathematics by grouping students into Non-Anglo-Cultural-Background (NACB) and Anglo-Cultural-Background (ACB) categories in Australia, and pointed out that *effort* may be a cultural artifact of Confucius-Heritage-Culture. Other studies also found Chinese students attribute their success and failure to the effort they put into their work (Hau & Salili, 1991; 1996; Hess et al., 1987). However it is still not clear how the Chinese students differ from the Australian students with respect to their attributions of success and failure.

In this paper, we examine the differences of students' attributions of success and failure in mathematics between China and Australia, using a questionnaire developed and data collected in a previous study in Australia. Attribution theory is used for developing this study, but besides this, we also attempt to address some cultural forces which affect the attribution.

Rationale

Attribution Theory and Antecedents in the Attribution Process

One of the most frequently used theories to explain attributions was proposed by Weiner (1979), in which he categorised the dimensions of attribution of failure and success into three main aspects: locus (internal vs external), stability (stable vs unstable), and controllability (controllable vs uncontrollable). He further noted that the perceived stability and controllability as well as the locus of the attributions might affect the attributers' future behaviour. For example, if failure in mathematics is attributed as an internal, stable, and also uncontrollable factor, failure is inevitable, and therefore further effort will not be taken to avoid the failure. On the contrary, if failure is attributed as an internal, unstable and controllable factor, failure is avoidable, and therefore further action will be taken to avoid the failure in the future.

Weiner's theory is important in explaining attribution as it builds up a framework for the classifying of attribution factors, but an obvious question which follows is why different groups of people make different attributions? Personal factors may well have some responsibility for the differences, but we can assume also that cultural factors are important in interpreting differences when people are from different cultural backgrounds. The reason for making this assumption is that on the one hand attribution is a process where people are seeking the causes of an event or behaviour (Magill & Rodriguez, 1996), and on the other, "culture is a set of ideas, or a set of people with certain ideas" (see Bishop, 1988, p. 5). Different cultural groups of people have different ideas including beliefs and values, which may act as "behaviour principles that function as standards of desirable ends and of the means to achieve those ends" (Pan et al., 1994, p. 20). Thus these culturally different beliefs and values can influence the ways of making judgements such as attribution.

Value and Belief Differences in Education in China and Australia

As with every country, values development forms a strong part of education in China. Among the variety of values in education, two should be mentioned: One is effort, another is modesty. That hard work offers great achievement has been accepted in Chinese tradition (Chang, 1985). It is passed on by stories and is advocated by many famous educators (Hess et al., 1987). It is also documented as an important character quality that mathematics education aims to foster in Chinese school mathematics curricula (The State Education Commission of People's Republic of China, 1992).

Besides effort, modesty is another important quality that a person is expected to have in Chinese culture (Luo et al., 1995a). Countless sayings in China extol this kind of quality. Confucius instructed his students "bu chi xia wen", which means a person should not regard it is a shame to learn knowledge from the person who has a lower social status; he also said "zhi zhi wei zhi zhi, bu zhi wei bu zhi, shi zhi ye", which means a really knowledgeable person never covers up his ignorance. "Modesty makes a person progress, conceit makes a person lag behind" is another popular saying in China (Luo et al., 1995b).

Even though Australia is a multicultural society, the values this society holds are those which many Western societies hold: mutual respect and respect for the individual, tolerance, honesty, fairness and justice, freedom of speech and beliefs, and equality etc (Ling et al., 1998). The individual seems to be placed centrally in this society. However, effort in work seems not to be particularly emphasised, and it is often stated that Australians are not particularly job-oriented (Heady & Wearing, 1981; Horne, 1964). One can see this trend reflected in mathematics education. For example, in the document *A National Statement on Mathematics for Australia Schools* (The Australian Educational Council, 1991), the aims of mathematics education include a variety of affective qualities, but hard work in learning mathematics is not mentioned. Clarkson and Leder (1984) noted, in Western society "it is the habit of parents to test a child at something, and then decide whether to pursue that teaching of that task or not when they have judged whether the child is ready for it "(p.420), which suggests that there may be a belief among parents in Australia whether success in completing a task is not first dependent on the effort, but first on how difficult the task is.

The Instruments

In a previous study in Australia (Leder & Bishop, 1994), a questionnaire to assess students' attribution was developed. Part of it categorises students' attributions of success and failure in mathematics into four factors: *ability, effort, task* and *environment*. Examples from this questionnaire are shown in Figure 1.

Imagine that the following events happened to you:

EVENT A A part of your maths homework was wrong, causes:

1. You didn't understand the topic very well	SA	A	U	D SD
2. You were careless about completing it	SA	A	U	D SD
3. The part marked wrong included a step which was more difficult	SA	A	U	D SD

4. There had been no one at home to ask to help	SA	A	U	D	SD
EVENT B You got the results you wanted in maths, causes:					
5. The work covered in class was easy	SA	A	U	D	SD
6. You spent a lot of time studying maths	SA	A	U	D	SD
7. The teacher is good at explaining maths	SA	A	U	D	SD
8. You are good at maths	SA	A	U	D	SD

Figure 1. Sample questionnaire items.

There are 9 events (thus 36 items) in this questionnaire. These items are put into 8 groups, namely, success due to *ability*, success due to *effort*, success due to *environment*, success due to *task*, failure due to *ability*, failure due to *effort*, failure due to *environment*, failure due to *task*. It should be noted that *environment* in this questionnaire refers mainly to the role of the help from teacher and the others. The five-point Likert scale is adopted, in each item subjects are required to indicate their agreement on five point scale from Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) to Strongly Disagree (SD).

For this study, the questionnaire was translated into Chinese by the first author of this article. The translation was then checked by colleagues from a university in the People's Republic of China before it was administered to the school students in China.

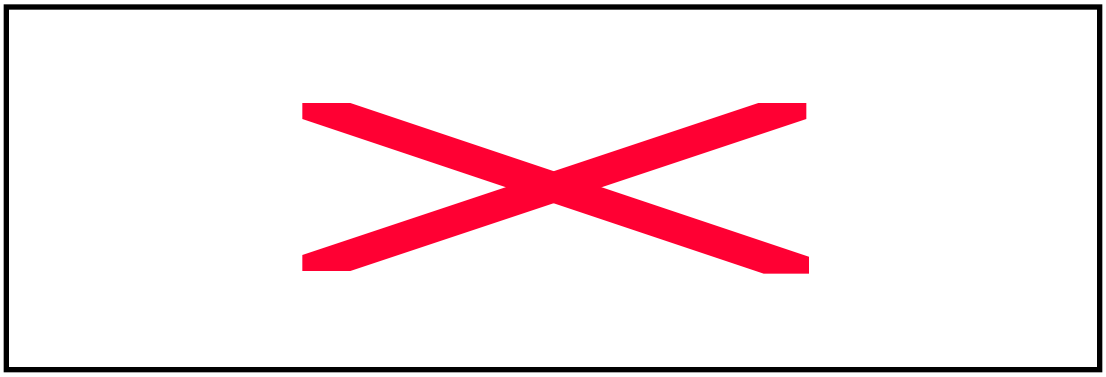
The Subjects

The participants in China were year 7 and year 9 students in a middle school in Kaifeng City, Henan Province, P.R.China. The level of economic development in this city is in the lower middle level in Henan Province as well as in China. The school is a key school in Henan Province, meaning that it has a higher proportion of students enrolled in universities every year than other schools. 44 Year 7 students and 37 Year 9 students answered the questionnaire. Among these participants, 42 were boys and 39 were girls. The participants in the previous study in Australia were Year 7 and Year 9 students in schools of various social backgrounds in the metropolitan city of Melbourne. There were 172 Year 7 students and 181 Year 9 students in that sample, and 172 were boys and 181 were girls.

The Results

Table 1, Table 2, and Table 3 show the overall results, boys groups' results and girls groups' results respectively. T-tests were carried out to examine the significant difference of each factor between students from PRC(China) and AUS(Australia).

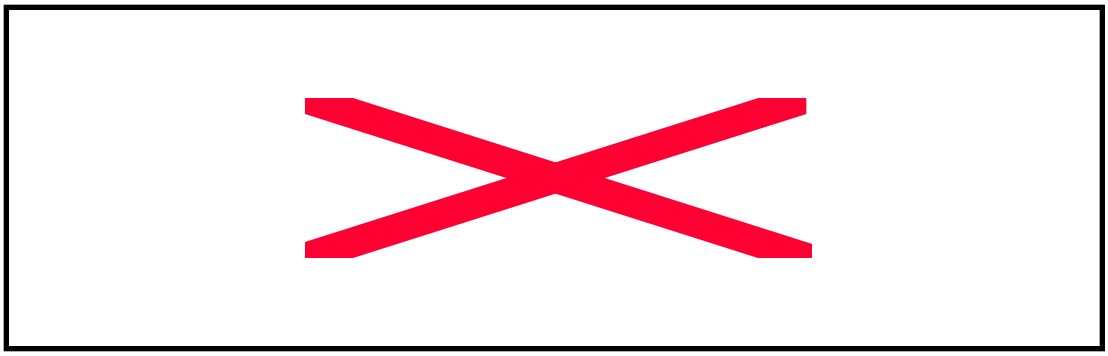
Table 1
Students' Attributions of Success and Failure in Mathematics¾ Overall Results



* Significant at p<0.05. **Significant at p<0.01.

It can be seen from Table 1 that students from PRC attributed their success in mathematics to the factors in the order (1) *environment*, (2) *effort*, (3) *ability*, and (4) *task*; while the students from AUS attributed their success in mathematics in the order (1) *task*, (2) *environment*, (3) *effort*, and (4) *ability*. The t-test analysis found that there was a significant difference in the factor of *task* between the two groups of students. As for the attributions of failure in mathematics, students from PRC put the factors in the following order: (1) *effort*, (2) *ability*, (3) *task*, and (4) *environment*; students from AUS considered the factors of their failure in the order of (1) *task*, (2) *effort*, (3) *ability*, and (4) *environment*. The t-test found that there were significant differences in all the factors except *ability* between two groups of students. This result shows that students in the two countries weighed the four factors rather differently regarding their failure in mathematics.

Table 2
Students' Attributions of Success and Failure in Mathematics-Boys Groups' Results

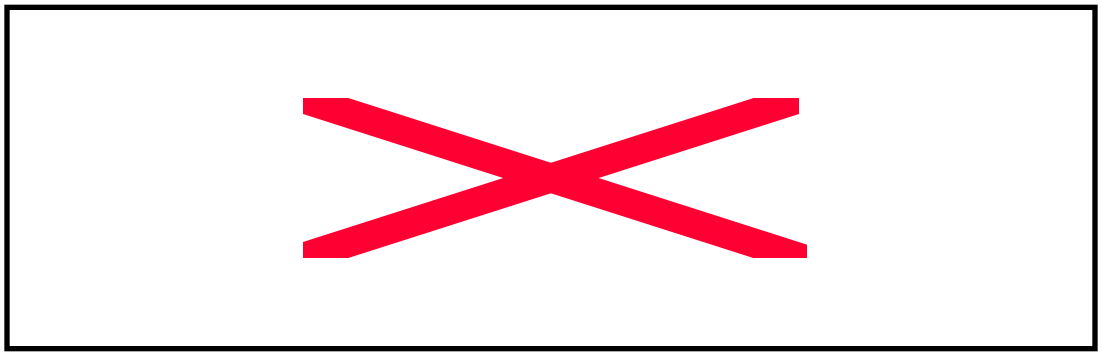


* Significant at p<0.05. **Significant at p<0.01.

Table 2 shows the results from the boys' groups, in which both groups demonstrated different orders of attribution from those in the overall results regarding their success in mathematics. The boys from PRC regarded their success first as *effort*, second as *ability*, third as *environment*, fourth as *task*, while the boys from AUS considered their success first due to *task*, second due to *environment*, third due to *ability*, fourth as *effort*. The t-test showed that there was a significant difference in the factor of *task* between the two groups

of students. As for failure in mathematics, the two boys' groups demonstrated the same attribution orders as those in the overall results, and the t-test found there were significant differences in all the four factors except *ability* between the two groups of students.

Table 3
Students' Attributions of Success and Failure in Mathematics-Girls Groups' Results



*Significance level at $p<0.05$. **Significance level at $p<0.01$.

Table 3 shows the girls' attributions. The girls' attributions of success in PRC and AUS showed more similarities than differences. They both thought of *environment* as the most important factor for success, with *ability* being the least important. The girls from PRC put *effort* second and *task* third in their attributions of success, while girls from AUS put *task* second and *effort* third in their attributions of success. A significant difference existed in the *task* factor between the two groups of students. The attribution order of failure of the girls' groups corresponded with the overall results of each country. The girls in PRC considered *effort* to be the most important factor for their failure in mathematics, while the girls in AUS ranked *task* as the most important factor for their failure. The two groups both rated *environment* as the least important factor for their failure, and *t*-tests showed there were significant differences in all the factors except *ability*.

Discussion

It can be seen from the above results that students from PRC and AUS had different emphasises with respect to the dimensions of attribution. Students from PRC attributed their success more to both the external factor *environment* and the internal factor *effort*. In contrast students from AUS attributed their success more to the external factors *task* and *environment*. Students from PRC had a higher agreement on the internal factor *effort* regarding their failure, while students from AUS had a relatively emphasis on the external factor *task* regarding their failure. As *effort* is regarded as a controllable, unstable variable, whereas *task* and *environment* are regarded as uncontrollable and stable variables in the attribution theory, it implies that students from PRC may make more effort to gain success in learning mathematics than the students from Australia.

The boys groups' attributions of success showed more differences than the girls groups. The boys from PRC rated the internal factors *effort* and *ability* higher for their success, and the boys from AUS rated the external factors *task* and *environment* higher for their success, which signifies that boys from PRC might wish to strive more to get success in mathematics. The girls from PRC and the girls from AUS both ranked the external factor

environment as the most important variable for success, and the internal factor *ability* as the least important factor for success. As *environment* here refers to the help from teacher and the others, it shows that the girls in both countries considered that other people's help was particular important for their success.

Gender differences in attribution patterns existed in both countries. Compared with the boys, girls from PRC and AUS both attributed their success less to the internal, stable, uncontrollable factor *ability*, whereas for failure they had a relatively more emphasis on the factor *ability*. This suggests that the girls in both countries might be not so confident in mathematics as the boys.

The above results can be partly explained by the values and beliefs held by the two societies. It has been stated at the beginning of this paper that effort and modesty are values advocated by the education system in China. These values were probably transmitted to students and therefore one could expect that the students would think that their successes and failures in mathematics were due to the role of effort — success due to effort, failure due to lack of effort. However, the fact that effort was not identified as the most important factor in the attribution of success was probably because the value of modesty has played a more important role in the attribution process. In the application of this value, it is often regarded that success should not be accredited to the subject himself/herself totally, but it should be first accredited to the help from others, especially the help from teachers. It is also a custom that teachers should always be respected by their students. For failure the subject himself/herself should be mainly responsible.

The results in Australia seem to correspond with the beliefs held in that society as well. As is pointed out at the beginning of this paper, task may be seen as the most powerful variable in determining a person' success and failure, whereas effort is not considered as a particularly important factor in completing a task. This belief might make the students in Australia come to the conclusion that success was due to the task being easy, and failure was due to the task being difficult.

The above discussion suggests that beliefs and values held by these two societies are perhaps the causes of the differences between the students' attributions of success and failure in mathematics. Moreover they are probably also an important source of the national differences in mathematics achievement between China and Australia. However, the explanation of the attribution data is far from perfect and many questions still remain. For example, how were the values and the beliefs transmitted to students? Why did girls demonstrate more similarities in their attributions than boys between the two countries? Why did girls in Australia consider the factor environment as the most important factor for success as well? These questions indicate that the attribution process is a complicated one, and further studies are necessary. As well as more individual studies of attributions, there needs to be more research on issues like teachers' and parents' beliefs and values regarding mathematics learning in the two cultures. Only then will there be some better explanations of the attribution process and how it interacts with factors such as beliefs and values in the two cultures.

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