'Science Education for Them is to See its Relevance to the World Around Them'

by Kanan K Purkayastha and Dr J M B Kearsey

BERTRAND Russell, in his book *On Education*, mentioned that before considering how to educate, it is well to be clear as to the sort of result which we wish to achieve. One must have some concept of the kind of person one wishes to produce, before one can have any definite opinion as to the education which one considers to be the best. We consider that Russell's observation is particularly appropriate in situations where resources are scarce and where the expectations placed on the results of education are high. Consequently, we decided to revisit the purpose of scientific literacy and science education in the contexts of developing countries like Bangladesh. This essay addresses three main issues. First, what is scientific literacy? Secondly, what is the relationship between scientific literacy and science education? Thirdly, what implications do the relationship between scientific literacy and science education have for the development and implementation of effective education policy in a country like Bangladesh?

Public Understanding of Science

The renowned physicist Richard Feynman in his book *The Meaning of It All* mentioned that *science* sometimes refers to a special method of finding things out. Sometimes it means the body of knowledge arising from the things found out. Sometimes 'the new things you can do when you have found something out or the actual doing of new things'. He also mentioned that, as a consequence of science, one has a power to do things and power to do something of value. We consider that Feynman's power of science is related to the scientific literacy issue.

According to the American Association for the Advancement of Science report, *Science for All Americans* (1989), the scientifically literate person is: '...one who is aware that science, mathematics, and technology are interdependent human enterprises with strengths and limitations; understands key concepts and principles of science; is familiar with the natural world and recognizes both its diversity and unity; and uses scientific knowledge and scientific ways of thinking for individual and social purposes.'

According to The Oxford English Dictionary, to be literate is to be 'acquainted with letters; educated, learned'. One who is literate is 'a liberally educated or learned person'. We consider that literacy involved more than the ability to read and write. A literate person commands a certain measure of learning as well. A liberal education should include education for citizenship. When considered in this way, the term 'literacy' takes on wider connotations of active and effective participation in society. Thomas and Durrant, in their article on the *Public Understanding of Science* published in 1987, suggested that to be scientifically literate is not to be expert in anything in particular. It is rather to be able to deal effectively with matters scientific as they arise in the course of life. Hence they raise questions about the relationship between scientific 'capability' and scientific 'literacy'. In our opinion, these power and capability issues are related to the knowledge and skill dimensions of scientific literacy.

One might argue that scientific literacy is the synthesis of attitude, skill, knowledge, and participation. One could also argue that scientific literacy is a combination of practical scientific literacy, civic scientific literacy, and cultural scientific literacy.

This argument seems to one as an exogenous approach, that is a process of imposing scientific values from outside. This kind of approach may end up with some kind of cultural clash. That means society's existing values may not accept the new scientific values. However, one could also approach scientific literacy using an indigenous viewpoint. That means improvement of scientific literacy in a society using society's existing cultural values. In the Vienna Programme of Action on Science and Technology, 1979, it was mentioned that developing countries 'must develop their own capacity to evaluate, import, absorb and improve upon, those aspects of the science and technology knowledge accumulated in developed countries that would be suitable and would contribute to their autonomous development'.

This suggests that in order to improve scientific literacy in a developing country, one should consider its own capacity and suitability. That is ability of the people to cope with scientific issues, basic literacy and their aptitude, need for science and technology in a society, society's basic need etc.

Now, the question may arise, "Why scientific literacy for the public?. If one considers some science related issues that the public will have to make decisions on it in near future, by far most urgent concerns in developing countries like Bangladesh surround the development of nuclear weapons. The allocation of resources to science education related to defence or environmental issues which is related to existing culture or value of a society, is important. This situation demands a well-informed public.

Science is carried out, by groups of people, for groups of people. The outcomes of science are used by communities. It follows that science is a social activity. As social activity needs participation, so some level of knowledge on scientific issues is essential. Those citizens who are not scientifically literate are debarred from these social activities. Science and technology are not outside influences applied to development. Science and technology are essential aspects of development. In the same way as one does not apply one's lungs to respiration, nor one's heart to the circulation of blood nor one's legs to walking.

Technology is related to the application of science. Ordinary people have various concerns about the application of science through technology.

It is quite clear that the application of science through technology has an important impact on ordinary people's lives in developing countries such as Bangladesh. Scientific literacy should be an important aspect of the education of these people if they are to be fully equipped to be active participants in a democratic society.

One might conclude from this discussion that scientific literacy should be the happy blending of 'What is best for the society?' and 'What is already existed in a society?'. Now the question may be asked whether developing countries need a synthesis of these two things or whether the two things complement one another. A consideration of these questions leads one to ask whether the new scientific literacy requires a different form of science education to that which serves to increase the number of technical and scientific workers.

In Bangladesh, the demands for scientifically literate society emerge from both socialistic and nationalistic approach. On the one hand, science for development of awareness (Bangladesh Education Commission Report, 1974), on the other hand, science for application-oriented society (National Education Commission Report, 1988). One approach recognises the 'attitude', 'knowledge' and 'participatory' dimension of scientific literacy, the other recognises the 'attitude' and 'skill' dimension of scientific literacy. If one considers socio-economic aspirations, the normative dimension of scientific literacy is to maximise benefit to cost ratio, relevance, productivity and adaptability.

Therefore, scientific literacy in the context of Bangladesh would be the synthesis of attitudes that permit people to respond actively and effectively. People also need the skills that are necessary to interpret new developments in science and technology. They also need some basic knowledge of science and technology particularly in the context of their own lives and participatory notion to apply this literacy. This process of synthesis should recognise 'what is best for them' and 'what is already existed there' approach. Then it would be possible for the ordinary citizens to see the relevance of scientific principles to the world around them.

Science Education

Ordinary Bangladeshis need enough of a scientific background to make informed decisions on subjects involved in their day-to-day life. Stephen Hawking's answer to resolving this issue in his book, *Black Holes and Baby Universe and Other Essays*, is 'clearly, the basis must lie in what is taught in schools'. He also mentions that school science is often presented in a dry and uninteresting manner. Children learn it for passing examination without thinking about its relevance. Possibly, it was for this reason that Feynman, in his book *The Meaning of It All*, mentioned that science teachers should teach people how to think, how to think about things, how to understand things.

Conclusion

An attempt was made to show how the notions of scientific literacy could be related to scientific literacy as a goal of science education in Bangladesh. We have also raised some issues concerning the definition of scientific literacy and its practicality. Scientific literacy and science education issues impinge on policy reform. Such reforms may concern curriculum policy or may involve the structure of organisation of schools. One important aspect of education policy reform in this area is where to start, at the beginning, the end or the middle (16+ age) part of education system.

We favour the 16+ restructuring approach in order to get the immediate benefit, because in the existing educational management system in Bangladesh, there are availability of optional route in the 16+ level. One major immediate impact is that after higher secondary level when one becomes a teacher in primary level, then we could get a teacher who is scientifically literate. There are some other benefits too. As for example, if we strengthen polytechnic education, which is also 16+ level, then it might be possible to get skilled work force which is another important dimension of scientific literacy. So by minimising the incompatibility of student aspiration with state direction by restructuring the education system, it could be possible to improve scientific literacy as well as serve people through education in a better way.

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A 'Netted' Market in the Offing

by Mir Lutful Kabir Saadi

INNOVATION of the Internet has greatly modified the communications scenario of the world, especially for the media. Electronics and print media witnesses has tremendous success within the last one decade. This technology is helping the media to flourish further.

Today's communication technology has progressed to the point where "any technology which is sufficiently advanced, is indistinguishable from magic." When you get an e-mail, you do not think about what networking hurdles had to be overcome to get the sender's information on your laptop or PC. The computer is now a communication device, enabled by the high-speed modem standard on nearly every new PC.

Over the last 20 years, the number of countries with Internet connections has increased from about half a dozen to over 170. Growth rates for the number of hosts and users have been around 100 per cent annually for a decade. Although this extraordinary diffusion has been truly global, it has not been uniform. A few large areas have been slow to acquire or adopt this technology, including many poor countries in sub-Saharan Africa and small island states in the Southwest Pacific.

In terms of population, wealth and geography, the most striking under-representation in this "Interneted" world is the 51 members of the Organisation of the Islamic Conference (OIC). In late 1993, 15,000 nets comprised the global Internet. The OIC total was 42, with 29 in Turkey and Indonesia. Even within the OIC, among the slowest to join the world's Internet community have been the nations of the Persian Gulf i.e., Bahrain, Qatar, Iran, Iraq, Saudi Arabia, Kuwait, Qatar, the UAE and Oman. But fortunately being a least developed country, Bangladesh was lucky enough to join the Internet community in the early '90s. Now the question is why was there so little of the Internet in this part of the world for so long and what has brought about its acceptance in so many countries in a short time?

Nevertheless, acceptance of the Internet in this part of the world still remains limited. With approximately 2.5 per cent of the world's population and a much greater fraction of its wealth, the Persian Gulf countries today have less than 0.04 per cent of the Internet hosts.

The Internet, an information superhighway, is revolutionising the ways in which products and services are marketed to customers. Its impact is rapidly transcending the traditional distribution channel functions, providing access to geographically diverse communities and customer groups. Instantaneous exchange of up-to-dates about products, services and market transaction is facilitated, as well as efficient collection of information about customer communities with specific needs, interests and demographics.

The world of marketing is continually evolving. New technologies create new and innovative means of interacting with customers. The web has created a new revolution in marketing providing much more than just a new medium through which organisations can communicate with the public. The Internet is becoming the world's largest public electronic marketplace. It is estimated to reach 50 million people world-wide, with growth estimates averaging approximately 10 per cent per month. Innovative business professionals have discovered that the Internet can be exploited to offer a number of services both for their customers and for their strategic partners. Consumers are able to shop from their homes for a wide variety of products from manufactures and retailers all over the world.

With the rapid increase in the number of on-line users, there are two distinct types of marketers who are moving rapidly capitalising on this growth. The first type are companies, both established and start-ups, that are setting up their web presence in order to leverage their new channels to gain competitive advantages in marketing products and services. The second type are companies that generate, collect processes, and market information about transactions and customers in direct markets, both 'virtual' and 'real'.

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Feminisation of Poverty in Bangladesh

Appropriate Alleviation Measures Needed

by Rashida Sultana Shumi

Crisis coping capacity : Physical burden of coping with any disaster or crisis falls on women more than men. During any disaster like flood women have the gender assigned role like gathering fuel, wood and taking care of children, old and sick members of the family. In crisis period a poor woman sacrifices her meal for children and husband.

POVERTY is lack of certain basic capabilities of the human beings — capability to live a healthy active life, free of avoidable morbidity and premature mortality, capability to live in dignity with adequate clothing, shelter and education. However, poverty in Bangladesh can be viewed both as i) a status as well as ii) a process.

The status perspective of poverty is by definition static and descriptive of the status of the poor. So from this perspective, poverty manifests itself in low income leading to a) inadequate food intake, b) disease prevalence, c) short life expectancy.

The process perspective of poverty is dynamic and deals essentially with the factors that generate poverty. Viewed from this perspective poverty in Bangladesh is generated by the factors like : a) low productivity, b) unemployment and under employment, c) low wages, d) low literacy compounded with inadequate access to education, and e) unequal gender participation in economic decision-making.

From the process perspective the causes of poverty appear as not simply a question of entitlement but also of structurally reproduced distributional inequalities. There is an extensive class analysis of impoverishment and polarisation in rural Bangladesh. (Hossain 1987, North-South Institute 1985).

To understand poverty two approaches are used :

a) Unidimensional approach: It views poverty simply as a matter of income deprivation or nutritional deprivation.

b) Multi-dimensional approach : It considers degradation of quality of life.

The indicators of multi-dimensional approach are:

1. Nutritional deprivation, 2. Health and sanitation, 3. Security, 4. Access to state distribution system, 5. Institutional capability, 6. Crisis coping capacity.

Poverty in Bangladesh has received much attention from renowned economists, social scientists and policy makers. There are good numbers of work on poverty in Bangladesh. But there is not much analysis or works on gender based forms of disenfranchisement and poverty. The fact that women often experience poverty differently from men and that men dispose their labour in a variety of ways and are able to engage in verity of income earning activities are not captured in these citation. Women's labour power is very often constrained by *purdah* and they cannot put efforts in income earning activities. Thus they have no entitlement in social product and access to decision-making.

The gender dimension of poverty therefore occurs because women and men experience poverty differently and unequally. Absolute poverty level in Bangladesh suggests that it is also a critical area in which to locate and understand female poverty. Gender diminution of poverty in rural Bangladesh in terms to degradation of quality of life can be analysised as the following :

Nutritional deprivation : All human beings have a pre-determined minimum level of nutritional requirement . But most women in Bangladesh are not able to fulfil it. Very few women and girl child consume an adequate quantity and quality of food. Thus most of the women in rural Bangladesh suffer from long-term malnutrition.

There are also flaws in the estimation of minimum level of nutritional requirement of women. One of the problems with this is that estimates of minimum requirement which rely, among other things, on body weight and activity levels in case of women is unreliable and tends to reproduce past nutritional discrimination. Pregnant and lactating women have higher calorie requirements. Most of the pregnant women in Bangladesh cannot fulfil their minimum calorie requirements. As a result they suffer from severe malnutrition which increases the risk of morbidity and mortality.

Though the main reason for widespread malnutrition is simply that people do not have enough food, but gender relationship and economic factors are main reasons for female malnutrition. In the narrowest sense of basic needs, women suffer deprivation to a great extent than men within the household.

But women's contributions in arranging food in rural areas are immense. Poor women glean the fields after harvest, gather edible wild plants, fuel, fodder from common property reserves, even beg or borrow rice from neighbour. But she takes the lowest amount of food after satisfying her husband's and children's hunger.

Sometimes she provides labour to wealthier household and receives meals as part of her wages to share with her children. Most of the poor women in Bangladesh take meals of only rice with salt, water in which it is cooked and cheap vegetables like *bon kacku* (wild arum) etc. The poor can hardly afford more than two meals a day, the women in those family make do with one.

If a poor woman in rural area has a pair of hens and/or a cow or goat, she never eats the egg or drinks milk from them. Either at are sold or given to the male members of the family.

The custom of giving male members the choicest and largest servings of food and gender differences in agricultural labour wage and pattern of remuneration lead to more frequent meals for male members compared to female members.

Another major reason for malnutrition of women in Bangladesh is the super imposition of early, frequent and closely spaced child bearing on already high levels of malnutrition.

The sex role and socialisation process inculcate some ideologies in women which make them altruistic sacrificing as well the part of the poorest portion of the society. Women in rural areas believe that "a good wife is one who makes sure her husband has enough to eat. If a woman eats before her husband, she shortens his life. All these prevalent dogmas are responsible for feminisation of poverty.

Insufficient access to health care : There is discrimination in access to health care. When a boy gets afflicted with any disease he receives more attention and better possible health facilities for treatment than a girl child in that position.

In rural Bangladesh when a woman conceives it is a normal event but it can have fatal consequences due to malnutrition and lack of access to health care. Maternal mortality here is among the highest in the world (around five to seven per thousand live births) and accounts for nearly a third of deaths among women in their reproductive years (Chen et. Al. 1974).

Maternal mortality rates are highest among poor women : A poor woman, when she gives birth to a baby, is hardly under doctor's care even in case of emergency like cesarean. Then she does not have any option but to accept death. Due to insufficient access in healthcare poor women often cannot give birth to a live or healthy child. Again these women are always under pressure to undergo a succession of closely-spaced birth, which make them anemic and lethargic.

Most of the women in rural areas do not report their illness. Illness appear to be a normal rather than an exceptional event for women. They suffer from some common diseases like anemia, low back pain, uterus infection, but they do not report, thus their illness is not recognised.

A study on health-related behaviour in village households noted that men, particularly heads of household, were most likely to report on their own illness (UBNIG, 1987). Women themselves ignore their own ill-health and see it as their duty to continue to work as long as they are physically able to.

Personal insecurity : Another major problem with the poor women is personal insecurity. Vulnerability along with deprivation is common feature of poor women in Bangladesh. Gender-based forms of vulnerability affect women very much. In villages and in urban areas poor women become the victim of sexual harassment and assault. Sometimes landless poor women are tortured and beaten by their powerful neighbours on issues like simple trespassing of her pets (goat, cow hen etc.) into the latter's fields.

Women have to stay with their violent husbands or even put up with sexual abuse from the employers because they offer option for their livelihood. Orphan girls and widows are made deprived from their property. Another tool of oppression of women is dowry. When poor women cannot fulfil the demand of dowry then she is tortured by her husband and other members of her husband's family. Sometimes she become victim of murder.

There are many cases of suicides or "accidental death by drinking pesticides" in many villages of Bangladesh and the victims are predominantly female. Most of the times these accidental death occur because of illegitimate pregnancy and rape.

Another study based on interviews with prostitutes in Dhaka city found that most of them were drawn from the poverty stricken rural districts of Bangladesh and that forty-five out of sixty prostitutes interviewed reported rape, divorce or remarriage by husband, allegations of immorality by neighbours or sale into prostitution, as the major factors behind their entry into the brothels (NORAD, 1988).

Lack of access into other indicators of standard of living :

Clothing : Many women in rural areas do not have their minimum requirements i.e. at least two pieces of winter cloth.

Education : Parents in rural areas are interested to send their boychild to school rather girl child. Percentage of primary enrollment of girl child is increasing but drop-out before completion of primary education is also increasing.

Crisis coping capacity : Physical burden of coping with any disaster or crisis falls on women more than men. During any disaster like flood women have the gender assigned role like gathering fuel, wood and taking care of children, old and sick members of the family. In crisis period a poor woman sacrifices her meal for children and husband.

Effect of seasonal dimension of poverty is inevitable on women.

In agricultural sector there are two seasons, peak season, when poverty decreases, and lean season, when poverty increases. In lean season women are often tortured and beaten by their husbands and other male members of family as food falls short. Conflict over food is a frequent source of violence within the family in lean season.

There are good number of anti-poverty strategies taken up by the government and NGOs. But those shall have to be more sustainable as well as equitable. These strategies shall have to be based on strategic analysis of the political economy of class and gender to go beyond practical concern and provide welfare.

Micro Fares Macro

Microelectronic revolution is knocking on India's door, writes **Frederick Noronha** from Dona Paula (Goa)

MUMBAI'S famous red buses, run by Bombay Electric Supply and Transport (BEST), will soon have automatic fare collection thanks to a revolutionary microelectronic system.

Electronics multinational Philips has entered a consortium with Gemplus Technologies and V.J. International to bring automatic fare collection systems to India and BEST has agreed to introduce India's first such system on its buses in the country's commercial capital.

Single-chip low cost telephones, inexpensive self-tuning radios, car immobilisers to prevent vehicle thefts are other products of the microelectronic revolution. In recent years, the global electronic industry has grown rapidly. The main impetus for such phenomenal growth has been the pervasiveness of electronic products and continued technological breakthroughs in the field of microelectronics and associated disciplines.

To discuss one such discipline, representatives of big names in the computer industry met here over the weekend. Their topic of discussion: VLSI, or Very Large Scale Integration. Though the term may mean little to the layman, it's very many applications will make lives easier for millions.

VLSI is virtually invisible to the common man. He won't even know he is using it. It fits into toasters, cameras, washing machines, televisions and scores of other electronic devices. VLSI refers to the design of chips used in electronic items.

VLSI circuits, consisting of millions of transistors working together, are used in a wide range of applications. Such circuits also go into personal computers, multimedia, mobile communications, organ transplants and even the de-coding of the human genome.

For some time now, India has been acutely aware that it needs the capability to design and produce its own chips. In a computer and electronics-dominated world, this would become essential. To come closer to that end, big names from Silicon Valley, Bangalore and other centres known for their computing skills were present at the Goa meet. These included the Israel-based Intel vice president (microprocessors) David Perimutter and global industry leaders from firms like Cadence Design Systems Inc, Semtech Corp, National Semiconductor Corp, Bell Labs, LogicVision Inc, Philips and Texas Instruments.

There were also prominent academicians from the Massachusetts Institute of Technology (MIT), Stanford, Berkeley, and India's own prestigious Indian Institutes of Technology (IITs). Of the 400 participants, about half were researchers from countries like the US, Japan, Israel, Germany, Canada, Italy, France, Sweden, Portugal and Saudi Arabia.

In keeping with the global division of labour of the late 20th century, VLSI business houses have already carved out a slot for India. They see India as the best place to carry out their design and development activities just as they view East Asia as the most suitable for their manufacturing units and have singled out China, Singapore, Malaysia and South Korea to carry out the testing and packaging processes.

Take, for instance, the Hyderabad-based VEDA-IIT or the VLSI Engineering & Design Automation Institute of Information Technology. It has been promoted mainly by QualCore Group Inc, one of the prime business affiliates of the DII Group Inc, of Colorado, US. The group has a revenue of over $1 billion per annum.

"In India, there are not many institutes which are imparting industry-oriented training in this advanced area of VLSI engineering. Hence there is a large gap between demand and availability of trained expertise in this hi-tech field," said the VEDA-IIT. It offers four-month diploma programmes in VLSI design for graduates, experienced electronics designers and R&D organisations.

Other firms are also studying opportunities closely. Intel, the corporation which dominates the global computer chip industry, said that it plans to invest in the Indian market. Intel is on the lookout for companies "that are aggressive, have good business plans, and good ideas." "These are the start-up type of companies that we'd like to invest in," Intel's Bangalore-based India Technology Centre director Ramamurthy Sivakumar told IANS.

Besides being a "huge market" for Intel, India was teaching the mega corporation new strategies. Because of its peculiar market needs, India was pushing Intel into changing its product portfolio. "The issue is to give products to every segment of computing that needs a different product. This is what we're learning about the Indian market and that will get reflected in products we design in the future," Sivakumar added. In the US, said R.V. Joshi, a researcher at IBM's T.J. Watson Research Centre in New York, Indians are found in chip-design centres. Specially where there is a lot of software-related hardware involved.

"A number of firms are setting up their design centres in India. Including TI, National Semiconductors, Motorola, IBM-Asic Design Centre, ACS Thompson in Noida, Keynes, Synopsis. They're all key for the success of India, and for the success of their companies too. These companies are pouring money to hold such conferences," said Joshi, who belongs to Pune and studied at the IIT in Mumbai. "From the kitchen to the cell-phone to the Boeing 767, everybody is using the same technology in various different ways," said conference organiser Ajit Shirodhkar, a pharmaceutical professional who switched to agriculture.

"With the Goa University Vice Chancellor (B.S. Sonde) also being a microelectronics man, we can form a good nucleus which will also bring in knowledge from the IITs, IISc (Indian Institute of Science) in Bangalore and the like," he said. India apparently has a tiny share of the global VLSI market. Of an estimated $270 billion market, the country has just around one per cent. Goa University's computer science department head V.V. Kamat said, "We're hoping some surplus of this conference can go into setting up a design centre in Goa. We're working on trying for that."

Kamat pointed to huge grants given by industry to educational centres like the IIT in Mumbai. But younger varsities like Goa University would have trouble attracting such funds and build up infrastructure.

Next year's VLSI conference -- the 13th to be held in India, sponsored by the VLSI Society of India and the federal Department of Electronics -- will be held in Calcutta. To be held from January 3 to 7, it will focus on wireless and digital imaging.

--India Abroad News Service

Global Study on Women and Media

AN ambitious project to monitor women's representation in the world media has been set in motion by the World Association for Christian Communication (WACC), the University of Leicester, MediaWatch Canada and 80 monitoring groups worldwide. Called the Global Media Monitoring Project 2, the findings of the research will be released in 2000. The first project originated at the 1994 Women Empowering Communication Conference in Bangkok, organised by WACC. The aim of the study, released at the Beijing Conference, was to create a database on the participation and portrayal of women in the world's news media. The second study will gather and analyse information published and broadcast on a particular day in early 2000, from 80 countries. It will also take into account the cultural specifics of each country.

Transported into Power Politics

A research study by the Transport Research Laboratory at the Overseas Development Agency (now called the Department for International Development) in Britain, has explored the gendered nature of transport activities in Ghana's capital, Accra. When men work in transport activities, they do so with the aid of technology (wheelbarrows). Carrying head loads, women, on the other hand, are often substitutes for technologies.

The wide-ranging study, undertaken from 1993-95 and comprising more than a 1000 interviews with male and female porters (kayayoo) revealed substantial cultural differences between the transport functions of male and female porters.

Interestingly, both male and female respondents were in agreement that women are not strong enough to make use of wheeled non-motorised transport. *— WFS/News Network*