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Practical education for environmental awareness: education children on the arsenic contamination issue in Bangladesh

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Abstract: This paper aimed to report the findings of an experimental education project designed to address the arsenic awarness issue in Bangladesh. The project successfully build up a useable education model: while it generated some immediate and actual benefits. As such the model/process that has been developed through this project may be reciprocated elsewhere for its sustainable use and long-term benefits.
Key words: Education, environmental awareness, arsenic contamination.

Introduction

The arsenic contamination of groundwater is one of the main environmental issues in Bangladesh, and about 38 million people are currently at risk (Tani, 2005). It stems from excessive irrigation practices that are intended to prevent the spread of dysentery and cholera through stagnant pond water, and to enable poverty reducing crop cultivation in the dry season. It could be said that, ironically, efforts to secure supplies of safe water have caused even more serious water pollution issues. One of the most effective measures for keeping water safe is to provide villages with deep tube wells, however there are insufficient funds to endow all villages with this resource. Since arsenic contaminated water can still be used for some agricultural purposes or other livelihood activities, distinguishing between water that is safe for drinking and water that is only appropriate for other usages has been a priority. Furthermore, some research by the Bangladeshi Government has revealed that people who receive sufficient nutrition are less affected by arsenic poisoning.

Bangladeshi governmental and non-governmental organizations have conducted water tests to identify the areas and individual tube wells known to be contaminated by arsenic, and have painted the affected wells in red and the arsenic-free wells in green (MoLG, 2004). Fig. 1 shows the areas where ground water has been contaminated with arsenic. Research has shown that the southern low-lying areas have been particularly affected.

This paper is going to report on an experimental environmental education project designed to address the arsenic issue in Bangladesh. The project aimed to build a practical educational model that would provide children with knowledge of the issue, whilst simultaneously promoting the need for "a healthy body to avoid the arsenic affect" by motivating them to adopt proper eating habits. The project has two main purposes: (i) To give children the knowledge they need to avoid, or build their resistance to crucial environmental issues in their living environment, (ii) To build a comprehensive model of enlightenment education for school teachers and children through a participatory workshop method.

Implementation System of the Project

Four primary schools, located in the Barisal district, an area seriously affected by arsenic contamination, were chosen for the experiment. These were built and managed by a Bangladeshi NGO named Basic Development Partners (BDP), and have received economic support from Japanese NGOs. BDP has provided non-formal primary education in Bangladesh since 1990, particularly in remote areas. Now they have 74 schools in six administrative areas, and 29 of them are in the Barisal district. BDP selected the four target schools for this project from amongst this group.

The project team, named "Water Smile Project (WSP)", comprised a researcher (myself), BDP staff, several school teachers, and a few Japanese volunteers from JAFS (Japan Asia Friendship Society), which is one of BDP's donor agencies in Japan. The project receive the financial support from Ajinomoto Ltd.

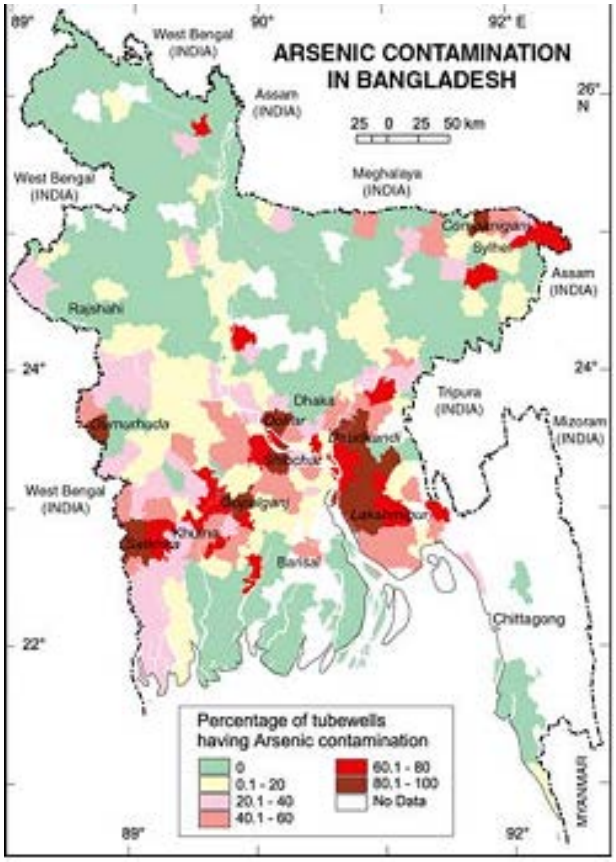

Fig. 1. Map of Arsenic Contamination Area
Source: Banglapedia

The project had three main stages, with the latter two experimental practices based on research gathered during the first stage;

i) Participatory research and establishing the children's life environment.
ii) Making teaching resources to provide children with the appropriate knowledge and motivation to discuss their water utilization.

iii) Promoting proper nutritional habits for improved health through the provision of vegetable seeds.

Fig. 2. Research and Mapping Chart

Plate 1. Completing the chart

Participatory research and establishing the children's life environment:

For the first stage, the project team conducted research on the children's life environment, with the help of the children, and established the level of their knowledge of arsenic. This research was intended to give the researchers an understanding of the children's living conditions, and also to make children more aware of their own environment. We divided ourselves into several groups, each group consisting of 10 children from classes 4 and 5, their teacher, a BDP member of staff, and two Japanese members. They visited children's homes and completed the research mapping chart (Fig. 2 and Plate 1). In total, 48 sample swere collected from our research at the four target schools.

The chart has six main parts:

i) Basic information about the family (family members, income, micro-credit[1] use)
ii) Children's everyday routines
iii) Food (contents of meals based on the previous day's lunch and dinner, and the current day's breakfast)
iv) Home garden and livestock
v) Water utilization, and the number of steps from the house to the pond and the tubewell used by the family
vi) Knowledge about arsenic and common associated illnesses.

Plate 2. Taking photos of their own living environment

On the back of the chart, the children drew the layout of their house. They also took photos of whatever caught their attention, such as their house, their home garden, or their livestock (Plate 2). These activities encouraged the children to take note of their living environment, and things they usually paid no special attention to.

The research clarified four key points:

First, most of the children's families use a Micro-Credit program (MC), and have loans significantly in excess of their income. Of the 48 families, 46 use MC and owe approximately five times their income (the average income is 3,095 Taka, whilst the average debt is 17,015 Taka). Some families have accumulated debt from more than one NGO.

Table1. Fruit and Vegetables from Home Gardens

gourd	balsam pear	pumpkin	*chichinga*	radish	*kakkuro*	potato	*kochu*
10	2	6	4	1	2	1	2
okra	root clump	egg plan	basil	*data*	*lalshak*	*shapra*	chili
3	1	6	13	2	7	1	5
guava	grapefruit	mango	jackfruit	litchi	papaya	coconut	banana
21	6	22	14	8	24	27	7
tal	pomegranate	*bel*	lemon	*gup*	*pam*	*amra*	palm
1	1	2	3	1	1	3	6
wheat	betel palm	blackberry	jute	nut	vegetable	fruit	none
1	1	6	3	4	(1)	(1)	(8)

Table 2. Contents of Meals

Foodstuff	wheat	rice	potato	dhal	meat	fish	egg	milk	vegetable
Breakfast	9	29	20	5	1	3		1	1
Lunch		29	6	14	2	20			2
Dinner	2	23	3	11	1	14	1	1	2
	pumpkin	*shapra*	papaya	coconut	spice	basil	*zira*	onion	turmeric
Breakfast			1		13			7	12
Lunch	1	2			17	4	2	12	17
Dinner	1	2		1	12	1	1	12	10
	chili	garlic	salt	oil	cinnamon		tea	sugar	
Breakfast	13	5	17	11	1		4	3	
Lunch	15	4	23	18	2				
Dinner	14	5	14	10	2			1	

Table 3. Water Utilization

Water	Tube well	Pond	Small Pond	Big Pond	River
Drink	44	3	0	1	0
Cook	5	39	0	0	4
Wash Dishes	3	40	2	0	2
Wash Clothes	3	40	1	0	3
Toilet	5	38	2	0	2
Livestock	6	34	2	1	4
Bath	7	36	1	0	3

Table 4. Common Disease and the Treatment

Common Disease	cold	fever	cough	headache	stomachache	earache	toothache
	22	43	25	8	10	1	2
	loose bowels		tear	numbness	hand-foot pain		breathe difficulty
	5		1	1	1		1
Solution	Doctor		Medicine	Natural Medicine	Shaman		ORS
	44		2	1	1		1

Second, although people cultivate several kinds of fruit or vegetables in their home gardens (Table 1), the children seldom eat them (Table 2). One reason is that they are often grown as cash crops funded by MC loans, with the result that the families often sell them to buy essential goods such as rice, salt or oil, or to repay their loan, rather than eat them.

The third point is about water utilization. The families have already stopped using the shallow tube wells which have been contaminated with arsenic. Instead, they get general-purpose water from the ponds (Table 3) that are located nearby most houses, and undertake longer trips to deep tube wells for drinking water. Since the number of deep tube wells is limited, and it is inconvenient or hard for most villagers to source water from there[ii], they reserve deep tube well water for drinking only. Of the 48 children in the research, 30 confirmed that their main chore at home was fetching water from the tube wells.

The last point is that the children's knowledge of arsenic exceeded our expectations. As the third point illustrated, they were already distinguishing between water suitable for consumption and for general usage, and people seldom suffered from arsenic-related illnesses. Ailments which were more common are listed in Table 4; these included colds, fevers or coughs which caused by a weak constitution, rather than infectious illnesses, such as diarrhoea, from contaminated water.

The findings indicate that the arsenic contamination is not only an environmental issue, but also related to their economic and social situation. The results were shared with BDP staff and the schools' teachers, to help determine what types of teaching materials were needed to make the children more aware of their living environment, and to motivate them to consume a more balanced diet.

Teaching materials to inform children about their environment

As mentioned above, the families have faced a sequence of issues; the spread of shallow tube wells prevented the contraction of infectious diseases from pond water, but introduced the new danger of arsenic contamination. Consequently they had to shift their supply of water once more, from the shallow tube wells to the deep tube wells. Similarly, whilst the Micro-Credit program has improved their economic situation in some ways, it has also turned their home-grown vegetables into cash crops intended for sale rather than for their children's mouths. These issues have not arisen through the any particular individual seeking to gain an advantage, but rather occurred in the pursuit of programs intended to benefit the public as a whole. Therefore, rather than seeking to proportion blame or find a single cause, it is more important to focus on improving the capacity of the public to adapt to new problems in their living environment. The project therefore focused on encouraging children to consider what they could achieve by themselves, rather than having to depend on information they are given.

One BDP staff member, who was from a village in Barisal, recounted his experience from his childhood, which provided the central idea for our project;

When I was a boy (he is now 52 years old), there were two ponds in my village. We used one pond to get drinking water, and the other for everyday tasks, like washing clothes, bathing, or for our livestock. Both ponds were shared within our community, and everyone kept the pond for drinking water clean and did not use it for anything else. However, if one of the villagers got an infectious illness, everyone avoided using the pond and children were sent to stay with relatives. They knew that there was a risk of being infected if they used the pond, and many of the illnesses in those days were fatal.

In order to tackle dysentery and *E. coli*, and to support the green revolution, irrigation facilities and tube wells spread through out the villages, and people no longer drank water from ponds. The shallow wells became the common source for water among the villagers, and in addition to reducing the risk of contracting infectious water-borne diseases, made it possible for people to cultivate rice during the dry season.

However, the arsenic problem then arose. People couldn't go back to using the ponds anymore, because they thought; "the pond water smells too bad to drink." They had stopped using different ponds for different purposes. Consequently they began shifting to deep tube wells, but this costs more than they can afford by themselves.

A proposal was developed to create a picture-based story that would represent the history of water in the region, and become a teaching resource that would provoke thoughtful discussion amongst the children. A workshop approach was chosen to produce the material, involving all 20 teachers from the four target schools.

At first, the project members discussed the plan, drafted a story and sketched pictures based on the history of water in the area. Then the teachers decorated the story and created detailed illustrations for each scene. Two teachers worked on each scene, and nine pictures were then selected to form the basis of the whole story, entitled "Story of the Ghosts Living in Water." Since children in the villages like and are familiar with ghost stories, we decided to person if the arsenic and associated diseasesas ghosts. The material was intended to provoke children into thinking about how they could deal with "the ghosts."

After revising the story and the pictures produced by the BDP teachers in the workshop, we tested the final product to evaluate how effectively it would convey the story tochildren. The teachers tried telling the story to some students to check if they could understand it or not. The story does not have a conclusion, but is open-ended in order to generate discussion in the classroom about what children could do about this issue by themselves. Some options are suggested, such as; thinking twice before reusing pond water, gathering and filtering rain water, keeping their environment clean, or eating a more nutritious diet to maintain their strength.

This particular story making process is significant for two reasons. First, the story was based on their own history, not dependent on knowledge of external or distant events, so that the children find it easy to understand that the problem is relevant to them. The other point is that the participatory workshop gave the teachers a sense of ownership over the resources, making it easier for them to use it in their classroom.

Vegetable "Seed Project" for improvement of children's nutrition

Our research and map of their living environment revealed the need to provide children with a guide to maintaining a properly balanced diet. This could also be considered one of the measures they could take to protect themselves from arsenic poisoning, as a well-nourished body has a better chance of resisting the effects of arsenic. Our storybook therefore included suggestions for building a stronger, heal thier body: "Vegetables and fruit have ingredients that keep your body in good condition. If you eat vegetables and fruit, you will be healthy and well, and your body will be strong enough to protect you from the bogey."

The project team, including the school teachers and the BDP staff, discussed ways to address this issue, which led to the "seed project". The project provided children with vegetable seeds and urged them to grow it at home and to eat the vegetables by themselves. The WFP (UN World Food Program) provided the children with biscuits at school, but temporarily providing food has a limited effect on the children's ability to improve their own nutrition. Creating sustainable habits that they could practice by themselves are needed. We supplied five kinds of vegetable seeds for the school children to plant in their garden at home for their own consumption. Since they would be able to get more seeds from their own crops, or could buy more quite inexpensively, the children could continue this practice without the need for continued project support.

Fig. 3. Worksheet of 'Seed Project'

Plate 3. Vegetable grown by children
Note: The low area of Barisal is often damage by floods, but they utilize the water flow to develop their cultivation system in the water

Usually children just help out in their family garden, seldom taking on the responsibility of growing anything themselves. But if they plant the seeds which they get from school and cultivate the vegetables by themselves, then in their cultural context, their parents would never sell those vegetable without the children's consent. The children could therefore eat those crops. At the same time, in addition to supplying the seeds, the teachers could also motivate the students to attend to the cultivation of the crops, for example, by setting assignments to report on how much they have grown, or by creating a competition to see who can raise the biggest pumpkin. The project assigned students an observation sheet to complete on vegetable growth (Fig. 3). One BDP member of staff said that, as Bangladesh is an agricultural economy, it is important for children to be familiar with cultivation.

Children at first planted the seeds in small pots, and then replanted them intheir garden at home (Plate 3). Their parents taught them how to do the planting.The BDP staff and the teachers pointed out the significance of this, explaining that the roles had essentially been reversed; instead of the children helping their parents at home, the parents were now helping their children. Although most parents had little experience of going to school by themselves, and could not help their children on many school matters, they were quite used to agriculture. This would be first time that parents had been able to help their children with their "homework". The significance of the seed project therefore includes the transformational effect it has had on family roles, and the way in which it has brought school and home closer together.

Fig. 4. Harvest Party at School

At the end of the project period, the children brought their crops to school and cooked and ate them together (Plate 4). The benefits of the project will be achieved if the children become accustomed to both cultivating and consuming the vegetables, something that must be viewed in a long-term context.

Conclusion: Repercussions as an educational model

While this project aimed to build a useable educational model, it generated some immediate and actual benefits. We focused on only four target schools, however other schools nearby soon expressed disappointment at not being included in the experiment. It means that the project generated some interest and consequently some benefits for them, just through the process of our experimentation. Outcomes such the story book and the seeds bank can be shared with other schools of course, but the process of this project should also be shared and reproduced; ensuring that the beneficiaries, in this case the teachers and children, also participated in the process and contributed to the project is a very important part of the model. If our workshop method, or the way in which the story book was created, could be adapted to other educational practices and other issues, then this experiment would be established as amodel for other projects. Therefore, we progressed carefully through the project stage by stage, and recorded the process in "The WSP News Letter", published six times in total, once for each stage of the project.

Our next challenge is to take into other schools this educational practice and the materials that were created, in order to address this issue else where and to improve their situation. Also, the model/process that has been developed through this project should be applied to other objectives.

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References

Tani, M. 2005. Rural Life and Arsenic Contamination: from Bangladesh village (in Japanese). Kyushu University Press.

Ministry of Local Government, Rural Development and Co-operatives. 2004. National Policy for Arsenic Mitigation. Bangladesh Government, Web port.

Neela, *et al*. (eds). 1997. Learning to Share 1: Experiences and Reflections on PRA and Community Participation. Concept Publishing Company, New Delhi.