Note: This article reports on part of a project that set up an animal health care system run by tribal youth in about 900 villages in the early 1980s. The system was also an early example of computerized monitoring of technical performance parameters and economic indicators.

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School Drop-outs as Bare-foot Veterinarians: Lessons from a Non-formal Education Project

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This article by Vijaya Sherry Chand focuses on the experience of a non-governmental organization in educating 113 school drop-outs as 'bare-foot' veterinarians in the tribal areas of Gujarat. Based on an analysis of this experience, the author draws implications for education and research.

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The 'drop-out' phenomenon—students not lasting the primary schooling cycle—has been a persistent and almost intractable problem of the school system in India. The problem has been especially acute in tribal areas, drop-out rates among tribal children being as high as 78.51 per cent *(Annual Report,* 1992). This large contingent of drop-outs constitutes the 'wastage' incurred in the educational system. These drop-outs, most of whom belong to the poorer sections of the population, presumably go back to their land and labour, or join the ever increasing numbers of migrants hoping to make a living in the cities. This 'dropping out' of the frame of the concerns of policy makers and researchers, and the absence of avenues for re-education or training, constitute the tragic dimension of the drop-out phenomenon.

Non-formal education projects, usually initiated by non-governmental agencies, have opened up opportunities for a minuscule fraction of such school drop-outs. While the problem of what happens to the drop-outs after they do drop out is no doubt immense, such experiments serve as faint indicators of what may be achieved with the untapped potential of people unable to complete their schooling. This paper deals with one such project carried out in the 1980s in the tribal areas of South Gujarat. The project aimed at training local people, who had dropped out from school, as animal health workers or bare-foot veterinarians. The following sections describe the technical context of the project, the profile of the programme and the workers, and the pedagogy and curriculum followed in training the workers. The concluding section draws implications for education of people with minimum formal education, in the context of a development programme.

Technical Context of the Project

The 'weaker' sections of society, for instance the tribal communities, have been 'targets' of official development programmes such as the Tribal Sub-plan and the Integrated Rural Development Programme (IRDP). The IRDP aimed at equipping eligible beneficiaries with

income-generating assets through a mix of government subsidies and bank credit. Milch animals, usually buffaloes, formed a major share of the programme. The milk-marketing infrastructure established under official dairy programmes like the Operation Flood made this asset a favourite choice of the development bureaucracy. The beneficiaries were encouraged to form cooperatives which could supply the milk produced by them to the official milk-marketing grid. However, these cooperatives, especially the ones set up in tribal areas, were not always successful. A few of the tribal milk cooperatives set up in South Gujarat between 1979 and 1981 started developing problems in the maintenance of the productivity of their animal base and in the administration of their activities soon after their establishment. The cooperatives and their sponsoring agencies approached a non-governmental organization (NGO) based in Ahmedabad, the Behavioural Science Centre, for help in revitalizing the buffalo programme.

A brief evaluation of the cooperative projects indicated that the milch buffalo was a new animal to the people. The local people till then had been maintaining cattle of the so-called non-descript breeds for draught purposes and goats and poultry for meat. The buffaloes, being new to the area, had yet to get acclimatized to the hilly terrain. The broad hooves of the animals, more suited to the plains, tended to develop problems very quickly. Other problems identified were high mortality of milch stock and calves, and poor productivity on account of curable diseases (cattle mortality was mainly due to epidemics of diseases like haemorrhagic septicemia. The mortality rates were as high as 50 per cent, in contrast to acceptable figures of 5 to 10 per cent).

Though the milk marketing channels of the district dairies were well organized, their veterinary services were still not in place. The official state government veterinary services could not reach out to the villages since one veterinary doctor, who had two or three livestock assistants, was expected to cover 200 to 300 villages and maintain block-level veterinary dispensaries. Therefore, the cooperatives felt that there was a need for' a system which could take care of a majority of veterinary problems at the village level. As far as nutrition was concerned, the people depended on fodder available in 'open-access' forests and on agricultural by-products, mainly stovers of sorghum and maize, straw of wheat and ragi, and pigeon pea residues. In addition, they could purchase the concentrate feed produced by the dairies and distributed by the cooperatives. However, during summer, there was a general shortage of fodder. The leadership of the cooperatives felt that education about nutritional management should be combined with training of members in various technical aspects of animal husbandry.

Genesis of the 'Bare-foot' Veterinarian Programme

The NGO, in collaboration with the cooperatives, decided to evolve a Tribal Village Worker Education Programme (hereinafter referred to as the TVW project) with the aim of training young people who could function as 'bare-foot' veterinarians. These individuals could be trained to take care of primary veterinary problems like curative and preventive medicine, and to slowly start organizing the other supportive services like nutrition, cooperative management, etc. The educational foundations were laid during 1982-1983, so that all the workers were in place by mid-1983. Most of the educational follow-up work was carried out between 1983 and 1986, and by the end of 1986, the bare-foot veterinarian system was well established.

Profile of Programme and Workers

The TVW project covered 104 tribal villages spread over four districts of South Gujarat. These villages were organized into 46 cooperatives. One large block-level cooperative covered 42 villages, and the rest of the cooperatives (village cooperatives) covered one or two villages each. The total number of workers trained under the programme was 113, of whom 17 were women. Each worker had to deal with about 100 farmers and approximately 300 large animals and many small animals. All the workers belonged to the scheduled tribes, most of them to the Vasava Bhil, Chaudhury, Gamit, Kokna, and Dubla communities.

Criteria for Selection: Formal Educational Status

The selection of workers was made by the cooperative leadership. Two major criteria used by the people were age and educational status (schooling, reading, and writing). Most of the workers, at the time of training, were in the age group of 18 to 30. Almost half of the workers had dropped out of school before reaching standard 5, about 40 per cent had dropped out during upper primary school (5th to 7th standard), and the rest had reached the 8th to 10th standard (secondary school). A majority of the workers were, thus, drop-outs from primary school.

While the drop-out problem is a serious one, the quality of primary education, as measured by learning

achievement of the primary school students, is also a matter of concern. There is generally a tendency to focus more on quantity, on the grounds of improving access to education. However, Harbison and Hanushek (1992) suggest that, in fact, there is no trade-off between children's access to education and their scholastic performance within it. Concentrating on quality will generate enough resources for meeting quantity considerations. Thus, a focus on quantity aspects without a corresponding emphasis on quality objectives has resulted in the devaluation of the meaning of passing the 5th or 8th standard.

In practice, the TVW project did not distinguish between the various levels of schooling achieved by the workers. It was realized early on that as far as competence in reading, writing, numeracy, and comprehension was concerned, there was little difference between the upper and lower primary levels. It was also assumed that the status of workers as drop-outs would not affect their performance in a non-formal education project.

Pedagogy and Educational Methods

In the Indian context, it has been stated that 'what is learnt by pupils is no more significant than., who learns and who fails to learn' (Kumar, 1989) and that present curricular practices make the so-called backward tribals internalize symbols of 'backward' behaviour. In addition, in a mixed classroom in which tribals and non-tribals are present, the word *adivasi* or tribal in connection with indigenous practices and knowledge has to be used carefully since the imprecise term tribal 'translates into a precise indicator of identity in a contemporary Indian classroom.' This limitation applies even to an exclusively tribal classroom set-up since existing curricular and pedagogic practices tend to reinforce certain negative stereotypes and values already internalized by tribal children and youth.

The pedagogy developed by the TVW project, therefore, had to integrate two major objectives of learning: a) competencies at the individual and, more importantly, at the group level; b) appropriate values like self-confidence, respect for wisdom already in the community, an open but critical attitude to both indigenous and external technological and cultural practices, etc. The pedagogy included two types of learning—integrational or holistic learning and skill-oriented learning. These were integrated within a framework which included three main components of learning—theoretical discourse, experiential learning and self/other learning, and two instument-medium dimensions—the individual and the group.

Non-negotiable Principles

Some of the essential principles and assumptions followed by the pedagogy were:

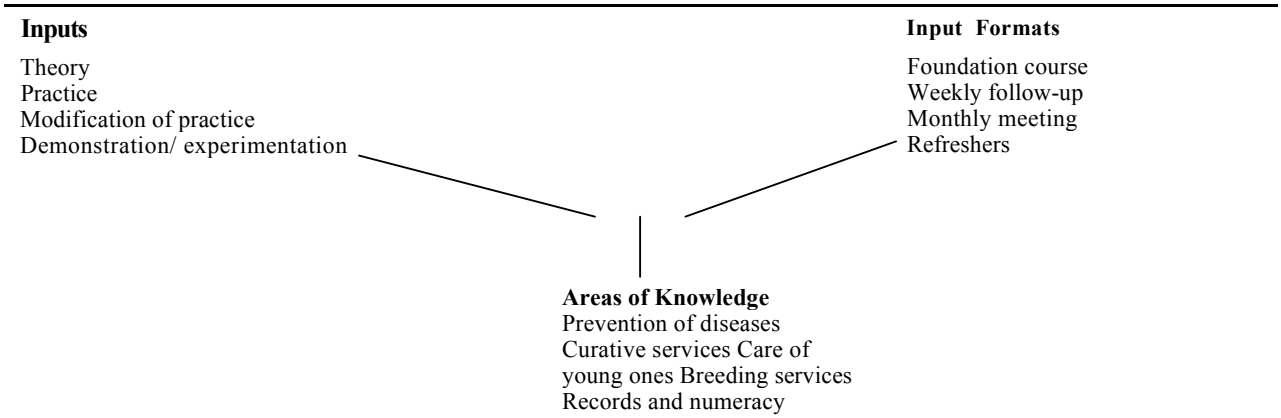
- Instilling and reinforcing in the workers a sense of critical respect for people's knowledge and con fidence in the people's and their own decision-making abilities.
- Putting a technology in the people's language, without ignoring the science behind the tech nologies, both local and external. This implied use of the vernacular and even of local dialects.
- Once a technology was demystified, the under standing was translated into actual practice, and such a practice, which meant a series of repeti tions—action, observation, and inference—was es sential for transforming the workers into active subjects.
- Learning needs of the workers had to be concep tualized at both the individual and group levels. This was necessary for two reasons: a) as described in Figure 1, the non-formal education setting re quired learning through methods like coaching and learning by doing (individual level), and through group sharing, discussions, and sharing of ex periences; b) a more specific reason was that this way of conceptualizing learning needs would help the workers later since their learning had to be applied in the villages at both the individual and group levels. For instance, while individual-level technologies like animal treatment were important, the trend was towards application of group-level technologies like vaccination programmes, fodder collection and conservation, bull maintenance, etc.

Areas of Knowledge and Input Formats

Given these pedagogical assumptions, the types of inputs, the input formats, and the areas of knowledge covered were worked out as in Figure 1.

The foundation course was of a month's duration and the monthly meetings were usually held over one or two days. The refreshers were of two types—short duration (three to four days) and long duration (a week to ten days). Experiments, usually on fodder growing and conservation, mineral supplementation of animal diets, calf care, etc. were carried out at the village or farmer level and at a centrally located farm which was

Figure 1: Areas of Knowledge and Input Formats



used for training purposes. Monitoring of the progress of the workers was done with the help of the cooperatives which gathered feedback from the villages. In addition, the TVW project established an information system which monitored technical parameters like animal mortality, productivity, pregnancy rates, etc. The findings were discussed during the monthly meetings. These meetings could, therefore, point out weaknesses of individual workers and also provide indications about their learning achievement. Usually, the'entire cycle from the foundation course to the stage of adequate learning achievement took about a year to a year and a half. It must be noted that 'adequate' learning achievement implied two components: a) a general set of competencies applicable to all; these included ability to provide primary health care and vaccinations, to mobilize people on common issues like nutrition, and to judge the productive potential of buffaloes offered by cattle traders to the cooperatives; b) specific standards which varied between groups of cooperatives. For instance, the ecological context of certain groups demanded that workers from this context develop the ability to deal with the forest department to organize fodder collection; some groups needed their workers to develop skills in dealing with issues like cattle insurance, testing of quality of milk, etc.

The Pedagogy in Practice: An Illustration

As indicated above, the pedagogy relied on learning through theory and experience at both the individual and group levels. In practice, this meant, among other things, the participation of the workers as teachers (peer learning) and learning from encounters with the market and institutions (encounter learning). A brief description of a workshop conducted in 1985 is given below as an illustration of some of the methods used in practice.

The two main components of the workshop were the process of teaching itself and the contents of the training.

- The process was based on activities and so designed as to maximize participation, involvement, initia tive, and scientific curiosity. Thus, the participant was an active subject, involved in the design of the action and in reflection upon the participation. The results were expected to be felt in two areas, in the personal, as reflected by higher motivation and initiative taking, and in the area of awareness or knowledge. Some of the methods used included:
  - — inviting workers who had obtained good results to handle particular sessions in their own language,
  - — asking workers who had previously been sent to the institutions involved in the programme, like the District Dairy Union, cattle yard, drought-affected areas where emergency feed ing was going on, state government farms, etc., to present their observations and learning to the other workers.
- The contents may be summarized as follows:
  - — Reflection on work done and review of areas requiring further study.
  - — Upgrading knowledge and powers of com prehension by exposure to simple technical papers in order to aid the process of concep tualization and reflection. These papers were based on local incidents or practices and tried to incorporate theoretical explanations of the principles behind them. A collected set of these papers constituted a rough 'manual' which

could be referred to when needed. The areas covered included aspects of disease prevention and cure, husbandry, and feeding and management.

- In order to lead from reflection to action, the next step was working in small, homogeneous groups of four or five to identify concrete problems and initiate small action projects. The observations recorded during these projects provided inputs for future training.

Curriculum Development

Blending Local and External Practices

One of the assumptions the TVW project made was that curriculum could not be prescribed, rather it had to be produced through a process of dialogue and selecting 'what is worth teaching' (Kumar, 1992). Such an approach implied participation of the teachers and learners in curriculum development. It also meant a critical appreciation of, and selection from, both 'local'* and 'external' knowledge systems. This section looks specifically at the linkages between the study of local practices and evolution of blended practices.

The practices observable in a given area can be understood along two dimensions, the source and the nature of the practices as described below :

	Source		
Nature	Local	Blended	External
Material			
Cultural/Spiritual			

Local-material Practices

The use of antiseptics like extracts of neem and custard apple leaves and the practices of tying a stick in the mouth to keep it open and feeding oil in cases of bloat are common veterinary practices in the TVW project area. Remedies for more complicated ailments are rarer. Certain surgical practices, like the use of bamboo as splints in case of bone fractures and the application of the principle of counter-irritation through hot branding to cure certain categories of lameness are commonly seen in tribal and other areas. An important and almost universal remedy in tribal areas is alcohol, especially *mahuda* liquor. Conditions treated range from anorexia (going off feed) and foot sores to infections like haemorrhagic septicemia, a disease characterized by high mortality.

Another practice, first observed in village Dadakui, Mandvi, Surat district, is to add a little cow dung to milk and again to curdled milk before churning it for extracting butter. Mr Ukadji Chaudhury, the worker from the village, claimed that the yield of butter was definitely higher with this addition. This practice was termed unhygienic and hazardous to human health by a couple of doctoral students of animal husbandry who visited the area in early 1983. Perhaps, the dung of herbivores has certain 'starter culture' qualities which could possibly be isolated from the health hazard threat. Regardless of the merits of the practice, the point is that such practices have no chance of even being considered potential research problems. The implication is that when cooperation between scientists/researchers and farmers is considered, the option of 'reverse learning' is ruled out.

Some of the workers belonged to the *'bhagat'* (traditional doctors) families and hence were familiar with certain medicinal herbs and trees important in human medicine.

Local-cultural Practices

Not all ailments can, however, be cured by *bhagats.* For instance, the practice of tying a sacred thread around the left ankle in cases of a snake bite depends for its success on the non-venomous nature of the snake or sub-lethal doses of venom. However, the social importance of the *bhagat* and more importantly, his accessibility and the social norm which enjoins him not to refuse to treat the (physically or psychologically) ill, makes the use of traditional medical and mid-wifery skills an important social practice. It must be said though, that the application of such knowledge to animals, *in this area,* is limited (personal observation); even within this limited application, many instances of the failure of the *bhagat* in veterinary practice were reported.

Thus, in comparison with pastoral communities or areas with a long tradition of animal husbandry, the tribal areas did not possess a diversified fund of traditional veterinary practices; there was a greater reliance on the practices of *bhagats* and very often, the range of existing veterinary practices and the *bhagat's* interven-

'Local' here refers to a geographical entity and not to a historical continuum; i.e., it is not synonymous with 'traditional.' Local practices may be traditional or recent innovations. An instance of the latter is the use of used engine oil to control mange in cattle.

tions did not cure diseases. This situation was pedagogically important, since the practical use of alternative remedies which were effective promoted faster learning. The propensity to take risks and learn from experimentation was also greater.

With regard to the understanding of breeding practices, a common statement of the people used to be 'buffaloes breed twice a year, definitely at least once in winter.' During discussions, it emerged that people were basing this statement on their observations of dogs with which they were familiar. That alternative breeding patterns can be observed was a crucial learning experience for many workers and farmers.

In the early 1980s, in many villages, milking used to be carried out after darkness fell as the people felt that the evil eye was inoperative in the dark. Milk used to be drawn into a vessel around the mouth of which a cloth was tied; the comment offered by the farmers was that the sound of the milk striking the vessel would be heard by the evil spirit which would then proceed to drink the milk directly from the animal. A scientist, Dr S B Kodagali, then working at the Gujarat Agricultural University, hypothesized that the cloth probably prevented the dirt on the flanks of the animal from falling into the milk. However, it is not always possible to offer an explanation from a scientific-rational perspective for a practice evolved within the parameters of a very different world view.

Evolving Blended Material Practices

Some examples of local practices were given above. However, the TVW project.assumed that the sources of knowledge were both local practices which had evolved through practice and the body of 'Western' scientific knowledge which had proved its merits in areas like control of infectious diseases, vaccinations, etc. Hence, a critical examination of external practices in order to evaluate their relevance, utility, and efficiency and their integration with local practices, if any, was essential in evolving blended technologies. These practices were then located at either the individual or the group level. The latter implied the location of the practice in the appropriate institutional context—existing institutions or new institutions (Figures 2 and 3).

Curriculum Development in Practice

Illustration 1: The Case of Calf Care

As mentioned earlier, the mortality rate among young calves was identified as a major problem which had the potential to affect the build up of the herd in the project _ area. The workers undertook a survey of the reasons for mortality and any existing practices to control the problem. Diarrhoea, for which small quantities of the extract of the bark of *Acacia catechu* were being used, and worm infestation against which the laxative, castor oil was often used appeared to be the reasons and the remedies, respectively. In addition, two widespread culturalpractices which had a bearing on the problem were identified: a) the colostrum, or the first milk, was never given to the calf; the human owners of the buffaloes offered part of it to the deities and drank the rest; b) the calf was not allowed to drink the milk until the placenta of the mother was expelled. In cases where the placenta did not fall off, the calves faced certain death. After examining the problem and going through the evidence on the positive features of colostrum feeding, the kinds of

Figure 2: Evolving Blended Material Practices

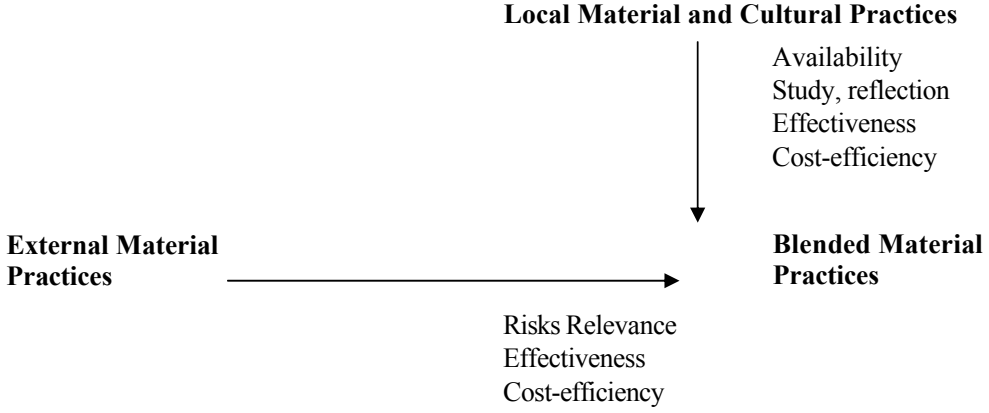
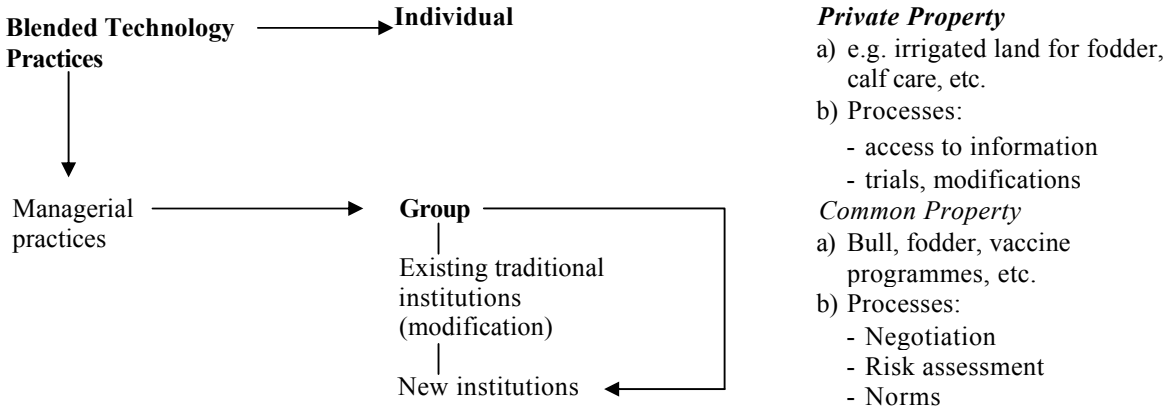


Figure 3 : Locating Blended Practices in Institutions



diarrhoea, and what Western veterinary science had to offer in terms of medicines, the workers decided the strategy for evolving a blended technological practice. In this case, it involved *countering* the local cultural practices described above while incorporating the medicines in use with a package for calf care recommended by the Agricultural Universities. This package consisted of five elements—medicines and feed supplements. The blended practice was successfully implemented and within a year the mortality rates had come down to eight per cent.

Learning from Group Reviews

As mentioned above, the medicine and supplement package consisted of five elements. When the workers started using it, each individual kept these five elements in bulk form with him and took care of all the calves in the village. However, feedback from the cooperatives indicated that sometimes all the five elements were not being administered. During group reviews, the workers felt that producers themselves had to practice this skill and, therefore, the pedagogy had to consider rearranging the five material elements. The workers, after discussing the problem, identified the shift required as one from a worker-focus to a focus on the individual calf. From this insight, it was easy to develop the required modifications in the practice. Individual packets, one per calf, containing all the five elements in the required doses were prepared. Instructions, in words and in pictures, on the use of the kit were also provided.

Illustration 2: Breeding Technologies

The District Dairy Unions introduced artificial insemination (AI) in many parts of the TVW project area through the cooperatives. This technology involved the supply of frozen semen and liquid nitrogen used as a storage medium on a regular basis by the District Union; and implementation by trained employees of the cooperatives, in this case the workers trained under the TVW project. The educational approach of the project while aiming at making the workers professionally skilled in the practice of AI also tried to provide an institutional context so that a blend of the new technology with existing natural service systems could be achieved. Though both these systems were common property resources, they differed on many counts as indicated in Figure 4.

AI technology attempted to introduce higher genetic potential; the quality of the bulls used for natural service in the villages was not always good. The individual farmer, in order to make a choice, had to evaluate this advantage against his or her perceptions of the individual bull *and* of the bull-management institution in the village. The workers' experience indicated that for success of AI, positive experience with bulls and with the associated institution was a precondition. Perhaps, quantity (high pregnancy rate) was necessary before quality (good genetic stock) became relevant.

Developing Local Institutions: Bull Management

Learning to locate a technological practice in an institution which builds on traditional organization is best exemplified by bull management. Breeding bulls have always occupied a place of prominence in animal husbandry since a bull is considered 'half the herd.' Along with the technology of maintaining a bull—its feeding, its housing and exercise, its service management, care

Figure 4: AI and Natural Service Systems

	Common Property	
	Artificial Insemination	*Natural Service*
Nature	New	Traditional
Familiarity	Nil	Familiar
Institution	Modern (Cooperative)	Traditional
Control	Market (District Union)	Self-controlled
Nature of risk	Human intervention (own villager) Dependence on dairy	Bull performance Control of bull-keeper possible
Costs	Practically free	Borne by members
Fun/involvement	Negligible	Trading of bull Settling disputes using the services of the bull, etc.

of the bull calf, etc., institutions for bull maintenance have also evolved to a high degree, especially in pastoral communities which have had a long tradition of animal husbandry. Such practices were studied by the workers through visits to pastoral communities. As a result of these study trips, some villages selected a particular person as caretaker of the cooperative's bull. Usually there is only one bull per hamlet and it is treated as the common property of the village. Some of the other norms evolved by cooperative members in many villages of Surat and Bharuch districts are listed below:

- Regularity of handling was accepted as a principle and so the bull was housed at the caretaker's place.
- When some of the cooperatives decided to provide extra concentrate feed to the bull during the winter breeding season, the members decided to store the feed bag in a common room. The argument was that they were helping the caretaker avoid the tempta tion to feed the concentrate to his own she-buf faloes. Usually one bag of 70 kilos was the monthly ration.
- Compulsory contribution of a few bundles of dry fodder every day by every household; these bundles had to be deposited by the members at the bull house.
- Seasonal contribution of agricultural by-produce by all members.
- Various systems of remuneration to the caretaker were evolved: a fixed monthly honorarium paid by the cooperative, a fixed amount based on the num ber of adult animals in the village, a fixed amount to be deducted from the members' milk income, a charge to be paid to the caretaker by the people using the services of the bull, etc.
- In a few villages, 'exchanges' of bulls were carried out after three to four years in order to rotate the bulls. Otherwise, the members depended on outright purchases of surplus young bulls from nearby villages.

Learning to Move from Dramatic to Less Visible Diseases

As mentioned earlier, the propensity to learn is higher in situations where effective external practices are available in place of absent or ineffective local practices. These effective practices are usually found in relation to dramatic diseases, in which large numbers of cattle are affected and mortality is high. However, the science behind the practice leads the learning cycle towards less visible or less spectacular problems. The vaccination experiences of the workers will be described to illustrate this cycle. As stated in the section on the technical context, epidemics of infectious diseases were a regular feature in the project area. This was characterized by a high death rate and severe losses of stock (buffaloes introduced through the cooperatives were usually covered by insurance, but death of other cattle stock represented heavy financial losses). Traditional remedies like alcohol were largely ineffective. Large-scale vaccination undertaken by the workers through the cooperatives resulted in a dramatic control of these diseases. However, reflection on the science behind the technology provided an exciting context for the learning of alternative techniques of protection against disease, the concept of immunity, limitations of vaccines, time required for vaccines to become effective in the

Figure 5: Dimensions of Blended Practices*

		Features of Local Material/Cultural Practices	
		Positive *Accept*	*Negative* *Reject*
Features of External Material Practices	*Positive* *Accept*	*	*
	Negative *Reject*	*	-

body, and possibilities of breakdown of immunity, etc. Later on, a progression towards disease causation and protection became easy. Thus, there was a shift in the emphasis from a blended practice which involved a dramatic disease, the effects of which were disastrous and control of which had positive results, to an understanding of disease prevention in the wider sense. The latter included diseases which were not so dramatic but which were present nevertheless, e.g., damage due to ectoparasites.

To summarize, for every problem, the solution involved evolving a blended practice by identifying the positive and negative features of local as well as external practices through the use of criteria like relevance, effectiveness, risks involved, costs, etc. The practices so evolved can be located in a matrix as in Figure 5.

Learning Strategy for Numeracy Competence

Most of the workers had been exposed to literacy and some numeracy when they were in school. However, after dropping out, their relapse into numerical illiteracy was more severe than the erosion in their reading and writing competencies. The TVW project, therefore, had to focus on building the mathematical competence of the workers. Numerical knowledge was understood at two levels:

- Number which is an abstraction.
- Mathematical concepts which involve manipulation of those numbers.

Number, as an abstraction, was not easily visualized by the people. Therefore, the pedagogy had to ground number in concrete reality. Once number was understood, concepts, also grounded in easily understood reality, were easy to grasp.

The concrete reality of the dairy cooperative had already introduced four basic concepts—addition, multiplication, averages, and the decimal system. Calculation of the total quantity of milk supplied and total income due involved addition and multiplication. The average fat percentage, on which the price of milk depends, introduced averages. In all these operations, the decimal system had to be used. These basic concepts were conveyed through appropriate aids and real-life examples drawn from the experiences of the learners. For example, a simple aid evolved with the collaboration of some of the workers consisted of a set of many short bamboo pieces of equal size. Each piece, representing a whole number, was cut up into ten equal parts, with all the parts strung together on a piece of wire. During use, each piece represented one fat per cent and, therefore, each part of the piece one-tenth of a per cent. Once, say, six different fat percentages were laid out, an average was got simply by mixing them up and dividing the lot into six equal portions and counting the value of each portion. Similar aids were developed to convey the concepts of percentage and multiplication.

The above pedagogy, then, involved:

- An expression of each concept in simple language borrowed from the concrete reality of dairy cooperative affairs.
- Communication of each concept through use of appropriate teaching aids made of locally available and familiar material.

* It may be questioned how the 'positive' aspects are to be gleaned from a world view which includes exploitative features. For instance, in certain situations, especially with women under stress (alienation), *bhagats* perform a useful role as 'psychoanalysts.' However, they also allow the possibility of "possession", leading many a times to bodily harm, excommunication, or in extreme cases, even murder. The way to deal with such a problem seems to be a process of education which tries to replace one set of beliefs about the practice with another. See for instance, the example of colostrum feeding and calf care cited earlier.

« Repeated practice by learners using real life examples.
- A planned gradation of concepts and examples for each concept on the basis of increasing complexity.
- Communication of a sense of the relevance of numeracy to daily life.

Learning through Experimentation and Observation

The experimental and innovation ethic among farmers has been noted by Gupta (1992). In the setting of a school, learning science depends very much on developing curiosity and experimentation. This, however, is compatible only with an atmosphere of freedom in which teachers and students engage in enquiry; control by the teacher is antithetical to the spirit of experimentation (Kumar, 1992). The pedagogy of the TVW project, as mentioned earlier, emphasized the importance of learning through experimentation, at both the individual and the group levels. Given the pedagogical principles of participation and promoting enquiry, the experiments were designed and conducted jointly with the workers and sometimes with the farmers. For purposes of illustration, a fodder-augmentation venture is described below.

Given the low levels of agricultural productivity, the by-produce available was limited in quantity. Growing of green fodder was constrained by shortage of land for fodder and lack of irrigation facilities. In order to understand these problems, the workers carried out certain experiments. These included:

- adding value to the main monsoon crops in the area—maize and sorghum, through intercropping with cow pea.
- trying out some of the harvesting methods learned by the workers in an established dairy training institute. These involved cutting the whole plants, allowing them to dry for a few days, tying them up in bundles, cutting the earheads, and finally drying and storing in the shade. Acceptance of this tech nology on a wide scale, however, did not take place.
- Another experiment involved comparing conser vation of green fodder as silage in both pucca silos and through the 'village pit' model propagated by the NDDB. The pucca silos had been constructed on various private *adivasi* farms by the government under an anti-poverty programme. However, al most all of them were being used as rubbish dumps. Each silo was about 32 cu.m. in capacity. Small groups of farmers were persuaded by the workers to participate in the experiment. The village pit method involved lining a hand dug pit of 1 cu.m. capacity with plastic, chaffing fodder manually and filling up the pit, using the prescribed additives of salt and jaggery. The former alternative was relatively risk free, but required more working capital and labour input. If done on a cooperative basis, one person at the village level was required to take care of the organization and distribution of produce and recovery of cost through milk revenue. The village pit method was more amenable to implementation by individual members, but risk of spoilage in any particular pit was higher. The combination of the two methods increased the availability of green fodder in the lean season significantly.

In another instance, the workers planned feed supplementation. The area had been identified by the government as iodine-deficient and hence goitre prone. Use of non-iodized salt was prohibited. The practice till then was to use the coarse granular salt made available by petty traders. During discussions with the workers, abortions of well-grown foetuses were reported as a problem in a few villages. The symptoms exhibited by the dead foetuses indicated deficiencies of certain minerals. A scientist, Dr S B Kodagali of the Gujarat Agricultural University, was invited to study the problem. This scientist was remarkable in that he combined a rare sensitivity to the economic conditions of the tribal population with an appropriate professional response to the technical problems of the area. The study, carried out by the present author and two tribal workers, W U Vasava and Kalpa T Vasava, quantified the mineral deficiencies in the area and Dr Kodagali prepared a suitable supplement as a curative input. The results obtained were encouraging and the study formed part of the doctoral research of two students. Later on, in an attempt to make the supplement a regular preventive input, the workers tried to produce the mixture in brick form through local presses. This effort did not succeed—the technology needed to be refined; in the meanwhile, an entrepreneur in a neighbouring district, who was acquainted with the efforts of the workers, succeeded in marketing bricks using a modified formula.

Many other experiments in growing fodder trees, extracting oil from *mahuda* seeds, and using the cake as cattle feed, feeding wild fruits to increase milk yield, etc. were tried out. The learning from these initiatives was incorporated into the curriculum.

Implications for Education and Research

Two strategies are commonly adopted for locating education, for science arid technology within the boundaries of traditional cultures (Layton, 1989): a) A common curriculum, irrespective of the context. This has been seen to deny access to science to the majority of learners, (b) The second approach acknowledges the importance of and tries to understand indigenous knowledge and ethnoscience. However, usually, this understanding leads to greater control over indigenous knowledge systems by 'modern' science, and hence is inherently exploitative.

These approaches result in a dilemma: "cultural congruence has usually been achieved only at the expense of debasing the currency. This is the historic curriculum trap of constructing a curriculum well matched to the clients and contexts, only simultaneous-!y to disad vantage those who follow it because of its specificity and, often, reduced status" (Layton, 1989). Responding to this dilemma is a,more "radical strategy" which sees 'modern' science as a cultural and time-specific product of the North and therefore constructs an alternative science which incorporates indigenous and external knowledges. This approach envisages 'mutually accommodating knowledge systems.' Very few science movements have tried to incorporate this perspective. This paper has presented a few examples of blended technological practices drawing upon both local and external knowledge systems and practices.

Training for Group Technologies

Examining the links between individual and collective rationality and strengthening the linkages for transferring technologies to groups have not been emphasized in the agenda for training farmers, extension workers, scientists (Gupta, 1989). Such a focus on group technologies is especially important in areas which are, ecologically speaking, high-risk, and in which markets are generally weak and reliance on indigenous institutions high. In the tribal areas under discussion, group efforts like bull management, fodder collection from forest areas, and vaccination programmes (in which *everyone* had to participate to ensure immunity cover), demand learning to locate group technologies in existing institutions or new institutions. This transfer of group technologies through embedding them in institutions demands high investment of time for evolving norms, but makes the practices sustainable. However, as indicated in the paper, the nature of buffalo ownership (private property) demands concurrent attention to individual technologies, for instance growing fodder on private land, primary health care, etc.

Content and Context of Learning and Research

As described in the section on Pedagogy, the effectiveness of learning in this project depended on an integration of three components—theoretical discourse, experiential learning, and self/other awareness at both individual and group levels. A participatory approach to learning at the group level is especially important since conceptualization of learning needs at this level helps in the application of the learning to promote group technologies and to locate them in appropriate institutions. Such efforts involve looking not just at the content but also at the context of future learning situations. For instance, it was mentioned earlier that learning was faster in areas which were exposed to effective external practices which could replace ineffective local material/cultural practices. Thus, propensity to learn becomes an important dimension of the context. Other dimensions of the context include the existing practices and institutions and also monitoring of the context itself. The latter is very important and opens up the possibility of 'double-loop learning' (Argyris and Schon, 1978). For instance, in the example of medicines and supplements for calf care cited earlier, instead of . focusing on improving efficiency of delivering medicines and feed supplements, the workers changed the design of the delivery.

Lateral learning or 'peer learning' is very often a neglected approach to learning. Encouraging good workers to conduct training sessions and share their experiences not only promotes faster learning, but also serves to recognize the quality of work put in by these workers. An additional dimension of this lateral learning is the sharing of the experiences of institutions like the market, dairy unions, insurance companies and banks, etc. (encounter learning).

The development of linkages between scientists, farmers, and extension workers has been explored by Gupta (1989). As the present paper indicates, some efforts to evolve a client-oriented research agenda are successful. However, the problems taken up have been defined in the language of the formally-trained scientists. For instance, mineral deficiencies, sterility problems in buffaloes, etc. Many others, which are in the language of local material and cultural practices tend to remain invisible. An approach which incorporates the indigenous and Western perspectives will promote reverse learning and immediately relevant research.

The content and the context of learning have been depicted in Figure 6.

Conclusions

All the 113 workers trained as 'bare-foot veterinarians' under this project had dropped out from school at various stages of primary and secondary schooling. However, the project did not distinguish between the various levels of schooling achieved since the quality of the formal education received only marginally affected learning and performance in a non-formal educational programme like the TVW project. On the other hand, certain negative stereotypes and values like 'backwardness' and low self-esteem had been internalized by the tribal youth from many sources, one of them being the formal educational system's curricular and pedagogic practices. In order to counter these, the project had to focus on the self as an important component of the learning process. This aspect of the education of the deprived was perhaps the most essential element in strategies of individual and group empowerment. It also provided an anchor for internalization of theoretical knowledge and experiential learning.

The TVW project assumed that curriculum could not be prescribed and that it had to be produced through a selection of 'valid' knowledge. Since the future clients (the cooperative members) of the trainees were clearly identifiable, the process of curriculum development drew upon their feedback; however, the teachers and the learners were the most important 'selectors' of knowledge. The local and the external knowledge systems constituted sources of 'valid' knowledge. Critical examination of the solutions offered by both these systems resulted in a major focus of the project's curriculum development—the evolving of blended practices.

Since many of these practices—disease prevention, breeding services, fodder augmentation, etc. —operated at the group level, locating them in appropriate institutions was necessary. In order to instil this outlook in the workers, their learning needs also had to be conceptualized at the group level. Regardless of this reason, group learning had its own value. Some of the methods used included peer learning, sharing of experiences, group experimentation, and learning from 'encounters' with institutions like the dairies, markets, etc. The concept of blending was equally important in determining the research agenda—what kinds of problems were to be taken, the process of research, and the utilization of the results.

As explained in the paper, the context of such learning and research was provided by the intra-group pace of learning, the application of skills as they were learned, the feedback from the clients, the propensity to learn specific practices, especially when these were superior to less effective local practices, and the development of institutions. However, monitoring this context was very important to develop the quality of reflexivity and to build a 'learning' group.

Figure 6: Content and Context of Learning

Learner Group 1: Workers
(Primary focus of TVW Project)

Curriculum
Practices: local/external
Skill training _
Numeracy competence
Values and attitudes

Pedagogy
Group/individual learning
Peer /encounter learning
Role reversals Learning from experiments

Context
Intra-group pace of learning
Practice of learned skills
Accountability to village
Feedback from cooperative

Learner Group 2: Farmers
(Primary focus of workers, additional focus of TVW Project)

Curriculum Context
Practices: local/external/blended
Application of skills Managerial practices

Pedagogy
Group/ individual approaches
Technologies and institutions
Learning by experiments/research

Context
Existing practices
Institutions
Propensity to learn
Monitoring of context

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