

# TEACHERS' UNDERSTANDING OF NATURE OF SCIENCE AND THEIR VIEWS ABOUT THE PRIMARY SCHOOL ENVIRONMENT STUDIES CURRICULUM

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*Generally there is a gap between the environment studies curriculum and its implementation in classrooms. The present study is aimed at learning about primary teachers' understanding about the nature of science and their views regarding the environment studies curriculum. A sample of 13 teachers from 2 Municipal Corporation schools in Delhi (MCD) filled a questionnaire (6) or were interviewed (7) on the same. Most teachers understand the nature of science as "scientific attitude or ways of thinking". They preferred exploratory learning based text-books to activity based text-books for environment studies. Most teachers were positive to the activity based teaching methodology but stated that the materials required to perform activities mentioned in text-books, should be provided in schools. Teachers reported that in MCD schools, most teachers do not get opportunities to attend science seminars. Teachers had a lot of confusion regarding evaluation in environment studies and were divided on whether science should be taught as a separate discipline or as environment studies. The study can be helpful to curriculum designers and text-book authors.*

**Keywords:** Nature of Science, Environment studies, Primary school teachers

## INTRODUCTION

It is generally observed that researchers and authors carefully prepare text books for science or environment studies in accordance with educational policies about curriculum, but when it comes to the implementation of these in classrooms, the theme behind a particular curriculum is nowhere realised (Wood & Lewthwaite, 2008). Factors such as teacher beliefs, knowledge, attitudes and competencies are critical agents to successful science program delivery (Lewthwaite & Fisher, 2004).

Teachers play a very crucial role in the implementation of the curriculum in classroom and also have their own views about science, environment and the curriculum. (Wahyudi & Treagust, 2004; Wang, 2004). There is presently much dissatisfaction with the levels of teachers' understandings of nature of science (NOS) (Lederman, 1999). Pre-service teachers' views about the NOS according to Nuangchalerm, (2009) can

be presented in terms of (a) knowledge construction; science as a subject that studies natural phenomena, as a body of knowledge, as enquiry process, as a thinking process and science as a description of moral and ethical issues (b) in terms of process of knowledge construction; observation and experiment lead to science if these are not present there is no science (c) in terms of scientific enterprise; relationship between science, technology and society.

As defined by the Columbia Encyclopaedia (1963) and cited by Siddiqui and Siddiqui (2005), "*Science is an accumulated and systematised learning, in general uses restricted to natural phenomena. The progress of science is marked not only by an accumulation of facts, but by the emergence of scientific method and of the scientific attitude*". According to this definition, three basic principles of nature of science are identified and these were the basis of analysis in this paper. They are: (a) an accumulated and systematised body of knowledge (b) a scientific method of investigation (c) and scientific attitude.

In South Africa, the primary school curriculum focuses on NOS as a learning outcome under the natural sciences learning area (Linneman, Lynch, Kurup, Webb, & Bantwini, 2003). In the National Curricular Framework (NCF) (NCERT, 2005) of India, at the primary level of schooling, environment studies as a subject is developed by integrating science and social studies. According to the NCF (pp. 42-43), "*At primary stage the child should be engaged in joyfully exploring the world around and harmonising with it. The objectives at this stage are to nurture the curiosity of the child about the world (natural environment, artefacts and people), to have the child engaged in exploratory and hands on activities to acquire the basic cognitive and psychomotor skills through observation, classification, inference, etc; to emphasise design and fabrication, estimation and measurement as a prelude to development of technological and quantitative skills of later stages; and to develop the basic language skills: speaking, reading and writing not only for science but also through science. Science and social science should be integrated as 'Environment studies'*".

## RESEARCH METHODOLOGY

**Sampling, Tools and Administration:** A convenience sampling method was used to select two Municipal Corporation Schools in Delhi (MCD), where some contact already existed. Eight teachers were drawn from one school and 5 from the other. A questionnaire was prepared that was filled by 6 teachers while 7 teachers were interviewed by the researcher using the same questionnaire. Details of the teachers are given in Appendix. Of the 13 teachers, 5 were female and 8 male, their ages ranging from 22-55. All the teachers taught all the subjects in a class and only four teachers had a science background.

The interview proforma-cum-questionnaire had open-ended questions related to: teacher's understanding about NOS, teachers' sources of information about implementation of new curriculum of environment science, teachers' views about the new environmental studies text books, (which are based on exploratory learning), the methodology of teaching they would prefer to use for a selected chapter, their ways of comparing environment studies text-books based on activities v/s those based on exploratory learning, the relationship perceived between methodology described in the textbook and questions asked in examinations and teachers' perceptions about good science teaching. The content validation was done with two subject experts and one language expert.

The question paper used in one of these schools (School 2) for final evaluation of students in environment studies was also obtained. This paper was used to provide insight into teachers' perceptions about the relationship between the methodology described in text-books and the actual test-paper. The environment studies text-book (Class IV) being used in MCD schools is '*Aaspas*' -Looking Around (NCERT, 2009), while the earlier class IV Environment studies text-book was '*Khojen Aaspas*' -Searching Around (SCERT, 2004). These two books were used to get comparative views from teachers about activity based environment studies curriculum (earlier curriculum) and the exploratory learning based text-books (present curriculum).

The book '*Aaspas*' is developed by National Council of Education Research and Training (NCERT). The book is based on the guidelines of NCF 2005, following its recommendation to "link children's life at school to their life outside the school". School principals and teachers are expected to "encourage children to reflect on their own learning and to pursue imaginative activities and questions". The foreword reports that it is "giving priority and space to opportunities for contemplation and wondering, discussion in small groups, and activities requiring hands-on experience".

'*Khojen Aaspas*' was the earlier book used in all the primary schools run by MCD, and Delhi Administration. The book was developed by SCERT, Delhi, and published by DTB, in

accordance to the National Policy of Education, 1986. Other institutions that had helped in development of these books were Eklavya, Bhopal, Homi Bhabha Centre for Science Education, Mumbai, and Centre for Science Education and Communication, Delhi. In the preface, the book states that, "*teachers of small children will feel that these books, minutely embrace children's psychology and daily experiences, communicate knowledge of different subjects in an active manner... In writing these books, special attention has been given to children of weaker classes, especially girls. Through simple activities an attempt has been made to link knowledge about language, mathematics, science and social studies to natural activities of children. The text-books will play a major role in implementation of policy of making education interesting and effective*".

To select a chapter to interview teachers, the criteria chosen was the explicitness of activities suggested to students in the text-book of environment studies '*Aaspas*' (Looking Around). It was found that the chapter-1 '*Chalo Chalen School*' (Going to School), chapter-19 '*Jadon ka jaal*' (Web of Roots), and chapter-25 '*Chatpati Paheliyaan*' (Spicy Riddles) requires children to perform certain activities that can be done in school. Out of these, the chapter-19 '*Jadon ka jaal*' (Web of roots) was selected. A list of materials required for performing the prescribed activities in the chapter was prepared by the interviewer, such as, textbook, trees, shrubs, glass, cotton, rubber-bands, thread, seeds (pulses or wheat or mustard or gram etc.). It is to be noted that the materials required by the chapter were those of daily use, and are expected to be available at general stores. The lists were obtained because teachers often state that activities are not conducted as materials are not available in schools.

The interviews with six teachers were conducted inside School 1 during the distribution of mid-day meals. Each teacher was interviewed at a time, inside classrooms. Five teachers allowed the interviews to be audio-taped, while 2 teachers wished to fill the questionnaire themselves. One teacher was interviewed outside the school premises, at the teacher's home and this was audio-recorded. In School 2, questionnaires were filled by 4 teachers. All teachers knew that the researcher was also a teacher in an MCD school. Before beginning the questioning, the interviewees were told "*generally teachers do not get opportunity to give feed-backs on text-books. So, through this interview we have an opportunity to do so. The purpose of this interview is to find out the suitability of methodology described in science text-books.*" The teachers were requested to read the chapter '*Jadon ka jaal*' (chapter-19) from the book. This was followed by responding to interview or the questionnaire.

**Responses to Teachers:** The responses to the question, '*Aapke anusar vigyan kya hai?*' (What according to you is science?),

suggest teachers' ideas about NOS could be placed in more than one category (Table 1).

|  |                           |
|--|---------------------------|
| Science as scientific method of investigation: Process of obtaining knowledge, study through observation, studying actions and reactions happening in human life   | 2 teachers, T-9 & T-11.   |
| Science as accumulated and systematised body of knowledge: Discovery of truth; based upon facts, systematic knowledge about physical, chemical and biological things around us   | 2 teachers, T-8 & T-13.   |
| Science as scientific attitude or ways of thinking: Understanding through reasons, with depth, through logic, understanding environment, argument, study through creativity, logic, simplification, art of innovating, obtaining novel knowledge, knowing about environment around us and how to deal with it, knowing about causes of changes | 10 teachers, T-2 to T-12. |
| Science different at different levels of learning: For children whatever is occurring around them is science, while for elders this is social studies.   | 1 teacher, T-1.           |

**Table 1:** Teachers' ideas about NOS

An excerpt from a response by a teacher to this question is as follows;

*Excerpt 1 (T-9): Science is "...understanding the environment around us, whatever actions and reactions happen in human life from birth till death; studying them".*

The second question tried to probe the sources of information for teachers about implementation of new curriculum of environment studies, '*Aapko vigyan ki nai kitaabon ke baarey mein sabse pehle suchna kaise mili?*' The responses were: school principal (5 teachers) and MCD Book store (2 teachers). The other responses were given, each by one teacher; other teachers, learnt about it when the books arrived, during teacher training in DIET, while teaching in Central school, newspaper, seminar. One teacher remarked that no seminars were organised in MCD schools before introduction of new text-books.

Question 3 aimed to get insights about teachers' views related to the new text-books of environment studies. '*Vigyan ki, kaksha chaar ki nai pustak ke baare mein aap kya sochte hain?*' There were positive views by 13 teachers, such as; information provided in interesting way through stories, is appropriate for children at this stage and mental capacity, is in accordance to mental and social level of students, learning through play way, observations and learning by doing; is a scientific approach, promotes easy explanation through stories and events related to present life, promotes self construction of knowledge and process of learning, examples of daily life highlighted in a simple form, minimum level of learning can be achieved, emphasises

learning by doing, gives complete knowledge about environment, quality of information is high, provides information through pictures, drawings and stories.

Negative views were provided by 2 teachers, in terms of non-availability of parental support for activities described to be done at home, lack of direct knowledge, children remain entangled in stories without understanding the use of knowledge, children not able to get deeper knowledge of science, less activities and a lack of explicit questions. Two teachers expressed both positive as well as negative views for exploratory learning based science text-books.

*Excerpt 2 (T-9): "My view about new book is..., that the nature of children that come (to our schools), or the age of children, for them it is a very good book, means (they) will not feel that they are being burdened too much..."*

Question 4 aimed at knowing about the methodology that teachers would use to teach the selected chapter (chapter 19) in class. '*Aap kaksha mein paath 19 kaise padhayenge?*' The responses were: through practicals, demonstrations, activities-observation-explanation, demonstration-explanation, field visits, book reading, clarification - explanation (avoiding activities due to lack of required materials). Eleven teachers reported that they preferred activities or demonstration as a part of teaching methodology.

*Excerpt 3 (T-9): "... In our school there are many trees and children (are) motivated to plant trees, so, by giving them examples of the chapter 'web of roots' can be taught".*

Question 5 aimed at understanding the ways in which teachers compare the activity based environment studies text-book and exploratory learning based text-book. '*Aap paryavaran adhyayan ki purani pustak se is pustak ki tulna kis prakaar karenge?*' The comparison can be summarised as: (a) Broadness of scope of information (b) Relating daily life experiences (c) Interesting information (d) Simplicity of language (e) Multiplicity of modes of dissemination of information: In activity based text-books the information was disseminated by mode of observing by doing, while in the exploratory learning based, it was through observation by doing as well as description of already established knowledge (f) Availability of materials required for doing prescribed activities (g) Quality of questions: The activity based text-book required children to think and analyse themselves to respond to questions, which made it less interesting than the exploratory learning based text-books, which lacks such questions. All the teachers compared the text-book based on exploratory learning, as being better than the activity based text-book, but only seven teachers gave reasons for this comparison.

*Excerpt 4 (T-9): "In the older science book... many question-answers were given...children had to think for them-*

*selves, analyze..., while in this (new book)... it does not look like that we are studying science. In this social studies is also included, and completely through play way and in a very interesting way children can be taught each chapter”.*

Question 6 aimed to explore the relationship between the methodology for teaching science expected of the exploratory learning based environment studies text-book and questions asked in examinations ‘*pustak mein diye gaye vigyaan shikshan ki vidhi aur pareekshaon mein puchhe gaye prashnon mein aap kis prakar ka sambandh paate hain?*’ Responses are summarised as: (a) Helpful: Exploratory learning gives permanent knowledge which helps in responding in examinations. Questions asked in examinations help to revise the knowledge obtained in class. Exploratory learning allows multiple answers to application based questions, (5 teachers) (b) Unrelated: The book provides indirect knowledge through stories, while in examinations direct knowledge based questions are asked/ the questions asked require memorisation, (2 teachers) (c) Closely related: Kind of questions asked previously can be easily taught through these chapters, (2 teachers) (d) Reduces fear of examinations: Whatever answer is given to application based questions is always correct, this reduces fear of failure in children, (1 teacher) (e) Difficulty in the construction of questions: Either oral examination or objective questions are the only available options, (1 teacher) (f) Do not Know, (1 teacher).

*Excerpt 5 (T-9): “..the way children study in class and respond.. when their examinations come, they are not able to do these, because then the questions are similar to those in older books. Even when I made a question paper, I was unable to understand how I should prepare the examination.. only oral tests should be conducted , but (if) the test is written, then objective questions will be better....”.*

Question 7 aimed at understanding what teachers consider to be the characteristics of good science teaching. ‘*Aapke anusar vidyalay mein vigyaan shikshan kaisa hona chahiye?*’ The responses are summarised as: practical method (2 teachers), related to practical and social environment (1 teacher), learning by doing and learning by reasoning (1 teacher) learning through activities (3 teachers), developing scientific approach in students (1 teacher), teaching pure science instead of environment studies, through practical experiments and demonstrations, by using available material in school (1 teacher), using simple stories and practicals (1 teacher), using games and labs (1 teacher), required materials are provided in the schools for conducting the activities (3 teachers), teaching approach to be learning by doing, while chapters in text-book related to children’s surroundings, not merely to science closed in boundaries (1 teacher), joyful and activity based, while text-books to be supplemented with a pocket book carrying objective type questions and general knowledge (1 teacher). Teachers had a

divided opinion on whether science should be taught as a separate discipline or as environment studies.

*Excerpt 6 (T-9): “According to me science teaching in school should be very interesting and activity based. It can by no means be taught by lecture method. But there are some things that we need to tell children beforehand, and... in this at every... topic practicals can be done, I feel that pocket books (should) also.... (be supplemented), which should carry objective type questions in it, (and) general knowledge”.*

## CONCLUSIONS

From the teachers’ responses, some inferences can be drawn of their understanding about nature of science, and their views about environment studies curriculum at primary level. Majority of teachers in the study understood NOS as scientific attitude or ways of thinking. Overall teachers preferred exploratory learning based text-books (new books) more than the activity based text-books (old books) for environment studies. However, most teachers considered activity based teaching to be a good teaching methodology. It’s interesting that while activity based teaching is the preferred pedagogy, the activity based books were not preferred. There may be various reasons for this including the fact that according to teachers exploratory text books do not promote scientific attitude or scientific ways of thinking.

Teachers remarked that the materials required to perform activities as described in text-books be provided inside the schools and that teachers be introduced or trained in the use of new science books. In MCD schools, majority of teachers do not get opportunity to attend science seminars, not even before the introduction of new environment studies text-books. Research studies point to the significance of incorporation of time for teachers to plan for implementation, and the provision of technical support for promoting program implementation in the program (Penuel, Fishman, Yamaguchi, & Gallagher, 2007). Teachers demonstrated a lot of confusion regarding evaluation in environment studies and they were divided on whether science should be taught as a separate discipline or as Environment studies.

## IMPLICATIONS

Teachers’ understanding about NOS can be taken into consideration by curriculum developers for environment science. As reported by teachers, they prefer activity oriented methods to teach environment studies, but due to lack of availability of required material or training about their use, these methods remain inapplicable in classrooms. Teachers need to attend science seminars, so as to get knowledge about suggested methodology, use of available/required resources, and the nature of evaluation required by the curriculum. The dilemma of teacher community over need of science as a pure

subject or as an integrated subject as reflected through environment studies, also needs to be addressed by the curriculum implementers. Teachers' negative comparison of activity based text-books with respect to the exploratory learning based text-books can be taken into consideration by text-book authors.

The study has a limitation of small sample size. It has the advantage of evaluating a new text book vis a vis an earlier text-book. It might be interesting to compare teachers trained in the use of the new books with those who have not received training.

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#### APPENDIX

##### Details of the Sample

| T. No. | Age | Gender | Class being taught | Qualifications | Subjects at graduation                  | Science seminars attended | Mode of Response |
|--------|-----|--------|--------------------|----------------|---|---------------------------|------------------|
| T-1    | 24  | M      | V                  | B.Sc, E.TE     | Chemistry, Maths                        | -                         | Interview        |
| T-2    | 55  | M      | V                  | XII, B.TC      | -                                       | -                         | Interview        |
| T-3    | 42  | M      | II                 | M.Sc.,B.Ed     | Physics, Chemistry, Maths               | -                         | Interview        |
| T-4    | 34  | M      | I                  | B.A., E.TE.    | Hindi, English, Pol. science, Economics | -                         | Questionnaire    |
| T-5    | 34  | M      | V                  | M.A., B.Ed.    | Science                                 | -                         | Questionnaire    |
| T-6    | 28  | M      | IV                 | B.A., E.TE.    | Economics, Pol. science                 | -                         | Interview        |
| T-7    | 37  | M      | IV                 | B.A., E.TE.    | History, Pol. science, English, Hindi   | -                         | Interview        |
| T-8    | 29  | M      | III                | M.Com, E.TE.   | Commerce                                | -                         | Interview        |
| T-9    | 33  | F      | I                  | B.A., B.Ed.,   | English, Hindi, History,                | 3                         | Interview        |

|      |    |   |     | E.T.E.       | Education                                  |   |               |
|------|----|---|-----|--------------|--|---|---------------|
| T-10 | 42 | F | IV  | M.Sc., M.Ed. | Botany, Zoology.,<br>Chemistry             | 1 | Questionnaire |
| T-11 | 44 | F | IV  | M.Sc, M.Ed   | Botany, Zoology.,<br>Chemistry             | - | Questionnaire |
| T-12 | 41 | F | IV  | B.A., B.Ed.  | Hindi, English, Pol. science               | - | Questionnaire |
| T-13 | 32 | F | III | B.A., ETE    | Hindi, English, Economics,<br>Pol. Science | - | Questionnaire |

ETE- Diploma in Elementary Teacher's Education, B.T.C.- Basic Training Certificate in Education, SSA- Sarva Shiksha Abhiyan