TO PUT THE LAST FIRST

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The Committee on the Teaching of Science of the International Council of Scientific Unions
in association with COSTED, ICASE and Unesco
TO PUT THE LAST FIRST: A CHALLENGE TO
SCIENCE AND TECHNOLOGY EDUCATION

Robert Chambers

... the major obstacle to the development of the rural poor
is the so-called educated man.'

Bunker Roy, Indian Express,
1 November 1983

Thinking About Future Human Needs

The title of the conference is 'Science and Technology Education
and Future Human Needs'. It is not 'Future Human Needs and Science
and Technology Education'. The sequence of concern is understandable
given that the Conference is organised by the Committee on the
It also reflects the mental set which most members of elites share,
of starting with their own skills and concerns and then extending
them towards others. The argument of this paper is that we should
reverse the sequence and reverse the direction and start not with
science and technology education, but with future human needs.

Starting with future human needs, two basic questions are how we do,
and how we should, think about them.

How we do think about future human needs is largely determined by
the biased system of knowledge in which we are trapped. Power, know-
ledge and the ability to generate new knowledge are concentrated in
urban and industrial centres, especially not only in the richer
countries of the North. These centres put first the concerns of the
rich and powerful - sophisticated weapons, rockets, chips, cars,
chemicals, disease of the affluent and ageing, the mechanised agri-
culture of temperate climates. They set standards and fashions and
draw towards them professionals from all over the world. The actions
and priorities of these professionals then define future human needs
as those of the urban, industrial, educated elite. Textbooks, train-
ing and the media then disseminate their values and concerns to other
less central, less powerful, environments.

Whose Needs?

How we should think about future human needs depends on whose needs
we are considering. Those most in need are precisely not those who
are 'first' - the urban - industrial, educated and elites. A majority
of the neediest are those who are 'last' - rural agricultural - little
educated, and concentrated in the poorer countries.

Their numbers are increasing. Rural populations in Africa and Asia
have risen fast and will continue to do so, and the numbers in Latin
America are large. For every two people in rural Sub-Saharan Africa
today three are expected by the end of the century'. India's rural
population will rise over the same period by roughly the size of its
current urban population. Urban poverty is appalling but is more
visible. It is in the rural areas of the developing countries of the
South that most of the neediest in the world are to be found and will
continue to be found. The logic of degree of deprivation and of
numbers argues for putting first the needs of those who are 'last', the poorer among the rural majority of the South.

This requires an assessment of their needs and priorities. The best experts on what they need are the poor rural people themselves. The needs they express vary by individual, gender, household, village and region, and frequently differ from those supposed by elite outsiders. Very often, though, they include health, livelihoods with secure and adequate food supplies and cash incomes, reserves to deal with emergencies, goods they can buy, shelter, and basic services for health, water, education and transport. For those who are most deprived, livelihoods and health are often the most critical.

First and Last

If these are their needs, how can science and technology education help them to meet them? It is here that the biased system of power and knowledge points professionals in the wrong direction. Again and again, the things valued in science, technology, and education are the opposite of what matter to the rural poor. This shows in a list of contrasts between the preferences of professionals - which usually come first, and the needs and resources of the rural poor - which usually come last.

First Biases Against the Last

Curricula, textbooks, training and research usually emphasise the first list against the last. In agricultural science, tractors are preferred to oxen or hand cultivation, chemical fertiliser to organic, exotic cattle to local goats. Agricultural research concentrates on the cash crops of plantations and mainly of the richer farmers - rubber, sisal, coffee, tea, cocoa, jute, cotton - to the relative neglect of the food crops of the poor - sorghum, the millets, sweet potatoes, cassava (tapioca, manioc, yucca). Medical establishments devote resources to the effects of overeating by the rich - heart disease and obesity, rather than to the effects of malnutrition among the poor. They value transplants and open-heart surgery for a few privileged adults more than tackling the diarrhoeas which kill millions of poor children each year. Engineers prefer large expensive structures - the huge dam, the two or three-lane highway, the skyscraper - to small and cheap works - local irrigation, improved dirt roads, rural housing. The biases are sustained and strengthened not only by education and training, but also by convenience, commercial interests, research funding, and professional rewards and recognition. All of these draw professionals away from the rural poor and towards the urban rich.

The biases also show in professional status. Nuclear physics has higher prestige than agriculture, surgery than community health, major irrigation with big dams than minor irrigation with small ones. The science Nobel prizes go for 'first' research. There has been no Nobel prize for work on cassava or goats.

The biases also generate technology that does not fit the resources and needs of the poor. Crops and practices evolved in favourable conditions on agricultural research stations fit the conditions of the richer farmers, but not those of the poorer. The endless cries for the 'transfer of technology' to the poor, and the complaints that the
### Professional Preferences

<table>
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<th>First</th>
<th>Last</th>
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<tbody>
<tr>
<td>Urban</td>
<td>Rural</td>
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<td>Industrial</td>
<td>Agricultural</td>
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<tr>
<td>High cost</td>
<td>Low cost</td>
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<td>Capital-using</td>
<td>Labour-using</td>
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<td>Mechanical</td>
<td>Animal or human</td>
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<td>Organic</td>
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<td>Large</td>
<td>Small</td>
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<td>Traditional</td>
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<td>Exotic</td>
<td>Indigenous</td>
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<td>Marketed</td>
<td>Subsistence</td>
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<td>Quantified</td>
<td>Unquantified</td>
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<tr>
<td>Geometrical</td>
<td>Irregular</td>
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<td>Visible and seen</td>
<td>Invisible or unseen</td>
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<tr>
<td>Tidy</td>
<td>Untidy</td>
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<tr>
<td>Predictable</td>
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<td>Hard</td>
<td>Soft</td>
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<td>Clean</td>
<td>Dirty</td>
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<td>Odourless</td>
<td>Smelly</td>
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<td>High status</td>
<td>Low status</td>
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<td>Rich</td>
<td>Poor</td>
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<td>Influential</td>
<td>Powerless</td>
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<td>Illiterate</td>
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<td>Male</td>
<td>Female</td>
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<td>Adult</td>
<td>Child</td>
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<td>Dark-skinned</td>
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<tr>
<td>Urban</td>
<td>Rural</td>
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<tr>
<td>Indoors</td>
<td>Outdoors</td>
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<td>Office, laboratory, clinic,</td>
<td>Village,</td>
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<tr>
<td>station</td>
<td>village home,</td>
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<td>Accessible</td>
<td>farmer’s field</td>
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<td>Day</td>
<td>Night</td>
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<td>Dry</td>
<td>Wet and hot</td>
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<td>and cool seasons</td>
<td>seasons</td>
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For Technology, Research and Curricula

For contacts and clients

For place

For time
poor are ignorant and stupid when they do not adopt it, overlook
the frequency with which the technology is inappropriate. The igno-
rant and stupid are often not the poor but the scientists blind to the
fact that their technology does not fit.

Two Sets of Knowledge

In practice, the technical knowledge of rural people is often
highly developed, but scientists ignore or despise it. Local know-
ledge of the environment is often detailed-knowledge of soils, plants,
trees, insects, animals, fruits, micro-ecology, animal behaviour and
so on. Local agricultural practices like intercropping, once re-
garded as primitive, are now recognised by agricultural scientists as
sophisticated, reducing risks and increasing total yields. The value
of medicinal herbs and many traditional remedies is now more widely
acknowledged. And when it comes to social knowledge concerning
strategies for survival, seasonal adaptations, social relations, con-
ditions of work and so on, the knowledge of rural people has clear
advantages over that of elite outsiders. In spite of this, education
still teaches scientists and technologists to believe that their
'first' knowledge - modern, sophisticated, acquired in classroom
and laboratory - is always superior, implying that whatever 'last' know-
ledge rural people may have is inferior.

The truth is that to help the rural poor better meet their future
needs requires both modern scientific knowledge, and local technical
and social knowledge. But modern scientific knowledge is much more
powerful, linked as it is with government, formal education, capital-
ism and commerce. For local knowledge to play its part, the imbal-
ance of power has to be corrected. This requires a conscious effort
on a wide front, and many, many reversals to give priority to the con-
ditions, needs and wishes of the rural and of the poorer; in short to
put first the people and things that are usually last.

Reversals: Three Challenges

Three of these reversals stand out as special challenges to science,
technology and education. They concern learning, location and values.

Reversals of learning entail students and scientists learning from
rural people. Those who are outsiders to rural life do not know what
rural people know. Nor, without asking, do outsiders know in detail
what rural people, least of all the poorer, want and need most.
Again and again, the scientist or the official visiting a rural area
goes as missionary and teacher, preaching to people what they should
be doing, instead of in the humbler role of student, asking questions,
listening and learning. Again and again, contact is with those who
are better off, more influential, and more easily reached, men rather
than women, adopters of innovations rather than non-adopters, those
who use services rather than those who do not - all biases against
meeting and learning from those who are poorer and more in need.

Reversals of location entail moving out of the town, off the research
station, away from the main road, to where the poorer rural people
are. This means fighting against the forces which pull professionals
towards larger and larger urban centres. It can mean choosing, as
Amulya Reddy and his colleagues of the Indian Institute of Science in
Bangalore have done, to work in a distant village.
Reversals of values entail resources and recognition for research and teaching concerned with 'last' people, conditions and technology. This means promotion and prestige for those who work on 'last' subjects like subsistence food crops, smallstock, women's unpaid drudgery, children's diarrhoeas, village water supplies, community health; for those who work in 'last' locations - villages, homesteads, fields, in remoter areas and poorer regions; and for those who work with poor 'last' people - small and marginal farmers, women, low status minorities, artisans, rural migrants, casual labourers, the landless.

A Balance

But the challenge is more than this. It is also to achieve a balance. Scientists and technologists who put 'first' things first are needed in the countries of the South for national development, for example to instal and manage infra-structure and to deal with multinationals and salesmen of the North who peddle expensive 'first' technology. Some techniques of 'first' science are also needed to solve some 'last' problems: it took the electron microscope to identify the rotavirus which causes so much diarrhoea. But current priorities are grotesquely biased towards the needs and interests of the rich and away from those of the poor, especially the rural poor. Balance requires a strong and influential cadre of determined scientists, technologists and teachers, in both North and South, who 'do a flip' and reverse their professional values, who take hold of the other end of the stick and see things the other way round, from the stance of those who are last, who change their priorities and put the last first.

Reversals to achieve balance are the exception but becoming less rare. Examples include shifts of priority in agricultural research to the food crops of the poor; research on the questions poor farmers want answered not those which scientists identify; training programmes where students have to learn to do what the poor do - buy food and cook for a family on a low budget or grow rainfed crops; and community health programmes which use both local and allopathic knowledge. In science and technology education the Eklavya programme pioneered in Hoshangabad District in Madhya Pradesh appears an important breakthrough. Educationalists and scientists learn local concepts, for instance of volume, and use locally available materials as kits for experiments through which students learn for themselves. In this programme, the mindless and destructive imprinting of 'first' knowledge through rote learning is replaced by a synthesis of the best of both systems of thought - locally-based concepts and 'modern' scientific enquiry. But sadly, such creative balance is still very much the exception. Perhaps an international network to link up and encourage innovators in rural science and technology education and help them to share ideas and experiences might be one positive outcome of this Conference.

A Massive Shift

All this means that for science, technology and education to serve future human needs requires a massive shift - in thinking, values, research, curricula and methods and locations of teaching. It implies that much more learning should start with rural and poor people, where they are, with what they have, and with what is important to them; that the strengths and validity of local technical knowledge should be recognised and used; that science and technology should more often
fulfil a referral and consultancy role in the service of those who are last; that research priorities and locations should be determined not by habit, convenience and commercial interests but by the wants, needs and resources of the poor, especially the rural poor. There are scientists, technologists, teachers and researchers who have already pioneered changes like these. They and those who follow them may not always be rewarded; but in the long term, few though they may be, and rewarded or not, they may do more for human wellbeing than the many who conform to the traditional values of their professions.

If the argument of this paper is correct, it raises a sharp question. Starting with future human needs, how can science and technology education put more of the last first? The question applies at all levels of education - primary, secondary and tertiary. It concerns both teaching and research. It involves curricula, textbooks, teacher training, teaching methods and materials, research priorities and topics, and locations of teaching and research. It presents a personal and professional challenge to all engaged in science and technology education.

What answers can the Conference give?

Footnotes:


2. This list is modified from Robert Chambers, Rural Development: Putting the Last First, Longmans, UK, 1983, p. 173, which also presents the argument of this paper in more detail.

3. It can be illuminating and startling to take a lecture, curriculum, textbook or course and analyse its content against the first-last lists.
