How Do Interest In Sciences Vary With Gender?

Paper presented by

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in

UGC sponsored National Seminar on

Gender Quest in Multiple Intelligences

At Farook Training College , Calicut

September 2-3, 2011

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Internationally, the proportion of science and technology students to the total students has been decreasing during the last two decades (Organization for Economic Co-operation and Development [OECD], 2006). In India too, students' interest in science was found to decline as they climb educational ladder from middle school classes to tertiary level. In Kerala, successive examination results have revealed that while girls perform better in Board exams at secondary and higher secondary level, boys top the medical and engineering admission entrance ranks. Elsewhere it is observed that, although girls generally do as well as or better than boys on homework, assignments and course grades in science classes, boys tend to outscore girls when tested on the same content in high-pressure situations such as standardized tests with time limits (Shettle, et al. 2007). These tests are typically not linked to instructed curriculum, and so can be understood to be measures of more general abilities in science (Halpern et al. 2007). But, as SAT scores under-predict young women's performance in college courses (Wainer, 1992) it is suggested that it is not ability, per se, but consistent gender differences in children's and adolescents' beliefs about their abilities in science, their interest in science, and their perceptions of the importance of science for their futures that hinders girls and women from pursuing careers in science (Halpern, 2007b). Researchers (Andre, et al.,1999; Herbert & Stipek, 2005; Jacobs, et al., 2002) have found that from early adolescence, girls show less interest in science careers.

Students are not pursuing science because they have no interest in science (Shukla, 2005). Kahle (2004) who reported more interest for boys (13^+ age group) and Singh (1999) who reported more interests for girls (18^+ age group) have reached almost opposing conclusions on gender difference in science-interest. Reversal of interest patterns of boys and girls is observed as they move from primary to secondary school (Greenfield, 1997). Gender difference in science interest (Feldhusen & Williard-Holt, 1993) which is more qualitative than quantitative (Qualter, 1993; Dawson, 2000; Tsabari & Yarden, 2005; Gafoor & Smitha, 2010) is attributed, among other reasons, to gender role socialization (Jones & Kirk, 1990).

In an Indian study (Subramanian, 2007), among the 289 scientists holding a regular position in any one of the seven institutes under consideration, a mere 35 (12.11 per cent) were women. There were more women in the biological sciences than in mathematics and physics; not even one of the many chemistry departments. Most of the women scientists said their parents themselves were well-educated and were very supportive of the career ambitions of their daughters. 21 of the 44 (47.72 per cent) women had a sister who was equally qualified and well placed, and 18 had a brother who was equally qualified, whereas only five (20 per cent) out of the 25 men had a sister equally qualified. This study challenges the notion prevalent among scientists that talent for doing science is inherent in a person, and if it is there it will reveal itself irrespective of the external conditions.

Thus, world over the choice of discipline is highly gender-dependant, and fields such as engineering or computing sciences are largely male-dominated. These choices may be linked to the negative pressures and

external expectations affecting female students. Persistent stereotypes weigh heavily on female student choices throughout their education.

Objective

In view of gender based divergence in interest in studying physics, chemistry and biology, this study explores interest in these sciences among school students in Kerala and puts forward propositions from reviewed literature that parents, and teachers, can employ for strengthening the interest in science of their wards, especially girls.

Sample

Sample comprises 3236 (1659 boys, 1577 girls) students studying in upper primary to higher secondary classes. There were 1461 (808 Boys, 653 girls) standard 5-7 pupils and 1000 (501 boys, 499 girls) standard 8-9 students from 14 upper primary and secondary schools each; and, 775 (350 boys, 425 girls) students of 12^{th} standard from 15 higher secondary schools of Kozhikode district of Kerala. Sampling used proportionate stratified random technique giving due weightage to school locality and type of management.

Measure

Scale of Interest in Science

Three separate versions of scale of interest in science were used to quantify interest in science of upper primary, secondary and higher secondary levels. Science topics suitable to the level of schooling were listed in each version for which students have to self-report by choosing any of the three alternatives- Not Interested, Somewhat Interested and Much Interested- which were scored 0, 1, and 2 respectively. Upper primary version listed 63 topics selected after thorough analysis of the contents in science textbooks of standards III to VII with which pupils are already familiar with. Test-retest and Split-half coefficients of correlation were 0.70 and internal consistency using Cronbach's alpha coefficient of homogeneity was r=0.95. Substantial positive correlation of 0.56 with the grades that pupils obtained in science indicated concurrent validity of this version of the scale. Secondary school version of scale of interest in science included 100 topics covering the three fields i.e., Physics, Chemistry and Biology after analyzing the contents in the science textbooks of standards 8-12 of schools following Kerala state curriculum. Test re-test reliability coefficient is 0.97 (N=40). For higher secondary version 6o topics of both theory and applications of various fields of science chosen after thorough analysis of the science text books of 11th and 12^{th} standards were used. In order to make the scores from the three versions comparable, raw scores were transformed into standard scores using the formula,

Interest in Science of individual student = (Sum of score obtained on all the items in the version / number of items in the version)/ Standard Deviation of the distribution of above scores among the sample using that version.

Results

Interest in biological and physical science topics among boys and girls

Table 1: *Mean interest in biological and physical science topics among boys and girls at upper primary, high, and higher secondary levels*

		Means		
	Area	UP	HS	HSS
Girls	Bioscience	4.80	3.60	3.99
	Physical science	4.53	2.96	2.97
Boys	Bioscience	5.06	3.2	3.62
	Physical science	4.27	2.95	3.22

Among both girls and boys, interest in science topics is highest during primary stage than during secondary schooling. During upper primary schooling, interests in both physical and biological sciences are equal among girls, while boys have more interest in biology than physical sciences. During secondary schooling the difference between interests in biological science and physical science become more pronounced, while the reverse happens among boys. By higher secondary stage girls have more interest in biology and less interest in physical science than boys. These findings echo those of Greenfield (1997).

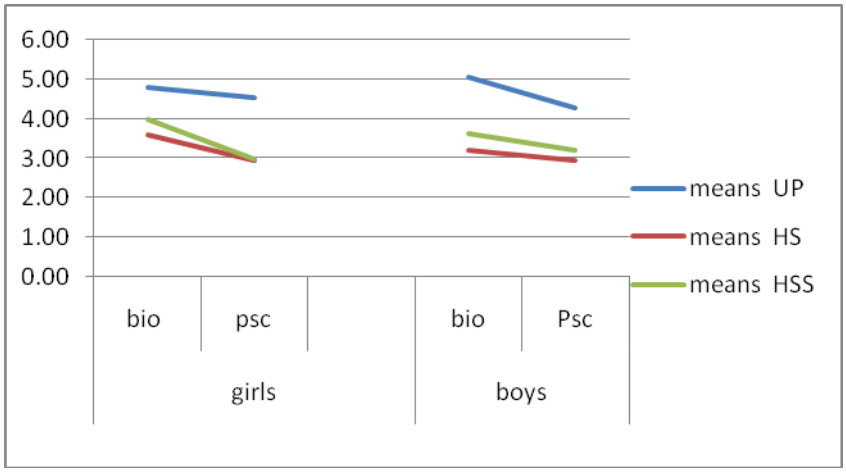

Figure 1: Levels of interest in biological and physical science topics among boys and girls at upper primary, high, and higher secondary schools

Table 2: *Descriptive statistics of interest in biological and physical science topics among boys and girls at upper primary, high, and higher secondary levels*

	Girls						Boys					
	Bioscience			Physical science			Bioscience			Physical science		
	UP	HS	HSS	UP	HS	HSS	UP	HS	HSS	UP	HS	HSS
min	1.15	0.21	0.45	0.41	0.00	0.42	0.94	0.13	0.15	0.07	0.12	0.07
p25	4.22	2.90	3.32	3.93	2.30	2.29	4.53	2.48	2.97	3.76	2.31	2.55
p50	4.96	3.66	4.07	4.67	3.00	2.92	5.23	3.18	3.57	4.46	2.96	3.21

p75	5.59	4.29	4.67	5.28	3.70	3.61	5.81	3.94	4.31	5.01	3.65	3.79
max	6.39	5.60	6.48	6.02	4.85	5.56	6.51	5.34	5.95	5.64	4.79	5.83

Table 2 and figure 2 shows that observation based on the mean scores of interest in science of the total sample (table 1) holds true for the 25th percentile, median score, and 75th percentile score as well. Interest in physical sciences declines as girls go up from upper primary school to higher secondary school through high school.

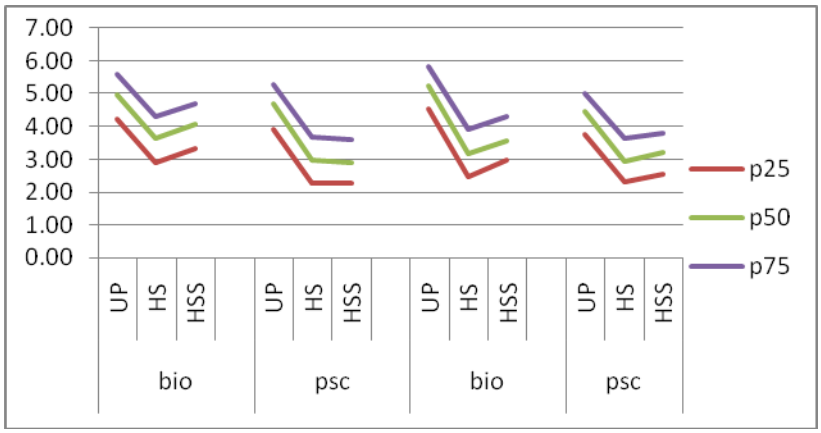

Figure 2: Difference in extent of interest in biological and physical science topics of upper primary, secondary and higher secondary levels

Interest in biology, chemistry and physics topics among boys and girls

Table 3: *Mean interest in biology, chemistry and physics topics among boys and girls at upper primary, high, and higher secondary levels*

	girls		boys	
	UP	HSS	UP	HSS
Chemistry	3.99	2.66	4.20	2.55
Physics	4.57	2.75	3.92	3.25
Biology	4.80	3.99	5.06	3.62

Table 3 and Figure 3 show that as the girls move from upper primary to higher secondary level disparity between their interest in biological and physical sciences becomes clear cut. By higher secondary level, chemistry is the least liked science subject among both boys and girls, but girls like physics only as much as chemistry; while boys prefer physics much more than chemistry.

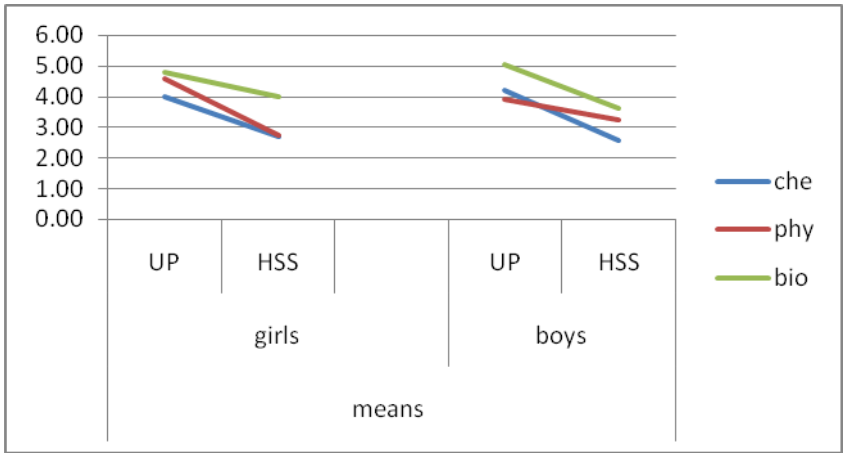

Figure 3: Difference in extent of interest in biology, physics and chemistry topics of upper primary, secondary and higher secondary levels

Conclusion and suggestions

Boys, more than girls, wanted to know more about physics topics whereas girls' interests lay more in the biological sciences; younger students expressed more positive attitudes toward science than did older students (Greenfield, 1997). Decline in interest in science is evident as the students, especially girls, get older. Declining interest in science of girl children cannot be wished away. Waning interest in science of girls will impact on the future workforce which include future teachers, who may fall short of the qualifications and background needed to enthuse the next generation, especially in physical science students. Differences between the genders in science interests and choices are much more subtle and complex than simple 'boys are better than girls'. Halpern et al, (2007b) also observed that girls particularly as they move out of elementary school and into middle and high school and beyond, often underestimate their abilities in science.

Not all girls have less confidence and interest in science, or any of its branches-physics, chemistry or biology. Pupils have comparatively more interest in biology. Interest in biology is due to pupils' desire to know about themselves and their surroundings. Physics can never remain behind in modern world, as it is the basis for many popular professional courses like engineering and computer applications. Pupils consider chemistry as something that happens in the labs. Topics like acids, recycling of waste, fertilizers, etc. may give the idea that these are 'jobs' to be done in factories alone thereby reducing their appeal. Boys are more interested in physics. This finding also has support of previous researches (Tsabari & Yarden, 2005; Christidou, 2006). Physics topics deal with abstract concepts that appeal girls less (Tsabari & Yarden, 2005). Moreover, experience has an influence on interest (Johnson, 1987; Sjoberg, 2000; Gafoor & Smitha, 2010). Influence of teachers cannot be ruled out as students of teachers with high interest in the specific fields - biology, chemistry and physics- had significantly higher interest in biology, chemistry and physics respectively (Gafoor, 2009).

'Merit' or 'competence' is largely a product of the opportunities made available to a person (Bulunuz & Jarrett, 2010). Gender gap that begins early in life can become magnified under the influence of both home and

school factors to impose limits on women's academic and career choices later in life (Greenfield, 1997). The out-of-school experiences available to our children, and those chosen by them from what is available to them, are expressions of the values and attitudes of their parents and other significant adults including teachers. The school may be a place where students can encounter values and attitudes suiting science; but schools are not yet equipped to free from gender bias entrenched in the social milieu. As elsewhere, in local settings too, link between positive background experiences with science and the development of interest in science is clear-cut (Gafoor & Smitha, 2010).

Making children realize that chemistry is something that is going on all around and within us will help them see its significance, that the very essence of biology rests on chemical reactions would help them appreciate the significance and utility of chemistry in our lives to develop interest in it. As interest develops very early in life and influence their future choices, monitoring it should begin from primary school itself. Leaving it unnoticed in the developing stages is detrimental as, it would be quite difficult to make people appreciate science. Identifying pupils' diverse interests helps to nurture interest as well as find innovative means to make those fields of science in which they lack interest appealing.

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