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# The Relevance of Science Education ( ROSE) Project - Preliminary Report from Malaysia

## Malaysian Students' Interests in Learning Science and Technological Topics

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## Background & Research questions

Falling recruitment and interests in Science and Technological (S&T) studies and careers has been observed in many countries. *The lack of relevance* of the S&T curriculum has been identified as one of the greatest barriers for good learning as well as stimulating interests in the subject. IEA and PISA studies tended to focus mostly on achievements. This prompted the initiation of an international comparative project *ROSE, The Relevance of Science Education* (Sjøberg & Schreiner, 2004) to gain insights into issues that relate to the relevance of the contents and contexts of S&T curricula from the perspectives of the learner. ROSE is a cross-cultural comparative project on young peoples' views and perceptions, attitudes, values, interests, plans, priorities related to science and technology. Researchers from countries around the world were invited to participate in this joint study. Over 40 countries , including Malaysia have joined the project. This paper reports on the results of the Malaysian survey on what S&T issues or topics pupils are interested or not interested in learning*.

### Methods and Sample

The survey methodology was used in this study. The Malaysian target population was the cohort of pupils who had just entered grade 10. A stratified sampling strategy based on 5 geographical regions was adopted. The first sampling unit was the school. Using a list of schools by regions, one urban school and one rural school were each drawn. A sample of 12 schools that possess the essential national characteristics were selected. The number of grade 10 classes in these 12 schools varied from 3 to 7. The teacher who was appointed research assistant carried out a second random sampling routine to select a number of classes for the survey using the criteria: select all the classes for schools with 4 grade 10 classes or less, otherwise randomly select a sample of 4 or 5 classes but making sure that both science and non-science tracks were represented. The final student sample derived from these classes consisted of 1544 pupils, 735 of whom were girls (48%) and 809 were boys (52%).

The ROSE questionnaire contained, among others, 108 topics or issues drawn from S&T contents as they often occur in various contexts in S&T curricula, textbooks, and journals. Pupils were asked to express how *interested* they were in learning these topics using a Likert scale of *1 (Not interested)* to *5 (Very interested)*.

The ROSE questionnaires were distributed to the teacher for administration over two teaching periods in mid-June 2004. Also enclosed were pre-paid and addressed envelopes for the return of the questionnaires to the researcher. Specific instructions for conducting the survey were also attached. By August 2004, all 12 schools had conducted the survey and returned the questionnaires.

## Data analysis and Findings

The data was analyzed using <SPSS for Window> version 11.0.

Generally speaking, Malaysian students were interested in learning most of the topics or issues listed. Of the 108 items, a large majority (94% or 101 items) were rated above the interested-not interested divide. Of these, 18 items were rated as very interested, and 83 items were rated as quited interested. Only 7 items were rated as not so interested. None was rated as not interested (at all).

To search for patterns in the answers to the surveyed items, exploratory factor analyses were carried out to classify items into common underlying dimensions or factors. Seperate factor analysis across gender grouping were initially

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* Other sections of the study include students' attitudes toward environment issues, the role and function of science and technology in society, perceptions of future priorities in their future job, perceptions of school science classes and science education, and out-of-school experiences in S&T are given in the Appendix

performed, and the factor structures for the boys and the girls were essentially similar, suggesting that the underlying factor structures derived from the factor analysis of the combined sample were meaningful and homogenous.

Of the 90 items that were rated above the interested-not interested divide, 21 factors with eigenvalues greater than 1 were extracted, explaining 64% of the total variance. The Measure of Sampling Adequacy (MSA) indice for the factor analysis was 0.923, which was excellent. Of these 15 meningful factors were discernabale:

| Factors which student expressed very high interest | **Gender Difference** |
|---|---|
| 1. ***Astrophysics*** *(9 items covering* life outside earth, outer space, meteors, comets or asteroids, moon landing, space exploration, black holes, supernovas, stars, planets, the universe, rockets, satellites, space travel; astrology & horoscopes) | Girls > Boys |
| 2. ***New Technologies*** (*5 items covering* computers, mobile phones, cassette tapes, CDs & DVDs, laser technonogy) | Boys > Girls |
| 3. ***Spectacular phenomena & inventions*** (*4 items covering* unexplained phenomena, recent S&T inventions & discoveries, weightless in space) | *No Difference* |
| **Factors which student expressed interest only** | **Gender Difference** |
| 4. ***Health, improvement of living conditions and Protection*** (*11 items covering* clean air, safe drinking water, medicinal use of plants, endangered species, waste, garbage and sewage, detergents and soaps, food production, conservation & storage, alternative therapies, food additives, improving harvest, organic & ecological farming). | Girls > Boys |
| 5. ***Explosives & weapons*** (*6 items covering* atom bomb, biological and chemical weapons, effect of strong electric shocks & lightning, explosive chemicals, nuclear power plant, radioactivity) | Boys > Girls |
| 6. ***Human biology, sex, reproduction and genetics*** (*9 items covering* growth & maturity, Sex & reproduction, human body, heredity & genes, gene technology & diseases prevention, animal cloning, birth control & contraception, biological & human aspects of abortion) | Girls > Boys |
| 7. ***Drugs and Diseases*** (*6 items covering* first-aids, sexually transmitted diseases, cancer, HIV/AIDS, alcohol & tobacco, narcotics) | Girls > Boys |
| 8. ***Natural phenomena: Light, Sound, and optics*** (*7 items covering* star twinkle, sky blue, rainbow, sunset, light & colours, ozone layer, ear & hearing, greenhouse effect) | Girls > Boys |
| 9. ***Science & Religion*** (*5 items covering* religion-science conflict, blunders & mistakes in research & inventions, why scientists sometimes disagree, famous scientists) | Girls > Boys |
| 10. ***Biology*** (*8 items covering* dinosaurs, animals, using colours to hide, attract or scare, brutal, dangerous & threatening animals, deadly poisons, poisonous plants, plants growth & reproduction) | Girls > Boys |
| 11. ***Health & Beauty*** (*4 items covering* exercise to keep th fit, eating & health, lotions & creams to keep the skin young, effect of radiation & sun on the skin) | Girls > Boys |
| 12. ***Electricity & Energy*** (*5 items covering* energy conservation & use, new sources of energy, electricity production, everyday electrical/mechanical equipment, electricity & the development of society) | Boys > Girls |
| 13. ***Earth Science*** (*4 items covering* the origin & evolution of life on earth, clouds, rain & the weather, development of mountains, rivers & oceans, inside of the earth) | *No Difference* |
| 14. ***Quasi-science*** (*4 items covering* dreams, life, death & the human soul, thought transference, mind-reading, sixth sense, ghosts & witches) | Girls > Boys |
| 15. ***Mechanisms & Scientific explanation*** (*4 items covering* mechanism of optical instruments, X-rays & ultrasound in medicine, dependency of plants, animals, & the environment, chemicalproperties & reactions) | Girls > Boys |
| The remaining *10 items* which include epidemics & diseases, tornados, hurricanes, cyclones, earthquakes & volcanoes, unseen light (infrared, ultraviolet), navigation by the stars, sound, noise & hearing damage, radiation dangers of mobile phones & computers, musical instruments & sound production, properties of gems & crystals for beauty) were loaded either singly or in pairs on the 6 remaining factors. | Girls > Boys |

**> implies more interested**

Gender differences were observed in all these factors except ***Earth Science*** and ***Spectacular phenomena & inventions***. Most of differences were in the direction favouring the girls except for ***New Technologies, Explosives & weapons*** and ***Electricity & Energy***. Thus, girls showed greater interests than boys in learning most of the S&T issues or topics listed.

The 7 items that were rated as not so interested include topics on petrol & diesel engines, crude oil, hazards of modern farming methods, atoms & molecules, eating disorders, plastic & cosmetic surgery, symmetries & patterns in leaves and flowers. Again gender difference were in the direction favouring the girls for most of these items. Thus, boys showed less interests than girls in learning most of these topics

**Conclusions and Implications**

The results revealed that the attitudes and interests of Malaysian secondary students towards S&T related issues and topics were mostly very positive, and ranked among the top few nations participating in the study (Schreiner & Sjoberg, 2004). As for gender divide, the significant trend in favour of the female Malaysian ssecondary students is consistent with the fact that female Malaysian secondary school students tend to perform significantly better than males students, and that proportionally more female to male students are entering tertiary level education,with the traditionally male dominant S&T university courses gradually moving in the girls' favour. The trend shows marked contrast with many nations, notably the West, where many developed countries face the problems of attracting more students to study science and pursue science-related careers and increasing divides along gender has been the common woe.

**References**


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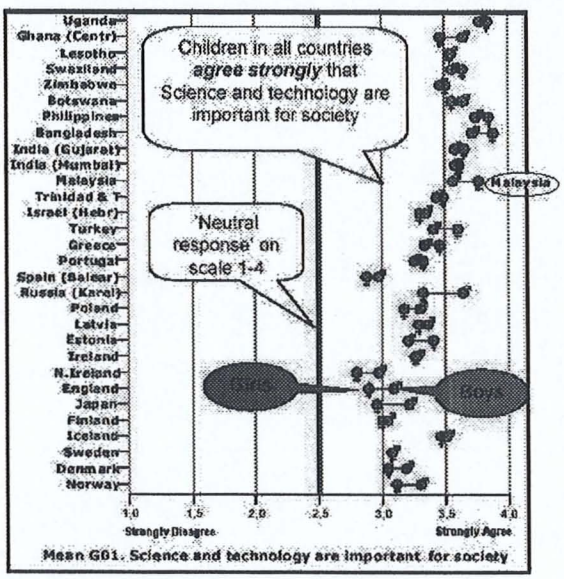
Appendix

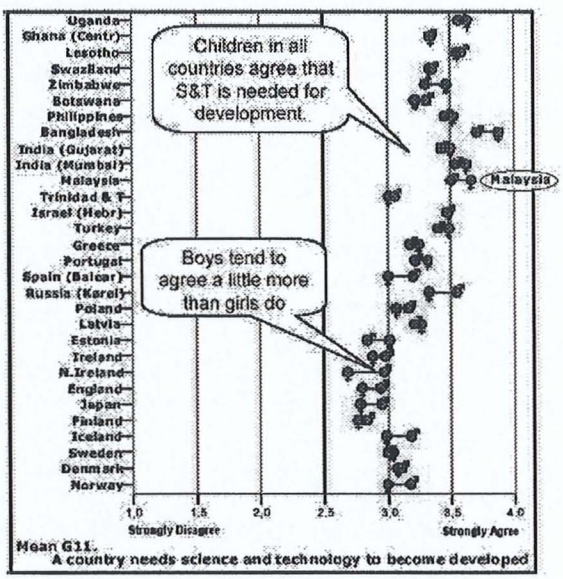
## International Comparative Results on Pupils' Views, Perceptions, Attitudes, and Interests related to Science and Technology: Some Selected Items

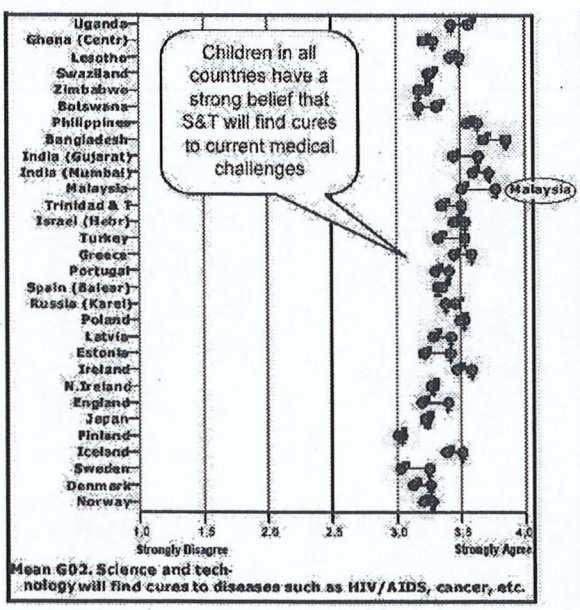
(a) *My opinions about science and technology* - Items that probe different aspects of how the pupils perceive the role and function of science and technology in society

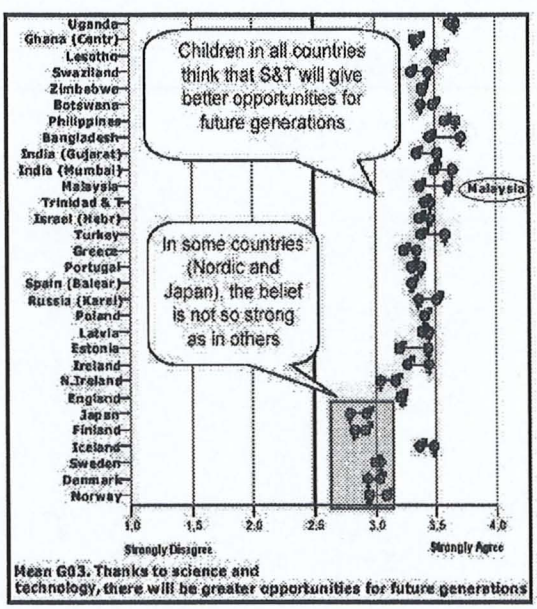
The results indicate that, generally, students in all countries show positive attitudes toward science and technology, especially its importance for society. The most positive attitudes are shown by students from developing countries, especially those from Africa. Malaysian students' attitude were fairly high - ranked between the African countries and the European countries.

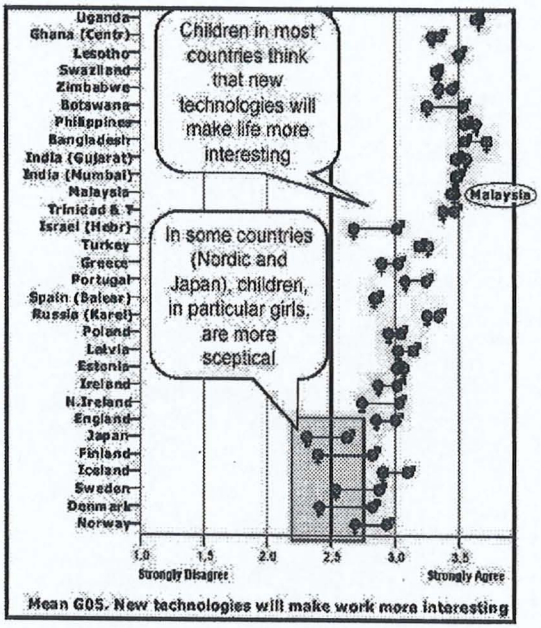
As for gender differences, Malaysian girls tend to be more positive in their attitudes towards S&T than boys, though the trend is somewhat reverse for students in some European (especially the Nordic) countries and Japan

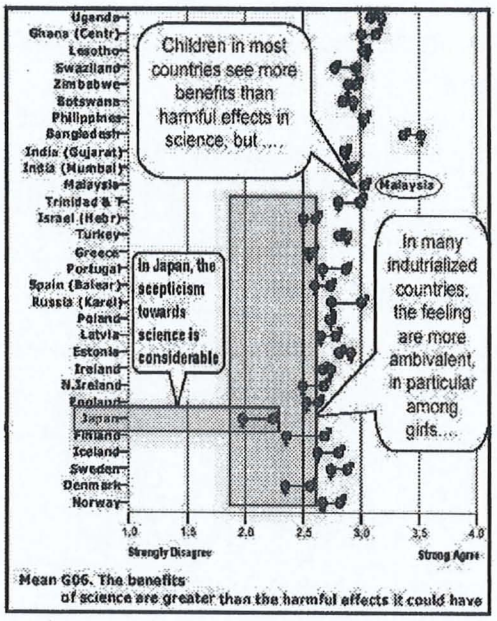


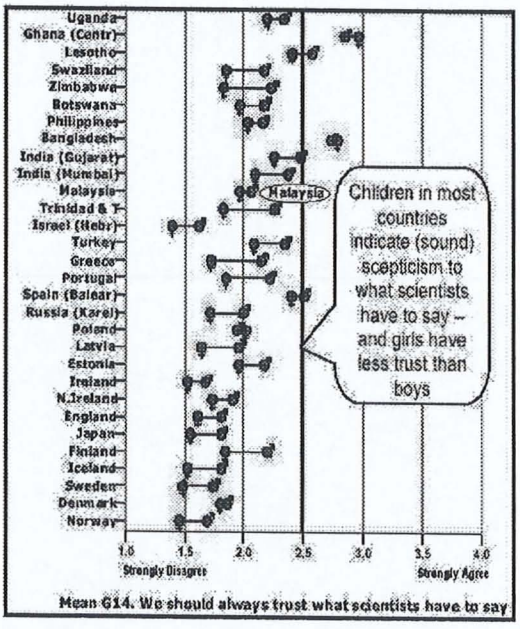



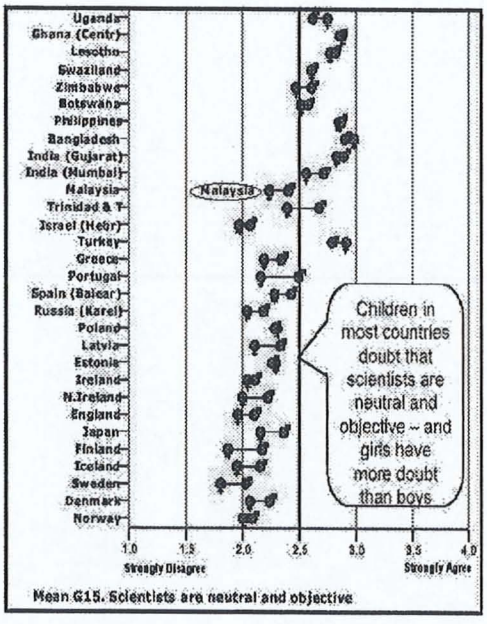



In many issues (e.g. the benefits od science are greater than the harmful effects it could have; we should always trust what scientists have to say,; or science are neutral and objective), however, while students in most developing countries show positive attitudes toward some science and technology issues, the students from the developed countries like Japan and many European countries are either ambivalence or even sceptical in their attitudes.

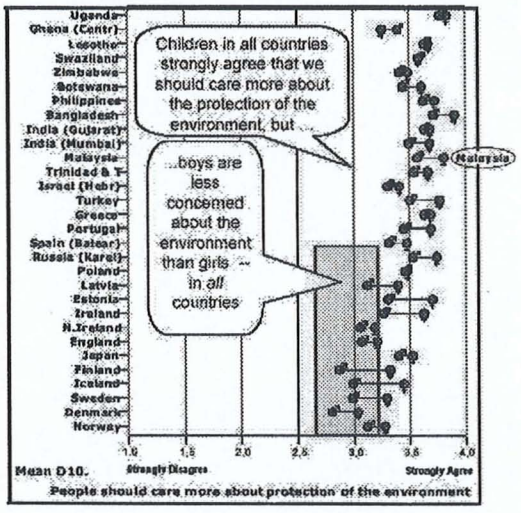
As for gender differences, the girls tend to be more sceptical in their attitudes towards these issues than boys in most countries.

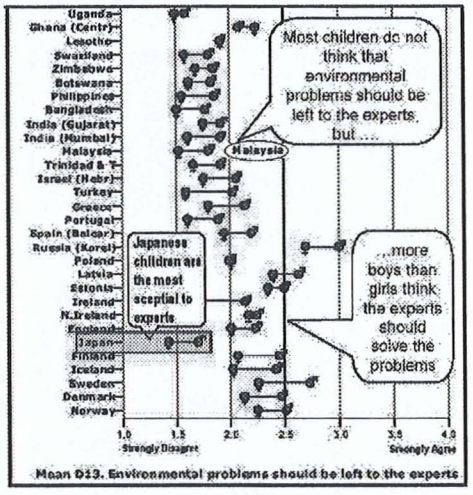


(b) *Me and the environment* - Items that seek to explore how pupils feel about issues related to the environment

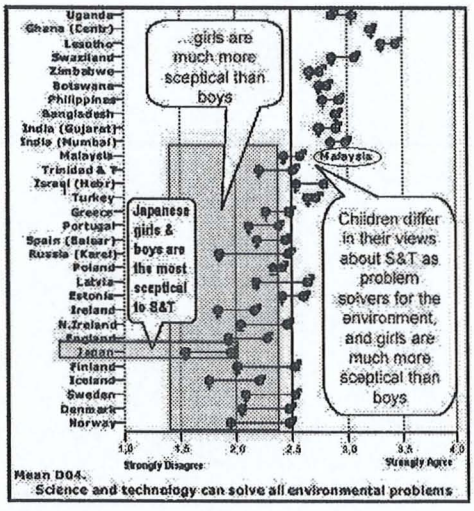
In generally, students in most countries express strong agreement that people should care more about the protection of the environment. However, they disgree that environmental problem should be left to the experts. Students from the developing and developed countries differ in the opinion that




Students from the developing and developed countries, however, differ in the opinion that science and technology cam solve all environmental problems. While students from the developing countries generally agree with the statement, the students in the developed countries, especially Japa are very sceptical.

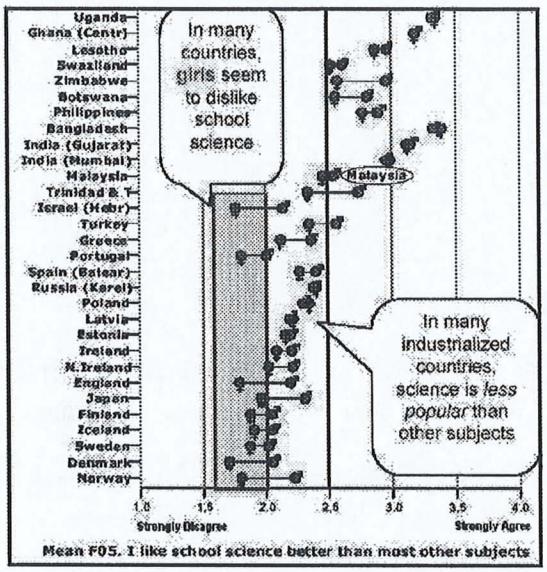
As for gender differences, the girls tend to be more sceptical in their attitudes towards these issues than boys in most countries.

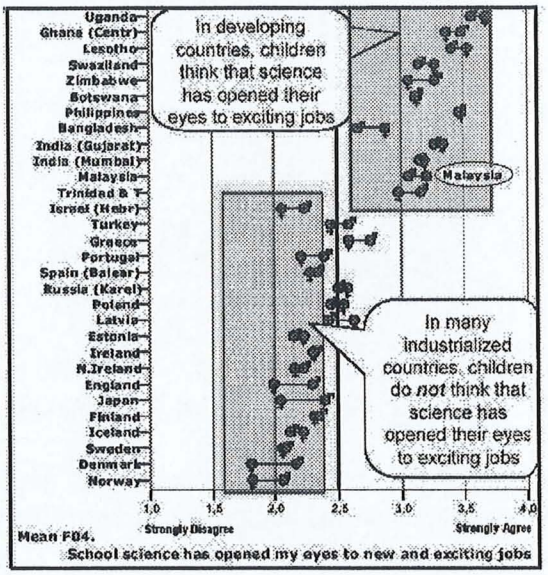


(c) *My science classes* - Items that provide information about different aspects of the pupils' perception of their science classes, like their motivation for science at school, their self-confidence in their own abilities in science at school, what they get out of science at school, their perceptions of the necessity of science education etc.

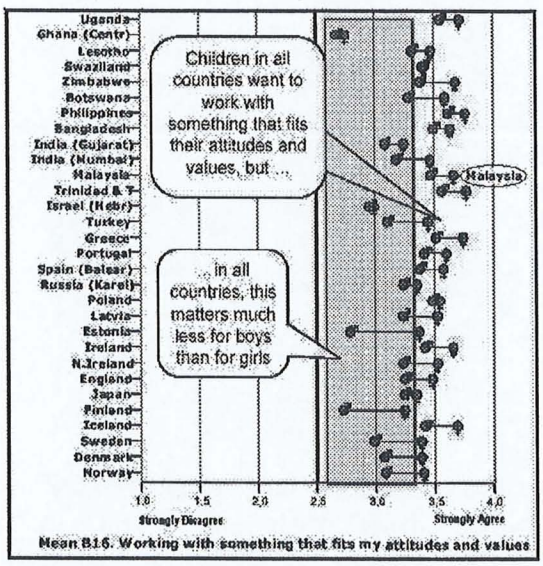
Students from the developing and developed countries differ in the opinion about school science. While students from the developing countries generally perceive that they like school science better than most other subjects, and that school science has opened their eyes to new and exciting jobs, the students in the developed countries expressed the reverse trend.

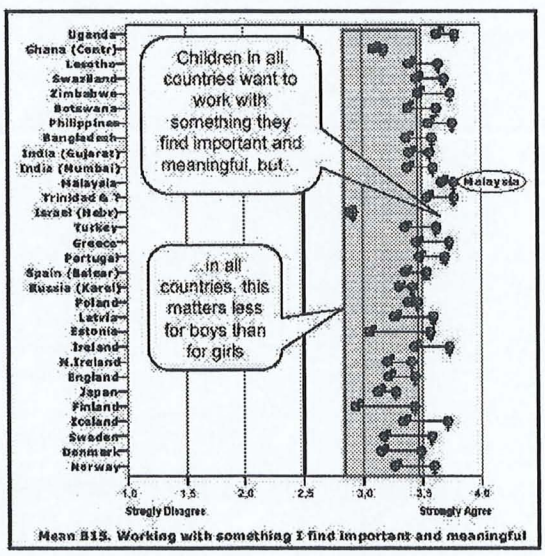
As for gender differences, the girls tend to be more sceptical in their perceptions of school science than boys in most countries.



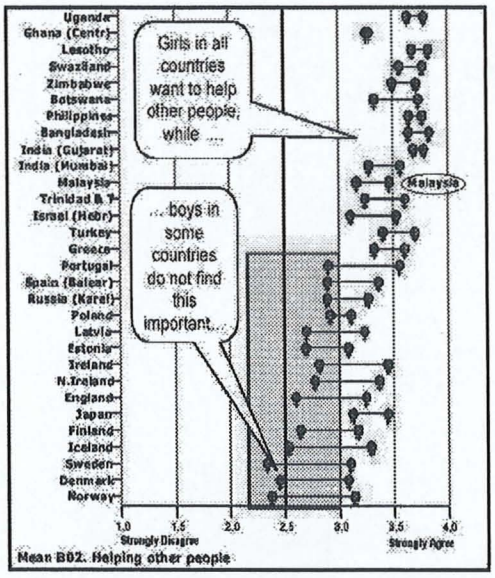

(d) *My future job* - Items that provide information about the future priorities and motivations of the pupils

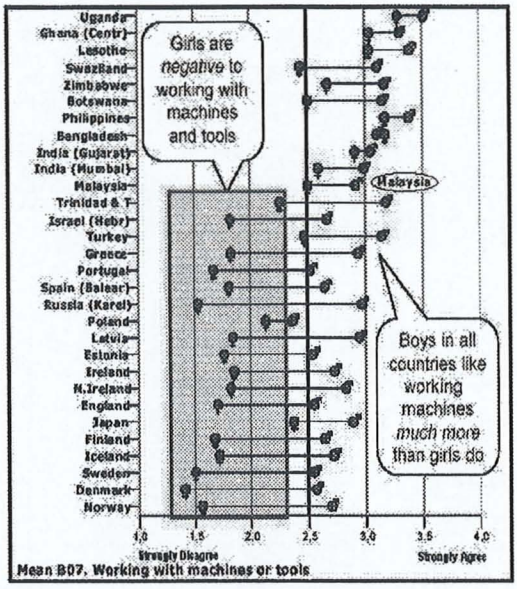


As for future jobs, students in all countries want to work with something that is important and meaningful, and that fits their attitudes and values.

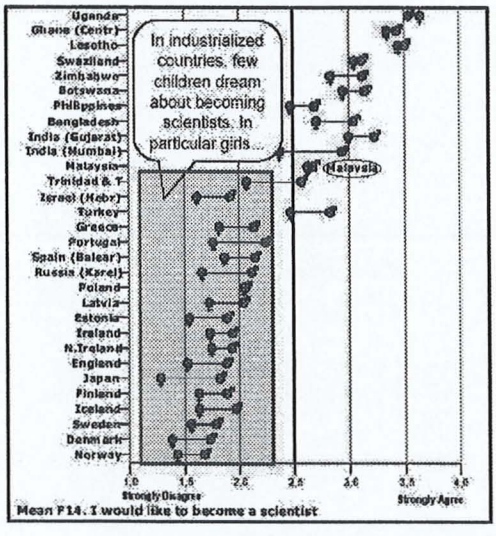
As for gender difference, this matter less for boys than girls.

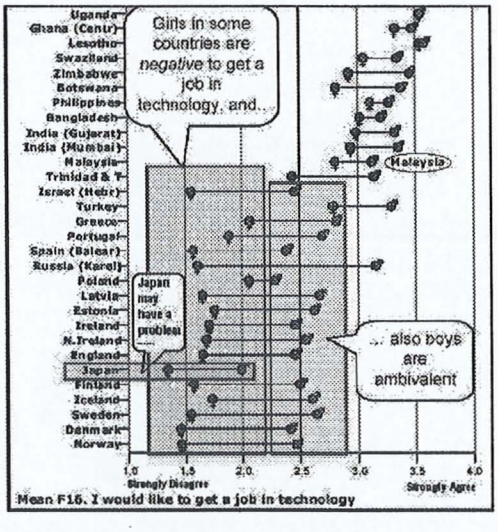



Students in all countries generally want to help other people though girls generally express stronger intents that boys. Boys in some western countries do not find this important.

As for working with machine and tools, wide gender differences are observed. Boys in all countries like working with machine and tools much more than girls.




In the industrialised countries, few students like to become a scientist, in particular girls. In particular, girls do not like to get a job in technology while the boys are ambivalence in their choice. On the other hand, students in the developing countries do like to become a scientist or get a job in technology.