SETTING THE BALL ROLLING: DEVELOPMENT OF A SCIENTIFIC AND TECHNOLOGICAL LITERACY CURRICULUM GUIDE FOR MULTI-AGE AND SINGLE-TEACHER GIRLS' ELEMENTARY SCHOOLS

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The paper describes the use of balls for development of scientific and technological literacy among rural girls in single teacher multi-age primary school setting. For these schools curriculum guidelines were developed in a participatory manner by the teachers (N=18) in the workshop mode to help them develop and transact hands-on activities using balls to get a feel for processes of science and low level technology. The outcome of the workshop has been in the form of a validated teacher training and support design for the scaling up of the curriculum transaction and empowerment of teachers to carry out the school-based initiative in developing scientific and technological literacy among rural girls. The participating teachers have reported positive reactions toward the activities and opined that the use of balls for scientific and technological literacy has helped in reducing sex-stereotype perceptions of science learning among the rural communities

INTRODUCTION

It is a common observation that most infant and primary schools in India do not impart hands-on science experiences to students; neither in a structured nor in an unstructured way. Elsewhere, such experiences are imparted with the help of the activities with the materials that have become hackneyed because of their use over the years in the same fashion. Therefore, a need was felt to introduce different materials for the hands-on and play-way experiences to infants in the pre-schools and children in multi-age lower-primary schools. Also, the scope of developing scientific and technological literacy needs be explored among children in this scientific age.

The main objectives for hands-on activities for elementary school children are as follows:

1. To provide opportunities for learning as they arise from the child's own play activities.
2. To impart experience in elementary manipulative skills in handling simple materials.
3. To satisfy the child's curiosity by developing his observation and exploratory powers.
4. To stimulate interest in learning and foster creativity.
5. To build up confidence of the child in handling new situations.
6. To help the child in recognizing patterns and relationships.
7. To increase the vocabulary of child and improve his or her oral communication.
8. To impart scientific and technological literacy.

Though the materials like sand, water, clay and pebbles are being used at the pre-primary level, yet it is always worthwhile to look for new materials for imparting hands-on and manipulative experiences to children for developing their scientific literacy.

There is no doubt that every new batch of children love to play around with sand, water, clay and pebbles. But it is often worthwhile to look for the new materials for hands-on experiences and conceive the related activity ideas.

METHODOLOGY

A curriculum development workshop was organized in summer of 2003. There were 18 participants from the UNICEF - supported schools called Pehchaneshalas. The workshop was residential and was held at the resource centre of the NGO which is providing teacher training and back-up support to Pehchanshalas. Pehchanshalas are the multi-age schools in remote areas of rural Rajasthan. The teachers had earlier received forty-day training in multi-grade teaching to implement multi-level classroom instruction through graded worksheets and activity cards. Also there is a strong mechanism of providing back-up support to these teachers through school visits and fortnightly review workshops.

For the two-day curriculum development workshop, three sessions were organized each day with each session lasting for one-and-a-half hours. Brain- storming, group work, sharing of information and knowledge construction strategies were employed. Everyday, a short review session for the activities done in the sessions was also organized. The material for the workshop consisted of 15 balls of different kinds, card sheets, newsprint sheets and sketch pens.

THE CURRICULM GUIDE

The main outcome of the workshop was in the form of curriculum guide describing the curriculum in two ways. First, the age group-wise activities got identified to work as curriculum guide as shown in Table 1. Secondly, the activities in various age groups were appropriated.

S.No.	Stage	Age Group	Activities
1.	Infant	3+to4+ years	Dropping balls; throwing balls; kicking balls; rolling balls; feeling balls; fitting balls into holes; bucketing the ball (a fun game); spinning balls; throwing and catching the ball; pairing balls; comparing balls.
2.	Lower Primary	5+ to 8+ Years	Ordering balls; classifying balls; bouncing balls; making a ball pyramid; transferring balls from one container to another; rolling balls on different surfaces; rolling balls down an inclined plane; timing of bouncing balls; making a paper ball; making a cloth ball; making a rubber-band ball; putting balls into water; tapping the ball; balancing the ball; swinging the ball.

3.	Primary	9+ to 11+ Years	Investigatory projects with balls to find relationship between the following variables: dropping height vs. bouncing height; rolling time vs. inclination of plans; rolling time vs. nature of surface; angle of drop vs. angle of bounce; throw vs. distance etc. Low-level technology with balls: ball bearings; ball and socket joints; ball wheels; ball-pen; ball cock; ball valve; ball-mill.

Table 1: The curriculum guide with hands-on experiences with balls at the elementary school level

Another aspect that got high-lighted in the workshop, which was to be kept in mind, was moving from unstructured concrete experiences to structured experience as the child moved from pre-education to primary-education stage. At the pre-school stage, the child should be allowed to play around with the ball freely along with doing some directed activities which needed to be used as talking points with children. On the other hand, at the lower-primary stage structured hands-on activities should be introduced slowly so that children could make and interpret simple observations. At this stage, no written work should be given to children and the sequence of 'do - observe - interpret - talk back' was agreed to by the participants. While at the primary stage, activity sheets should be used and children be asked to record observations interpret the results and look for applications of balls in daily life situations. It was also decided by the participants that, with the help of the above - listed activities, oral instructions should be given to children for doing activities at the pre-school and up to grade three primary children. Thereafter, activity should be transacted in the school. The children up to grade two were given experiences through oral instructions and under the guidance of the teachers since children's comprehension of written scientific language does not mature till then. For children of grade levels three to five worksheets were prepared (Table 2).

Activity
Investigating bouncing of a ball.
Directions
1. Work in a pair.
2. One child should hold the ball against a wall and mark its height.
3. She should drop the ball.
4. The second child should observe height to which it bounces and put a mark there.
5. The two heights be measured using a scale and recorded.
6. Repeat the activity from 5 more heights.
7. Draw the conclusion.

Table 2: A sample activity sheet

OUTCOMES

The two main outcomes of the workshop were as follows:

1. A curriculum guide for transaction of activities in a multi-age group learning situation of developing scientific and technology literacy among rural elementary school girls.

2. Simplicity and ease of implementation since activities are centered around one type of material, that is, balls.

Since it was a small group of teachers and training was participatory in nature with a built-in mechanism of review of sessions, the reactions of the participating teachers were asked in a written format. Some important typical comments of the teachers were as follows:

1. Since we have developed this scientific and technological curriculum guide ourselves, we have now a sense of ownership for it and a commitment to implement it.

2. Through this workshop the process of curriculum development has been demystified. Implementation can be done by combining an activity with a concept.

3. We could generate a lot of ideas for hands-on experiences centered around a single object. Along with production of the curriculum guide, it was a valuable exercise in divergent thinking.

4. This workshop has provided me a new material to work with along with the already known activities. Now I can provide more variety in hands-on activities.

5. In the rural situation, generally boys are allowed to play with balls and girls with dolls. This curricular input will help reducing the gender bias in social life.

Thus, some of the innovative feature of this initiative are: use of a single material for many activities (simultaneous integration and divergence); added variety; built-in aspect of teachers as curriculum developers in science and technology; suitability to vertical grouping in multi-age schools; and shift towards gender equity in science and technology learning and social life.