Akademika No. 25, Julai 1984

ATTITUDES TOWARDS MATHEMATICS AND SCHOOL LEARNING IN MALAYSIA AND INDONESIA: URBAN-RURAL AND MALE-FEMALE DICHOTOMIES

Frank J. Swetz, Hassan Langgulung & Abdul Rashid Johar

Sinopsis

Satu tinjauan mengenai sikap terhadap matematik dalam masyarakat, sekolah dan pembelajaran sekolah telah dilakukan di Indonesia dan di Malaysia. Seramai 1825 orang murid yang berumur tiga belas tahun telah diambil sebagai sampel dalam tinjauan ini. Hasilnya telah menunjukkan bahawa terdapat perbezaan sikap pelajar yang berasaskan pada kawasan tempat tinggal dan jantina. Pelajar-pelajar desa memperlihatkan sikap negatif terhadap matematik dan sekolah jika dibandingkan dengan rakan-rakan sebayanya di bandar. Walaupun pada keseluruhannya sampel perempuan didapati kurang positif terhadap matematik jika dibandingkan dengan sampel lelaki, tetapi pelajar perempuan di Malaysia tidak menunjukkan sebarang perbezaan yang signifiken. Pelajar perempuan di Malaysia kelihatan mempunyai kemahiran yang sama dengan pelajar lelaki dalam menyelesaikan masalah matematik. Penemuan ini bertentangan dengan kepercayaan dan andaian umum yang sering mencurigai tentang kecekapan dan sikap pelajar perempuan.

Synopsis

A survey of attitudes towards mathematics in society and school and school learning conducted on 1,825 thirteen year olds from Malaysia and Indonesia revealed differences based on country, sex and region of domicile within the countries. Rural students exhibited more negative attitudes towards both mathematics and school than did their urban peers. While the general female sample was less positive towards mathematics than their male counterparts, Malysian women's attitudes were not significantly different from those for Malaysian males. Malaysian women also seem to be equivalent to Malaysian men in their mathematical problem solving skills. This finding contrasts with popularly held beliefs concerning female attitudes and abilities.

Introduction

In assessing mathematics performance potential of sudents, attitudes towards mathematics learning are frequently cited as factors contributing to success. Several studies have shown that positive attitudes are conducive to good performance (Hungerman, 1967; Neale, 1969).

However, an individual's attitude towards mathematics can be influenced by many factors (Poffenberger & North, 1959; Aiken, 1976; Head, 1981). Two such factors which have been the focus of investigation are the individual's sex and socioeconomic standing. It is generally held that females exhibit less positive attitudes towards mathematics than their male counterparts (Carey, 1958; Hilton & Berglund, 1974; Keeves, 1973). Nevin (1973) proposes that a young woman's strong interest in human relationships mediates against a potential interest in such subjects as mathematics. Studies by Fennema (1976) and Beckmann and Stephens (1982) support this hypothesis and conclude that differential mathematics achievement and attitude by sexes is partially caused by sociocultural factors mediated through sex role expectations. Perhaps the most extensive investigation, to date, of socioeconomic standing and mathematics attitude and learning was conducted by the International Study of Achievement in Mathematics (Husen, 1967). Its findings indicated that a positive relationship existed between socioeconomic standing and mathematical performance — the higher the socioeconomic status of the student, the better the performance in mathematics. These findings are based on research conducted in western societies, therefore, a natural question arises, 'Do similar findings exist in non-western societies where cultural and societal norms and expectations differ?'

The Problem

Developing countries of the world in their attempts to achieve modernity and promote industrialization have placed a heavy emphasis on scientific-based education. An emphasis they hope will instill in their young favourable attitudes towards the use of science. This fact is particularly true in the teaching of mathematics — the foundation for general scientific advancement. Frequently, in functioning under severe economic and personnel constraints where educational equity within a nation is improbable, decisions must be made as to the allocation of educational resources in order to insure an efficient nurturing of human scientific potential. In such situations, a paramount decision is what subpopulation would supply the most attractive returns for the educational investment. In many traditional societies of the third world, this subpopulation is assumed to be urban males but is such an assumption necessarily valid? Do urban males in a traditional society have better attitudes towards mathematics and school learning than their fellow students?

In 1976, an exploratory study was conducted in Malaysia to investigate the attitudes of rural students, towards mathematics and

mathematics learning (Swetz, Langgulung & Hashim, 1979). This study was in response to official pronouncements concerning poor scholastic attitudes and performance of rural students (Murad, 1970). Its principle finding was that rural students had more favourable attitude towards mathematics than their urban counterparts but the limitations of the sampling process: size (N = 88) and the homogenous nature of the samples secured, prevented the extrapolation of the conclusion for Malaysia in general. Further investigation of the issue was warranted.

In 1980, a follow up, nationwide survey of attitudes towards mathematics and school and school learning was undertaken. A further dimension to the investigation was added by conducting the same survey in neighbouring Indonesia so that attitudinal pattern comparisons could be made. Although Indonesia differs in colonial background, it shares a common cultural-religious heritage with Malaysia. The main objectives of the study was to determine if rural-urban differences in attitudes towards mathematics and school exist in the populations surveyed.

Procedures

A survey form was devised by randomly combining items from two district scales of the International Study on Mathematics Achievement: Attitudes Towards the Place of Mathematics in Society, to be called Mathsoc: and Attitudes Towards School and School Learning, Schola. The resulting 19 item scale solicited a Likert-type response (See Table 1). Each item was to be responded to by checking: "Strongly Disagree" (SD); Disagree (D); Undecided (U); Agree (A); or Strongly Agree (SA). They were translated into *Bahasa Malaysia* [Malay] and *Bahasa Indonesia* [Indonesian] and, as a measure of translation integrity, retranslated back into English and compared to the contents and meaning of the original statements. The translations were found to be satisfactory.

A stratified random sampling process was used in identifying 20 schools, 10 urban, 10 rural in Peninsular Malaysia. Official government designations of urban and rural were followed. From these schools the attitudes of 1000 thirteen year olds, comprising 500 males and 500 females were solicited. A similar procedure was carried out in Indonesia with sampling restricted to Java, the most densely populated island in the archipelago. Indonesian urban samples were drawn from shcools in Jakarta, Semarang and Jogya and rural samples from the surrounding countryside.

Table 1
Student Opinion Survey

Directions: Below are several statements. Read each statement carefully. In the table at the right of each statement mark the column which represents how you feel about each statement.

Mark: Column labeled **SA** if you **Strongly Agree** with the statement. Column labeled **A** if you **Agree** with the statement.
Column labeled **U** if you cannot decide whether you **Agree** or **Disagree** with the statement.
Column labeled **D** if you **Disagree** with the statement.
Column labeled **SD** if you **Strongly Disagree** with the Statement.

Example:	SA	A	U	D	SD
Holidays are important because they allow you to rest from work.	—	—	—	—	—

Complete the items below:

1. It is important to know mathematics (algebra, geometry, etc.) to get a good job.	—	—	—	—	—
2. School is not very enjoyable, but I can see value in getting a good education.	—	—	—	—	—
3. Unless one is planning to become a mathematician or scientist, the study of advanced mathematics is not very important.	—	—	—	—	—
4. I generally like my school work.	—	—	—	—	—
5. Although school is difficult, I want as much education as I can get.	—	—	—	—	—
6. More of the most able people should be encouraged to become mathematicians and mathematics teachers.	—	—	—	—	—
7. I enjoy most of my school work and want to get as much additional education as possible.	—	—	—	—	—
8. I find school interesting and challenging.	—	—	—	—	—
9. Mathematics (algebra, geometry, etc.) is not useful for the problems of everyday life.	—	—	—	—	—
10. The most enjoyable part of my life is the time I spend in school.	—	—	—	—	—
11. In the near future most jobs will require a knowledge of advanced mathematics.	—	—	—	—	—
12. I am bored most of the time in school.	—	—	—	—	
13. I like all school subjects.	—	—	—	—	—
14. Mathematics is of great importance to a country's development.	—	—	—	—	—
15. I dislike school and will leave as soon as possible.	—	—	—	—	—
16. I enjoy everything about school.	—	—	—	—	—
17. Most school learning has little value for a person.	—	—	—	—	—
18. A through knowledge of advanced mathematics is the key to an understanding of our world in the twentieth century.	—	—	—	—	—
19. Outside of science and engineering, there is little need for mathematics (algebra, geometry, etc.) in most jobs.	—	—	—	—	—

Processing of Data and Results

Of the solicited sample of 2000, 1825 usable survey forms were returned. Since there was no way of determining, barring a personal visit, whether a selected school was coeducational (and many Malaysian and Indonesian schools are not) an equal breakdown by sex was not achieved. Returns from 846 females and 979 males were obtained: 888 urban and 937 rural. Survey scale items were sorted as to belonging to subscale Mathsoc and subscale Schola. A weight of 1 — 5 was assigned to each response according to whether the respondent marked SA(1), A(2), U(3), D(4) or SD(5). In the case of negative statements the weighing of responses was reversed. An attitude index was obtained for each scale by totaling numerical response values and dividing by the number of items in the scale: Mathsoc 8, Schola 11. Thus an attitude index close to 1 indicates a very positive attitude and a value close to 5 a negative attitude. Descriptive results for the populations polled are given in Table 2.

Analyses of variance (ANOVA) were computed for Mathsoc and Schola using country, location and sex as factors. The ANOVA results are given in Table 3.

The Mathsoc analysis reveals significant country, location and sex main effects and a significant country by location interaction. Inspection of Mathsoc attitude index means in Table 2 shows that Malaysians expressed a more positive attitude towards mathematics than Indonesians; males were slightly more positive in their attitudes than females as were urban dwellers in comparison with rural dwellers. Similarly, the Schola analysis exhibits the same general pattern of effects as Mathsoc with significant main effects for country, location and sex and a significant interaction for country by location. An inspection of Schola means reveals that Malaysians have a more favourable attitude towards school than Indonesians; urban dwellers are more positive in their attitudes than their rural peers and women have a more positive attitude than men.

The Pearson r correlations between Mathsoc and Schola indices for each sub-population were computed and are presented in Table 4. Significant differences in r scores exist between countries ($Z = 2.8$, $p < .05$), with stronger correlation exhibited between the Malaysian attitude scores; and urban-rural populations ($Z = 2.8$, $p < .05$), the urban population's correlation was more positive than that obtained by the rural population.

Discussion

In general, the findings seem to concur with those obtained through western-based research and popular opinion held in the local region. For the total sample population, Malaysian students express more favourable attitudes than Indonesian students towards the place of mathematics in society and school and school learning; urban students express more favourable attitudes than their rural counterparts and males express more positive attitudes towards mathematics than females but females are more favourable towards school. When Mathsoc scores are reexamined within the context of particular country

Table 2
Results of Malaysian — Indonesian Attitude Survey:
Means and Standard Deviations

Population	n	Mathsoc mean	Mathsoc SD	Schola mean	Schola SD
Total	1825	2.2527	.5119	1.9610	.3537
urban	888	2.2234	.5389	1.9428	.3542
rural	937	2.2804	.4836	1.9783	.3525
male	979	2.2265	.4952	1.9925	.3605
female	846	2.2829	.5293	1.9246	.3422
Malaysia	1006	2.040	.4753	1.9219	.3678
urban	488	1.9762	.4708	1.8738	.3490
rural	518	2.1007	.4720	1.9671	.3796
male	534	2.0267	.4729	1.9436	.3740
female	472	2.0557	.4781	1.8973	.3596
rural/male	266	2.0874	.4545	1.9870	.3866
rural/female	252	2.1147	.4904	1.9460	.3716
urban/male	268	1.9664	.4837	1.9006	.3565
urban/female	220	1.9881	.4554	1.8413	.3375
Indonesia	819	2.5135	.4280	2.0092	.3294
urban	400	2.5250	.4574	2.0270	.3426
rural	419	2.5026	.3981	1.9921	.3158
male	445	2.4663	.4075	2.0512	.3347
female	374	2.5697	.4451	1.9591	.3162
rural/male	235	2.4574	.3925	2.0475	.3176
rural/female	184	2.5602	.3990	1.9214	.2996
urban/male	210	2.4762	.4245	2.0553	.3536
urban/female	190	2.5789	.4866	1.9956	.3281

Table 3
ANOVA of Attitudes Towards Mathematics in Society
by Country, Location and Sex

Source of Variation	Sum of Squares	DF	Mean Square	F
Main Effects	104.320	3	34.807	170.720*
Country	101.107	1	101.107	497.857*
Locat	1.563	1	1.563	7.664*
Sex	1.751	1	1.751	8.585*
2-Way Interactions	2.979	3	0.993	4.870*
Country Locat	2.282	1.	2.282	11.191*
Country Sex	0.686	1	0.686	3.362
Locat Sex	0.001	1	0.001	0.005
3-Way Interactions	0.001	1	0.001	0.004
Country Locat Sex	0.001	1	0.001	0.004
Explained	107.400	7	15.343	75.246
Residual	370.492	1817	0.204	
Total	477.892	1824	0.262	

*significant at < = .01

ANOVA of Attitudes Towards School and Learning
by Country, Location and Sex

Source of Variation	Sum of Squares	DF	Mean Square	F
Main Effects	6.060	3	2.020	16.709*
Country	3.427	1	3.427	28.346*
Locat	0.590	1	0.590	4.878**
Sex	2.043	1	2.043	16.904*
2-Way Interactions	2.262	3	0.754	6.239*
Country Locat	2.018	1	2.018	16.693*
Country Sex	0.212	1	0.212	1.757
Locat Sex	0.045	1	0.045	0.372
3-Way Interactions	0.199	1	0.199	1.643
Country Locat Sex	0.199	1	0.199	1.643
Explained	8.521	7	1.217	10.070
Residual	219.647	1817	0.121	
Total	228.168	1824	0.125	

*significant at < = .01
**significant at < = .05

Table 4
Pearson Correlation Coefficients for
Mathsoc — Schola Attitudes

Population	n	R
Total	1825	.2633*
urban	888	.3222*
rural	937	.1973*
male	979	.2698*
female	846	.2717*
Malaysia	1006	.2838*
urban	488	.2780*
rural	518	.2667*
male	534	.2986*
female	472	.2724*
Indonesia	819	.1600
urban	400	.2214*
rural	419	.0846
male	445	.1236
female	374	.2457*

*$p < .01$
**$p < .05$

samples, it can be seen that the Malaysian urban-rural difference is pronounced ($Z = 4.18$, $p < .05$) while the Indonesian urban-rural scores do not demonstrate a significant difference ($Z = .746$, $p < .05$). Similarly for Schola scores, the Malaysian urban-rural difference is pronounced ($Z = 4.06$, $p < .05$) and the Indonesian urban-rural difference is once again not significant ($Z = 1.514$, $p > .05$).

An examination of male-female differences by country supplies an interesting finding. Western based research indicates that females should exhibit less positive attitudes towards mathematics than males (Carey, 1958) and this theory was certainly supported by the Indonesian sample results ($Z = 3.457$, $p < .05$); however, no significant difference for Mathsoc means between Malaysian males and females existed ($Z = .965$, $p > .05$). Across countries, females exhibited more positive attitudes towards schools than males, the differences carried through to in-country samples.

In analysing sex differences concerning mathematics performance and attitudes, four major hypotheses have been proposed in research literature:

1. Mathematics ability-attitude is dependent on a sex-linked recessive gene, i.e., genetic differences between males and females result in differing mathematics performances.
2. Mathematics is a male domain. It is a basically aggressive occupation.
3. Offspring choose their activities and interests on the basis of sex role modelling. Daughters pattern themselves after their mothers and stress the development of verbal skills.
4. Differential social expectations and reinforcement shape sex-related abilities and attitudes.

If one ignores the rather controversial first theory, the following three would seem closely bound by the socio-cultural milieu. Maccoby (1974) has summarized this milieu for the western context:

> Members of each sex are encouraged in, and become interested in and proficient at, the kinds of tasks that are most relevant to the roles they fill curently or are expected to fill in the future. According to this view, boys in high school forge ahead in maths because they and their parents and teachers know they may become engineers or scientists; while the girls know they are unlikely to need maths in occupations they will take up when they leave school.

How does such a context differ, if it does, in the Malaysian — Indonesian situation? Both Malaysia and Indonesia represent traditional societies where the behaviour and expectations of women are regulated by strict codes of cultural and religious constraints. In particular, both societies are primarily Islamic and thus male oriented, however, the role of mathematics in society has not yet been defined as sex-related, thus no stereotyping has taken place. Biases, quite simply, do not yet exist concerning mathematics. Traditionally, in Asia, women keep the household accounts and in many regions including Malaysia they supplement the family income by selling produce or craft products at the local market. A survey of mathematics achievement in Indian schools by S. S. Kulkarni and his associates (1969) revealed that women in the Mangalore region of the state of Mysore out-performed their male counterparts in mathematics and these results contrasted sharply with the findings for the rest of India where males were superior to females in mathematics performance. Mangalore possesses à matriarchal society where women control the families finances. Thus sex role modelling in an Asian context may result in the transmission of basic mathematics skills from mother to daughter.

Young women are caught up in the movements of modernity taking place around them and while they are very much aware of their traditional expectations and duties, they are equally anxious to participate in the new intellectual opportunities opening before them (Chipp and Green, 1980). These opportunities appear more prevalent in Malaysia where the government's success in instituting a universal modern primary education has assured girls access to education (Strange, 1978); Indonesia has been less successful in achieving such a status. Fennema in her 1977 examination of sex related differences in mathematics learning performance in the United States has pointed out that an important factor which reflects on the deficiencies of female response and performance in mathematics is mathematical background — prior mathematical study, and that females are less likely to pursue mathematical studies very far into secondary school. Students in Malysia follow rather inflexible curricula that dismisses personal choice and insures that both males and females, as long as they stay in school, will have exposure to the same mathematical background through their 13th year. Thus, it would seem that this study supports the fact that sex-related attitudes towards mathematics are strongly influenced by sociocultural factors.

The finding that there are no significant differences in attitudes towards the place of mathematics in society for Malaysian males and females prompts an investigation of the question 'What about mathematical performance?' A concurrent but independent study investigated the attitudes and problem solving ability of 199 (117 males, 82 females) entering university students (Swetz and Abdullah, 1981). The attitudes surveyed were views about mathematics teaching and mathematics as a process; females expressed more positive attitudes towards mathematics teaching than their male peers and no significant difference existed between the sexes for responses to Mathematics as a process. Further there was no significant difference of performance on the problem solving tasks between males and females and when a profile of difficulty was established for the problems ranking them in order of student encountered difficulty, the profile for males and females differed by one entry. This study indicates that, at least in Malaysia, men and women who have the same mathematical backgrounds perform similarly on mathematical problem solving tasks. The superiority of males in mathematical problem solving has been noted in several studies (Aikens, 1975; Hoffman & Maier, 1966) and yet it appears open to question (Sweeney, 1953; Parsley *et al,* 1963). It would certainly appear that sex-related differences in mathematics

performance are not universal and must be examined within their cultural and social context (Kulkarni and Naidu, 1970; Eshiwani, 1975). Researchers and educational planners should be extremely cautious in extrapolating findings across sociocultural boundaries (Wilson, 1981).

Conclusions

In Malaysia and Indonesia, as in many other developing countries of the world, educational oportunities favour the urban dweller, particularly the urban male. While the phenomenon can be justified in terms of economic and political considerations, its practice discriminates against large segments of the population, rural dwellers and women. If a true spirit of scientism is to be imposed, one upon which economic and industrial progress can be built, it is exactly these populations that must be reached. In the case of Malaysia, it would seem that an untapped reservoir of possible potential scentific talent can be found among its women who demonstrate both favourable attitudes towards mathematics and its uses and possess mathematical problem solving skills equivalent to their male counterparts. These attitudes and this talent should not be ignored.

References

Aiken, L. R. (1979). "Attitudes Towards Mathematics and Science in Iranian Middle Schools," *School Science and Mathematics* 79: 229 — 234.

——— (1975). "Some Speculations and Findings Concerning Sex Differences in Mathematical Abilities and Attitudes" in *Mathematics Learning: What Research Says About Sex Differences,* Elizabeth Fennema (ed.) (ERIC Center for Science, Mathematics and Environmental Education Columbus, Ohio).

——— (1976). "Update on Attitudes and Other Effective variables in Learning Mathematics," *Review of Educational Research* 46: 293 — 311.

Beckmann, Milton and Larry Stephens (1982). "Sex-Related Differences in Mathematical Competencies of Pre-Calsulus College Students," *School Science and Mathmematics* 82: 295 — 299.

Carey, Gloria (1958). "Sex Differences in Problem-Solving Performance as a Function of Attitude Differences," *Journal of Abnormal and Social Psychology* 56: 256 — 260.

Chipp, Sylvia and Justin J. Green (ed) (1980). *Asian Women in Transition.* (Pennsylvania State University Press).

Eshiwani, G. S. (1975). "Sex Differences in the Learning of Mathematics Among Kenyan School Students," *Kenya Educational Review* (December) pp. 111 — 119.

Fennema, Elizabeth and Julia Sherman, (1975). "Sex-Related Differences in Mathematics Achievement, Spatial Visualization and Effective Factors,"

American Educational Research Journal, 14: 51 — 71.

——(1976). "Sex-Related Differences in Mathematics Learning: Myths, Realities and Related Factors," paper presented at the American Association for the Advancement of Science Conference (Boston, Mass., February 22 — 23)

Head, John (1981). "Personality and the Learning of Mathematics," *Educational Studies in Mathematics* 12: 339 — 350.

Hilton Thomas and Gosta W. Berglund (1974). "Sex Differences in Mathematics Achievement — A Longitudinal Study," *Journal of Educational Research* 67: 231 — 237.

Hoffman, Richard L. and Norman Maier (1966). "Social Factors Influencing Problem Solving in Women," *Journal of Personality and Social Psychology* 4: 382 — 390.

Hungermann, A. D. (1967). "Achievement and Attitude of Sixth-Grade Pupils in Conventional and Contemporary Mathematics," *Arithmetic Teacher* 14: 30 — 39.

Husen, T. (1967). *Intenational Study of Achievement in Mathematics: A Comparison of Twelve Countries,* 2 vols. (John Wiley, New York).

Keeves, J. P. (1973). "Differences Between the Sexes in Mathematics and Science Cources," *International Review of Education* 19: 47 — 64.

Kulkarni, S. S. and C. A. Naidu (1970). "Mathematics Achievement Related to Students' Socioeconomic and Attitude Variables: A Pilot Study," *Indian Journal of Psychology* 45: 53 — 66.

Kulkarni, S. S., C. A. S. Naidu and Mohan Lal Arya (1969). "A Survey of Mathematics Achievement in Indian Schools," *Indian Educational Review* 3: 1 — 33.

Maccoby, Eleanor D. (ed.) (1966). *The Development of Sex Differences,* (Stanford University Press, Calif.)

Murad bin Mohd. Nor (ed.) (1970). *Kajian Kecicíran,* Ministry of Education, Kuala Lumpur.

Neale, D. C. (1967). "The Role of Attitudes in Learning Mathematics," *Arithmetic Teacher* 14: 30 — 39.

Nevin, M. (1973). "Sex Differences in participation Rates in Mathematics and Science at Irish Schools and Universities," *International Review of Education* 19: 88 — 91.

Parsley, Kenneth M. *et. al.* (1963). "Are There Really Sex Differences in Achievement?" *Journal of Educational Research* 56: 210 — 212.

Poffenberger, T. (1959). "Factors in the Formation of Attitudes Towards Mathematics," *Journal of Educational Research* 52: 171 — 176.

Rani, A. N. (1965). *Wanita Dalam Islam [Women in Islam]* penerbit RADJA-PENA, Surabaya.

Strange, Heather (1978). "Education and Employment Patterns of Rural Malay

Women," *Journal of Asian and African Studies* 13: 50 — 64.

Sweeney, E. (1953). *Sex Differences in Problem Solving* Technical Report No. 1, Office of Naval Research, Washington.

Swetz, Frank and Khalid Abdullah (undated). "An Investigation of the Mathematical Problem, Solving Abilities of Matriculation Students at UKM and the Mathematics Instruction They Receive," unpublished paper, Education Program, Universiti Kebangsaan Malaysia.

Swetz, Frank, Hassan Langgulung, and Amir Hashim (1979). "Attitudes Towards Mathematics and Their Influencing Factors: A Malaysian Study," *International Education* (1979) 9: 39 — 48.

Wilson, Bryan. (1981). *Cultural Contexts of Science and Mathematics Education.* Centre for Studies in Science Education, University of Leeds).