Technology Transfer to rural population through secondary schools : The Vigyan Ashram experience

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***Abstract*—** In this age of technology and globalization, we still see that the gap between the privileged and the disadvantaged is widening rapidly. It is necessary to multiply the pace of development by several times to achieve equality & prosperity. Use of new technologies for livelihood generation can help us increase productivity and efficiency. But there are a number of difficulties in transferring new technologies to the masses. Communities resist change due to lack of knowledge, inability to invest or take risks in trying new approaches. Also the complexities in new technologies do not inspire people's confidence. Vigyan Ashram in India has been trying to engage secondary schools as a medium of transferring new technologies to villages and demystifying them for ease of accessibility. New technologies are introduced to the students of secondary schools as a part of their curriculum and project work. The program is called 'Introduction to Basic Technology (IBT)'. 20% of the time in school is given for 'hands-on learning' of these technologies. Students provide technology based services to their own communities in practice. These technologies are learned, practiced and experimented upon, in school and the school becomes a demonstration centre for community. Vigyan Ashram has introduced more than 40 appropriate rural technologies to 92 secondary schools which in turn provide technological services to 300 plus villages. This paper will present a case of integrating school education and development programs in community. This also helps in making school education more relevant to the students. It is observed that it also helps the students in increasing their understanding of the subjects like science and mathematics. It brings down the absenteeism among school children. A number of students get introduced to their field of interest and choose their future vocation through this program. Many children came up with innovative solutions for the problems of their communities.

Keywords- *Appropriate technology dissemination, Rural Technology, Introduction to basic Technology (IBT), Development through education, Livelihood, Community Service.*

Introduction

Polak (2008) mentions that, two hundred and fifty years ago, eighty percent people in the world were just as poor as the 1.1 billion people today who survive on less than a dollar a day. Successive industrialization and technological development might have succeeded in alleviating a significant number of people from poverty across the world; however eradication of poverty remained just a dream. Most of the people in the world especially from rural and remote areas are still underprivileged and they have limited resources, skill-sets or knowledge to break out of the vicious cycle of poverty. Some parts of the world have been able to keep up with the fast pace of development but there is a huge gap between the haves and the have-nots. Although technology has the potential to bridge this gap, there are certain constraints to the percolation, distribution and universal access to new technology. A significant amount of effort is needed to impart knowledge about innovations, inventions and technological discoveries to marginalized people. Knowledge, like wealth grows exponentially. So any flaw in the distribution system of knowledge will have a visible effect on the growth of knowledge and therefore of wealth. So we see that successive waves of development bypass most of the underprivileged sections of society. In India, 25% of the population (293 million people) lives below the poverty line (Krishnan 2011). On the one hand, we are launching satellites and on the other, a large number of people go hungry to bed every night. The use of new technologies can help increase productivity and efficiency. However, difficulties in transferring new technologies to the masses leave serious gaps in our technology delivery models.

It is said that 'Technology does not discriminate between poor and rich and so it is the best social equalizer'. Therefore if we are successful in taking appropriate technology to the rural people then we can help them break out of the vicious cycle of poverty and find sustainable solutions to their own problems.

I. PRESENT PRACTICES OF TECHNOLOGY TRANSFER

It is observed that all universities and national research laboratories have a mandate to develop technology for the benefit of the underdeveloped and marginalized sections of society. It is likely that most of them are trying their best to carry out research in these directions but the fact remains that most of the researches done in these laboratories do not reach the masses.

There are various Government departments that are making efforts in propagating various technologies e.g. departments of Agriculture, Animal husbandry, Health, Water & Sanitation, Public Works (Low cost Housing), Ministry of non conventional energy sources (Solar /biogas), Rural Development (Watershed) and many others. All universities have specialized branches for these subjects which are expected to carry out research in rural technologies. There are national laboratories with specialized research dedicated to finding technical solutions to development problems. All of them claim to work for the development of the rural & poverty stricken target population. India is a big country with six hundred thousand villages. Even if these agencies made honest efforts it seems like a herculean task for them to reach every person of the target population. It is unlikely that they will be able to conduct coordinated efforts considering their specialty domains. Under such circumstances, efforts for dissemination of technology by these institutions remain limited and so does its impact.

Every year thousands of students enroll for graduate and post graduate courses. And as a part of their degree course, they are required to carry out project based on research problems. But many young students and professors are not able to identify real problems. Their project work remains merely as academic exercise and confined to paper work. Our rural areas are full of problems and every problem offers an opportunity to provide technological solutions. So the question arises: can we engage our students in process of development?

II. LIMITATIONS

It is observed in many cases that if approached directly, the target population is not ready to accept new technology. There are apprehensions, fears, myths, superstitions, unwillingness, lack of complete knowledge, lack of training and many other factors for this resistance. Indian farmers from remote villages remain untouched by the Green revolution and they stick to traditional methods of farming. Kalbag (2010) finds the target population severely handicapped to receive technological inputs due to the following reasons:

i) Lack of education – Majority of the people below poverty line are illiterate or neo-literate. They can neither retain the chain of instructions given orally nor are they inclined to write or read them. They are poorly trained in systems of measurement and have limited access to tools of measurement.

ii) Face to face training programs – This is a costly and slow process. Furthermore, identifying individuals for a particular technology is a challenge. Many a time people are not ready to leave their work place to attend the training because they lose their daily wages. Limitations of classroom training and over-dependence on the trainer are some other problems.

iii) After the training, if they want to use the technology and if they face difficulties in its implementation, there is no system for referring the problem back to the experts.

III. VIGYAN ASHRAM (VA) STRATEGY OF USING SCHOOLS AS A MEDIUM FOR TECHNOLOGY TRANSFER TO RURAL AREAS.

Kalbag (2010) suggested a transmitter-receiver concept for technology transfer. There are lots of electromagnetic waves around us. Only those people, who have the right instruments (like a mobile phone) are able to receive them. Similarly lots of technologies are generated around the globe every day; we need a receiver in every village to receive them. This receiver can communicate with the target population.

Vigyan Ashram identified secondary schools of the rural areas as receivers of the new technology. These receivers not only receive the technologies, but also innovate with them to suit the needs of their communities.

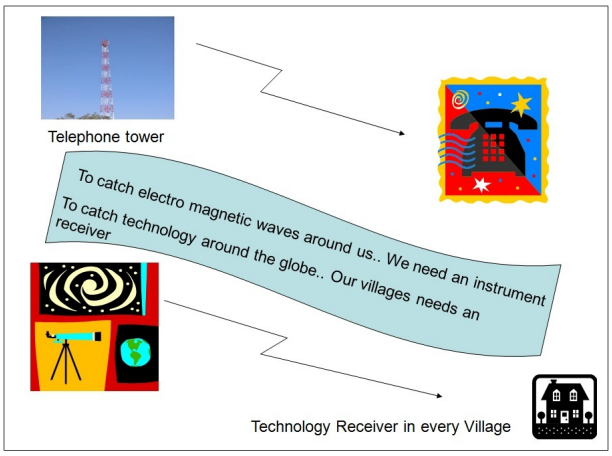

Figure 1 Transmitter - Receiver concept

IV. Introduction to Basic Technology (IBT) program

Vigyan Ashram (2012) in India is successfully using secondary schools for dissemination of technology among rural communities. It is implementing pre-vocational program, 'Introduction to Basic Technology (IBT)' in secondary schools from Class VIII-X. Various technologies are taught to students as part of their curriculum. Nature is considered as the syllabus for IBT.

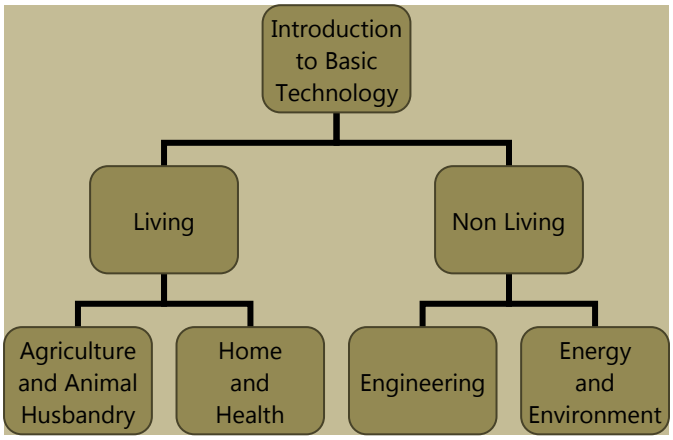

Figure 2 Syllabus of IBT program

Non-compartmentalized education and finding technological solutions for real-life problems is the crux of IBT. Students learn Agriculture, Animal Husbandry, Food technology; Health related laboratory techniques, Forms and uses of different renewable and non-renewable sources of energy, engineering methods etc. in the school curriculum through IBT. Artisans, farmers, innovators and entrepreneurs from the community are trained in new technologies and they in turn work as instructors to train the students. These instructors also provide technical services to the community as their own enterprise. Communities also get easy and cheaper access to the facilities which till now remained far from them. Underdevelopment of the community is used as an opportunity to give experiential hands on training to students. Students provide various services to the community as part of their projects. Here are some figures of Community Services during last 3 years:

Year	No. of Schools	Amount in Rupees	Avg per School (Rs)
2010- 2011	55	1435395	26098
2009- 2010	52	880351	16,929
2008- 2009	53	404640	7634

Technological solutions are experimented upon in schools and it becomes demonstrations for the community. Students become science communicators for their parents and communities. It is also observed that villagers come forward to share their problems with schools in anticipation of solutions. Presently the program is implemented in 92 schools in 3 states of the country reaching about 300 villages and more than 7000 students. Till now, Vigyan Ashram has successfully disseminated more than 40 appropriate technologies using this school system.

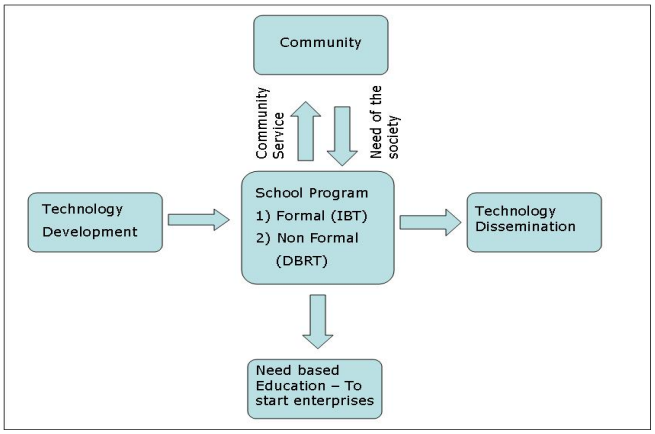

Figure 3 Model of technology transfer through schools

V. The technologies learnt by the students through IBT program in school :

AGRICULTURE - ANIMAL HUSBANDRY	ENERGY - ENVIRONMENT	Soil testing Mosquito control (Gappi Fish breeding),Making phenyl, liquid soap and selling Water testing Healthy diet, Soya milk, Blood testing
Drip irrigation, Sprinkler, Vermi composting, Vemi wash, Humidity chamber, AQUA Portal, Nursery technique, Azolla culture, Weather SMS, Seedling Tray, Vaccination Poultry, Age estimation, Rice cultivation, Crop using(SRI) Mulching, Silage Feed concentrate for animals Pest control Soil testing	Solar cooker, LED lighting ,Biogas, Soak pit, Watershed, Smokeless stove(Check dam construction), Earthing, Inverter Computer applications Plain table survey GPS	**ENGINEERING** Ferro cement, Bamboo treatment, Different Agriculture tools Ventilation – Low cost housing, Toilets, Pedal power, Fabrication Plumbing, Construction
	FOOD PROCESSING Solar drying, Food preservation, Drying of vegetables Medicinal plant cultivation	

Figure 4 List of technologies learned in IBT program

VI. CASE STUDIES ABOUT THE USE OF SOME TECHNOLOGIES BY STUDENTS TO PROVIDE SERVICES TO THE COMMUNITIES :

Biomass stove

Availability of electricity is a major problem in most of the villages of Maharashtra. Bhivadi village was also not barred from an 8-9 hour daily power cut. This caused huge economic losses to small businesses like Poultry. Poultry farmers use electric bulbs to provide the warm temperature needed for chicks to grow. A farmer from Bhivadi Village in search of solution to this problem approached the IBT School. Students of class 10th made two stoves for his poultry by researching a suitable design. He has been using these stoves for the last year and has ordered another for his relative.

Vaccination of animals

There are misconceptions about vaccinating animals among tribal communities. They fear that it reduces the productivity of the animal or that it will fall sick. In Dhule district, Government Department of Animal Husbandry trained high school students about vaccination & its benefits. With the help of these students from 7 schools, the Government's veterinary doctors could vaccinate 6449 animals (including cows, buffalos and goats) in 15 days. Children talked and explained things to the villagers and helped in restraining the animals. Some of them even got trained in administering vaccines under the supervision of the doctors.

Drip Irrigation

A farmer from Brahmanwel village placed an order with the IBT School to install a drip irrigation system on his farm. Students completed it as part of their project work. The farmer got the services at low cost and the students got hands-on training. Like drip irrigation, schools also provide services of sprinklers, mulching, vermin-composting etc. to farmers.

LED lights

A LED bulb consumes less power than conventional bulbs. IBT students in more than 50 schools have made LED torches and bulbs running on batteries and sold them to villagers at low cost. To reduce the cost of the lights they use locally available materials like coconut shells, old PVC pipes, old computer mouse etc. IBT students have sold more than 5000 such light units till date.

A few school children from Aichale village have learned electronics and started assembling inverters from kits.

Fertilizer – Improved agricultural methods

In July 2011, students of class 9th from Tandulwadi village learnt new agriculture techniques from 'Farmers Diary' published by the agricultural university. They created a demonstration plot of marigold flowers. They prepared the land, carried out seed treatments, prepared seedlings in the nursery for 21 days, used bio fertilizers and planted the plants, making sure to leave proper distance between the saplings. Based on the soil testing results, they decided on the quantity of fertilizers and also planted the plants by estimating the flowering time so that the flowers could be used during the festival seasons. No wonder they got a bumper crop! Seeing is believing, so parents and villagers visited the school to know more about it.

Nursery

Students of IBT schools in Nandurbar district learned to grow plants in a nursery. They prepared 9020 plants in June 2011 for an order placed by a local NGO and sold all these plants to the NGO. They even took out a rally in the village to create awareness about environmental issues and carried out plantation drive. Many students adopted 1-2 plants.

After seeing the success of nursery in school, a farmer Mr. Jagannath Gaikwad from Tisangi village made a nursery on his own farm with help from the school instructors.

Watershed development

Students from Gawadewadi village constructed a small dam by doing dumpy table and plane table survey. They contributed their labour to construct it. School at Shindawne got their rain water harvesting system done by their IBT students. The collected water is used by the students themselves for their agriculture class.

Sanitation

Construction of soak pits to stop breeding of mosquitoes is a regular activity in IBT schools. Every year hundreds of soak pits are made by the students e.g Botoni School made 10 soak pits this year. They also breed Guppy (local name) fish which feed on mosquito eggs. Construction of low cost and low water utilizing toilets, are also done by the students.

Testing potability of water, soil testing, blood group and hemoglobin tests are carried out in the school laboratory. Last year, Hingangaon school found out that 2 out of 4 wells in their village did not have potable

water. They informed the village council head and appropriate action was taken to purify the well water.

Food preservation

Students learn different techniques of food preservation in IBT. Drying, pickling, roasting etc, IBT students try to make different food items using local agricultural produce. Jams, Jelly, cakes, Biscuits, local snacks, (e.g. chikki) etc are always prepared in IBT schools. IBT students enthusiastically take up the responsibility of preparation of the snacks on annual function day of the school.

Schools also make vegetable dryers made of bamboo. It is very simple in construction. Schools dry vegetables in these dryers for monsoon season when vegetables are costlier. Many students tried it at home.

VII. ICT FOR DEVELOPMENT : AAQUA (ALMOST ALL QUESTIONS ANSWERED)

Vigyan Ashram found that it is necessary that these schools are linked with Technology Resource Centers as part of a problem referral system. VA in partnership with Indian Institute of Technology, Mumbai and Krushi Vigyan Kendra (Agricultural Science Centre)-Baramati has developed a portal called aAQUA **www.aaqua.org** Farmers can post their questions related to agriculture online and experts from Agricultural Science Centre address them. Students post these queries on the internet on behalf of their parents or neighbours and seek answers. Presently this system is under testing where internet is available.

18 schools have also subscribed to weather forecast via SMS. Students are given responsibility to write the weather updates on the notice boards of the village and their schools for the benefit of the farmers.

VIII. VIGYAN ASHRAM : EVIDENCE OF A CHANGE

Most of the times, technology and nature are considered to be in contrast with each other. It is believed that technology can emerge only from destruction of nature. Vigyan Ashram is successfully delivering the system of conversation and optimum utilization of natural resources along with technological development. So many everyday solutions are emerging from schools which get percolated into the rural communities.

The uniqueness of using local human resources to teach students enhances the pace of technology transfer. Since the teachers and students work together to find solutions to the real-life problems of their own communities, the gap between inventions and its utilization is reduced. Since the community is the first beneficiary of this system, it also pays back in cash for the services which give market exposure which would be an inevitable part of everyday life when these students step out into the world.

It not only provides financial gains but also dignity to the work they do. India had a social stratification system based on occupation. Even in this age of technology traces of it are seen in social systems where manual labour gets lesser 'respect' than the 'work of the brain'. IBT restores that lost respect to work and labour.

A big difference can also be seen from a Gender perspective. Both boys and girls do jobs outside their conventional gender roles in schools which also extends to their homes to a certain extent. IBT can help build an egalitarian point of view at various levels of gender, caste, class etc.

It is a creative process where all the five senses are used in the process of gaining knowledge. Multi-skill training in IBT opens up many avenues for future livelihood as well as provides choices depending on one's likes and aspirations. IBT program tries to inculcate habits of observation, measurement, analysis and documentation in the day to day work. Therefore , when students learn application of technology and develop scientific temper to look at problems it makes a huge difference in the overall thinking process of the society.

IX. LOOKING AHEAD : CHALLENGES AND PLANS

The education system developed by Vigyan Ashram is based on the principles of educating children by 'Learning while doing in real life situation'. It is useful not only for under developed communities but it has much wider application. Do-It-Yourselves movement across the globe, makers movement, Fab Lab community, STEM program in the USA and many others are trying to give opportunities to the students for working with hands.

Vigyan Ashram has the Fab Lab established by Massachusetts Institute of Technology (MIT), USA. FABLAB is a collection of set of advanced digital fabrication tool, which empowers people to make almost anything! This is a place where people can give

shape to their ideas, prototype it and test it. IBT program promotes the same spirit of Fab labs or D-I-Y communities with basic tools.

Vigyan Ashram has the biggest challenge of not getting narrowed down for the IBT program merely as vocational or skills training program on rural technologies for children from under developed communities.

Mahatma Gandhi in his idea of 'Basic Education' gave emphasis on 'Socially useful productive work' as a pedagogical medium of education. In his concept of education, all curricular subjects including social science, languages, science and mathematics should be taught in an integrated way by actually involving students in 'productive work'.

Gandhiji's idea of education coupled with Socrates' method questioning everything, will form a new method of education that will spur development from the grass-roots.

Vigyan ashram has demonstrated the effectiveness of the program in more than 92 schools. But there are more than 2 million high schools and 6 million villages in India. Challenge before VA is to demonstrate the replicability and effectiveness of the system in different geographical and cultural area of the country. Ultimately the goal is universalization of the program for the benefit of the society.

X. CONCLUSIONS :

Vigyan Ashram has demonstrated a model to integrate rural development efforts and education and thereby effectively achieving sustainable development. The program shows that real development is the development of intelligence. Therefore to train people find solution to their own problems, should be the main consideration for any development efforts.

People know what is best for them, what can work in the given situation and how to sustain that solution in their own socio-cultural milieu. It is the best way to train people in developing their own problem-solving methods. IBT program tries to engage students in the continuous process of formulating a hypothesis, experimenting with it, testing it, developing a prototype and adopt the technology as required.

Schools become the laboratories for community. In a number of villages, the community has come forward and contributed to start IBT in their schools. Teachers are the local artisans so the transfer of technology is quicker and more efficient. The community gets technological services and artisans their livelihood.

This program also makes education more relevant. It has a connection to the daily life of children and the community so schools do not become redundant. They do not remain as some institution where students are forced to go to because some law is in place. This system shows reduction in the rate of school dropouts as well as it increases understanding about curricular subjects. Also, it does not make the knowledge distribution merely learning by rote where students lose all their liveliness and become passive absorbers of textbook information. It makes them self reliant, analytical, interdisciplinary and realistic.

The transfer of technology through schools not only helps in reaching the most advanced technologies to the most marginalised sections of society but it also demystifies science and technology for easy access by those who truly need it. It creates a self reliant, skilled and confident young person who is ready to take up the challenges which life throws at him / her and also to serve their own community with a sense of responsibility and ownership.

XI. ACKNOWLEDGEMENTS

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XII. REFERENCES

[1] Polak Paul (2008), Out of Poverty, New Delhi, Tata McGraw-Hill

[2] Kalbag (2010),Selected essays of Dr.S.S.Kalbag on Education, Technology & Rural Development, Pune, Vigyan Ashram

[3] Retrieved from www.vigyanashram.com on 25th April 2012

[4] Krishan Khanna (2011), Transforming India, Mumbai, i Watch