

Using Science Textbooks in Classrooms

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Abstract

The National Education Policy (NEP-2020), India suggests that teachers use multiple instructional materials to teach. However, not much is known about actual practices in reality. The present study endeavours to address this gap. The method of microethnography was used in multiple classrooms to investigate how teachers use the textbook for planning and teaching science in middle school (grades 6-8) classrooms. Twenty four teachers were observed across three categories of schools namely; low fee, middle fee and high fee. Data was collected via observations and semi-structured interviews of the teachers to determine the significance/ importance of the prescribed textbook. Thematic analysis of the data revealed the large extent to which the textbooks were followed by the teachers. It was found that in general, the concepts taught in science followed the structure of the textbook including the sequence of sub-concepts, examples as well as the activities. There were not many differences found across schools with regard to contextualizing the concepts with reference to the diversity among students. The study has implications for both; the teacher education programmes and publishers of textbooks.

Keywords: science teaching, textbook usage

“If textbooks are treated as a vehicle for education, the living world of the teacher has very little value. A teacher who teaches from textbooks does not impart originality to his pupils. He himself becomes a slave of textbooks and has no opportunity or occasion to be original. It therefore seems that the less textbooks there are the better it is for the teacher and his pupils” (reproduced from Harijan, September 9, 1939). A textbook in essence is professional literature “defined by the content and target audience. On a broader scale, it is defined by the school system, since its content is ‘determined’ by the national curricula and the content and operational objectives of the subject or subject area” (Turk Škraba, 2006). Textbooks are created in accordance to curriculum goals. It is a guide that helps the teacher and the learner to organize and facilitate learning. A textbook is envisioned for mass use and therefore needs to take into account multiple experiences of the learners, especially in a country such as India. Additionally, the learners’ developmental stage should determine the language used and the level of complexity. However, the textbook should neither become the sole source that represents science nor something that limits the scope of learning.

Textbooks have been central to school science and have been considered as significant resources for science teachers (Chiappetta & Fillman, 2007; McDonald, 2016). Textbooks are used for various purposes, such as planning for content, provide for student activities, and provide assignments. According to Yager, the status of science education can be summarized in a single word-textbooks. (Yager, 1983, p. 578-581). Textbooks are used in different ways and for various purposes, such as ‘... to target and frame teaching, disseminate content, set assignments, supply scaffolding for student activities, provide homework, support and guide teachers and more generally regulate behaviour in different ways’ (Hansen, 2018, p. 369).

Kuhn, (1962) contends that textbook-centered teaching provides the basis for beginning into the normal science pursuit of the scientist. Indeed, according to Kuhn, textbooks are “pedagogic vehicles for the perpetuation of normal science” (p185).

Stake and Easley (1978) found that more than 90% of the science teachers showed that they used textbooks and other materials of instruction 90-95% of the time. According to them, “Behind nearly every teacher-learner transaction ... lay an instructional product, waiting to play its dual role as medium and message In a way, they virtually dictated the curriculum. The curriculum did not venture beyond the boundaries set by the instructional materials”. According to the study conducted by Weiss (1987) textbooks were used 90 percent of time in science and math grades. Yager (1982) too found , "Nearly 90% of teachers use a textbook 90% of the time" (p. 331).

Not too many studies have focused on the association between textbooks and teachers’ practice. According to Lebrun et al. (2002) “neither textbooks’ classroom use..., their impact on practices, nor the effects of their use on school learning, are really known.... [The] literature is deafening in its silence on classroom methods of the use of textbooks by elementary-school teachers and, indeed, by high-school teachers.” (p.71).

Alvermann’s research (1987) examined how teachers use textbooks. She determined that decisions taken by teachers are of two types: “preactive decisions” (for lessons planning) and “interactive decisions” (during implementation). The potential influence of a textbook as a learning implement depends on its use. Several studies have examined the use of textbooks (Lubben et al., 2003); Bergqvist and Rundgren (2017) investigated the relationship between depictions in textbooks and their adoption by teachers. McDonald (2016) focused on the way teachers choose Australian science textbooks and how they are used. He found that most teachers used other materials to supplement the textbook especially for choosing activities.

The study conducted by Mithans (2020) investigated the use of textbooks in the Slovenian primary and secondary schools. The results showed that the primary school teachers use textbooks mainly for revision, while the teachers at the secondary grades use them more for teaching content and evaluation.

Sosniak and Stodolsky (1993) observed the use of textbooks and other materials by teachers across different disciplines. Further, they asked teachers about their perceptions about textbooks. The authors claimed that “systematic attention to textbooks and their use by teachers and students is long overdue.” The present study focuses on this aspect wherein an attempt is made to observe how the textbook has been used by the teacher in the classroom.

Milne et al. (2002) in their study of groups of children drawing parts of a eucalyptus flower noticed two girls who carefully observed and drew the flower. However, when the girls perceived that the number of petals they had drawn was different from the that of the flower in their textbook, they erased their illustration and instead copied from the textbook. ‘Clearly Jane and Fiona did not value their voice in science. Instead, they bowed to the voice of the textbook’ (p. 118).

The various education policies promoted in India advocated the use of multiple textbooks and materials for use by the teachers for teaching. (Secondary Education Commission 1952-53; Kothari Commission 1964-66; NEP-2005 and NEP-2020). The National Curriculum Framework (NCF) 2023 categorically states “The current practice of ‘covering’ the textbook as the focus of classroom interaction should be avoided. Instead, the focus of classroom interactions should be the achievement of specific learning outcomes, and textbooks are one of the many resources available for teachers and students for achieving

the Learning Outcomes.” The NCF 2023 also states that the since the content in the textbooks is for engaging the students, each textbook should be accompanied by a teacher’s version.

The NCF 2023 further recommends “(t)here must be a provision for teacher orientation on the genesis of the textbook, its rationale, and the approach to pedagogy and assessment to ensure its appropriate use in the classroom. This orientation must be followed up through school visits, webinars, sharing of best practices, and regular interactions with the teachers to understand the challenges being faced in the use of the textbook.” p94

The National Education Policy (NEP 2020) endorses experiential learning. It has suggested that focus in the classroom be shifted from propagation of mere information to conducting inquiries, discussion, discoveries in the classroom thereby promoting experiential learning using learners’ experiences. The policy specifies using experiences of diverse learners to augment textbook knowledge.

The study investigated the use of textbooks in middle science classrooms. The focus was on how the textbook is used by the teacher to create learning. What “was being studied is the case” (Stake, 1988, p256); the researcher attempted to understand the composite system wherein the textbook plays a role. A variety of methods were used for generating a description and explanation of the role of the textbook in creating learning. These included classroom observations, interviews and analysing the text.

The study identified the manner in which science teachers utilized the textbook, took decisions about determining the sequence of topics from within and in how they applied it for teaching and evaluation. It was determined to actually observe teachers in the classroom to find out how they make use of the textbook. It was also imperative to find out from them about the importance of textbooks

Research Questions

How do teachers use textbooks to plan and make decisions about teaching?

How do they justify their use of textbooks for the teaching-learning process?

RESEARCH DESIGN

The main purpose was to obtain a description of how textbooks are utilized in a science class, investigate the teachers’ use of science textbook for science teaching and learning. The following techniques were used: Classroom observation in the form of chronicles as the teacher transacted the science lesson, a semi-structured interview of the teacher, and reading the relevant textbooks (grades 6-8).

The science lesson observations involved noting down verbatim what the teacher was saying or doing during the lesson and also as much of the student utterances as was possible. The notebook was placed as unobtrusively as possible. Direct eye contact with the teacher and the students was avoided.

I chose the method of microethnography (Erickson, 1986) as it allowed me greater access in multiple classroom situations and a chance to collect and analyse data without apriori theories. I wished to gain insights into how a teacher with her given beliefs and constraints used textbooks. I wanted to understand the conscious deliberation, decisions that the teacher may need to make from time to time, regarding the teaching and learning of science and the impact the textbook had on the lesson. It is for these reasons that I selected to concentrate mainly on the science teacher to gain an insight into the way she operated within the context of the school. I directed my attention to observe a teacher’s transaction of science lessons and conduct interviews to gain insights into the teacher’s understanding about the relevance of textbooks while teaching science.

The method of triangulation was chosen to substantiate these accounts of “observation” from three different points of view (Denzin, 1978) namely: the teacher, the observer and the text. According to

Ellicott and Adelman (1976, p. 74) “who in the ‘triangle’ gathers the accounts, how they are elicited and who compares them depends largely on the context. The process of gathering accounts from three different standpoints has an epistemological justification. Each point of the triangle stands in a unique epistemological position with respect to access to relevant data about a teaching situation.” The teacher is in the best position to share their views about the purpose. The textbook provides the sequence of content, the activities, examples and the assessment patterns. The observer is in the best situation to collect data about the interaction between teachers and students. By comparing my observation, with written text and the teacher’s interview, I was able to gather sufficient data to gain insights.

While presenting the data, I have used italics if direct quotes have been used.

Generalization (typification) is the product of identifying ‘sameness’ over time. A happening that takes place several times sets up a pattern. This generalization can be (re) constructed depending on the system of beliefs, conduct and ways of ‘knowing’.

Sample size

Delhi has a vast number of schools of various kinds. Sampling was carried out on three types of schools categorised on the basis of their fee structure: low fee (LF), medium fee (MF) and high fee (HF). Three schools were chosen from each category. Schools were chosen from North, West, South and Central parts of Delhi.

The focus of the study has been the middle grades (classes VI to VIII) science classrooms since they constitute a unit. All the schools used the textbooks prepared by the National Council for Educational Research and Training (NCERT) to teach science. This to enabled the sameness of textual content. There is only one ‘Science’ textbook for each grade. In most schools one teacher taught science in one grade. In only two schools (one each in the MF and HF category) two different teachers taught in the same grade, one for physical science and another for biology.

Table 1. Fee levied per month as the basis for categorization of schools

	Low Fee Schools	Medium Fee	High Fee
Total Fees per month	10-20	2,000-10,000	12,000 onwards
Uniform provided	Yes	No	No
Books provided	Yes	No	No
Textbook published	NCERT	NCERT	NCERT
Medium of Instruction	Hindi	English	English

Twenty four teachers were selected for the study across 9 schools. The teachers varied according to gender, and the socio-economic class to which they belong, the teacher education programme they had attended and their years of experience (2-20 years). All the teachers had a graduate degree in science; some also had a master’s degree in science. In addition, all of them had a degree in education. Each teacher was observed in the classroom 3-5 times. Early in the data collection phase, I observed teachers in different grades. Not finding any variation in the use of the textbook across grades, I chose to observe them in a single classroom. The focus has been on how the science teacher uses textbooks of science in the classroom.

Table 2. The number of teachers observed in the three categories of schools

Category of schools	Number of schools	Number of teachers
Low fee	3	7
Medium fee	3	9
High fee	3	8
Total	9	24

Anonymity has been ensured for the school and the concerned teacher. The data refers to the teachers based on the category of the school; the schools were referred to as A--I; and giving a number to the teacher. Thus, LFBT4 would mean the teacher 4 teaching in the low fee school B. The teacher names were arranged alphabetically in each school and numbered accordingly. The students have been numbered as S1, S2 and so on.

There are different ways of interpreting observations and it is the researcher's own beliefs are also to be stated as a necessary part of the study. By profession I am a teacher educator. Thus, I had to constantly guard myself from evaluating the technique and concentrate on the science lesson in progress. My academic post-graduate degrees in science and education, as well as my directed reading had made the field of science education a familiar one; in fact, it had helped defining the field for me.

FINDINGS

The study was carried out over a period of six months. The initial part of the work is locating a field and gaining access. Since the objective was to record observations in science classes, permission was taken from principals of the schools as the science teachers whose classes would be observed.

The observation data is recorded in the form of classroom chronicles which include all the events that take place in the order of occurrence. The aim of the research was directed to focus on the science teacher and the manner in which they used the textbook. This type of observation permitted me to study the way in which the science teacher directed the lesson, the execution of science education as it unfolds in the classroom by gathering evidence as the events occurred. Hence the continuity of events was both observed and analysed on the basis of antecedents and consequences. The theoretical neutrality of the records made it possible to interpret data on the basis of the views and ideas expressed by the teacher.

The various themes that emerged from my observations have been categorized. These have been correlated with the teachers' perspectives about the significance of the textbook. The following themes were determined: Perception of the textbook, Using the Textbook, Textbook and assessment, Textbook as source of Knowledge, Relationship between the teacher and the textbook. these have been described and analysed.

While presenting the data, italics have been used in case of direct quotes. In the case of teacher interviews, these have been followed or preceded by the name of the teacher. The data refers to the teachers based on the category of the school; the schools were referred to as A--I; and giving a number to the teacher. Thus, LFT4 would mean the teacher 4 teaching in the low fee school. The teacher names were arranged alphabetically in each school and numbered accordingly. The students have been numbered as S1, S2 and so on. Where I have presented interactions, I have used the symbol 'S' for student. In the instances where more than one student has responded I have arranged them as S1, S2, and so on.

1. Perception of the textbook

This theme looks at the perception that teachers have about the function/significance of the textbook in

terms of planning for lessons, and transactions in the class

The teachers of LF schools have no choice about the textbook. The book is prescribed by the Department of Education; the sequence of the chapters, in the textbook is divided among the three terms, to ensure parity among schools and students. There is thus a preset 'syllabus' to be covered in a pre-determined sequence per term. A few teachers in the government system referred to, and recommended guide books. The MF school teachers have the syllabus decided by the principal/ department which decides about the chapters to be 'covered' each term.

MF1: *I use the NCERT textbook for (classes) VI-VIII. That is adequate; for classes IX and X, I use a refresher (a book that gives extra information and questions and answers).*

MF5: *Till last year, we used another book, this year we have shifted to NCERT books.*

The HF school teachers hold meetings where they decide about the number of chapters to be 'covered' each term. In addition, they also discuss the details of content to be followed; in the case of one school, also the activities to be carried out. In another school, a laboratory manual was prescribed for the students.

HF1: *We also choose a set of books that provide activities*

HF7: *The books do not have extra information (she means concepts), so I dictate these out.*

In addition to the textbook, which is the main source of teaching and learning, some of the schools offer "extra material" in the middle school classes. This may be in the form of a suggested second textbook; notes dictated by the teacher, especially for definitions of the concepts taught, or extra reading material in the form of Photocopied sheets.

The high fee schools that also include laboratory activities as part of the curriculum, recommended that the students buy a laboratory manual in addition to the textbook, either prepared by teachers of that school or commercially available ones.

2. Using the Textbook

The textbook determined the type of concepts to be taught and the level of complexity; the examples given to elucidate the concepts and the activities to concretise these.

The low fee used the textbook extensively. The textbook directed each aspect of learning science - the curriculum, sequence of concepts, elaborations and examples, figures, activities and even questions that were to be answered as assignments. Hence, it was only to be expected that the textbook was the sole source of teacher preparation. For these teachers, the textbook was the only resource material. Yet the teachers did not keep a copy for themselves (one had to just get it issued from the school library; even that is not generally done). The teacher instead comes to the class and 'borrows' a book from a student.

During the interview when I asked teachers to elaborate how they planned to do teaching, whether they needed to study for the classes, their responses directed my attention towards the textbook.

LF1: *I do not need to study as such, to teach classes anymore. Of course, when the course changed, I did have to read up the textbook, but after teaching for one or two years, I do not need to do that.*

LF4: *Sometimes I just glance through the portion (of the textbook).*

LF3: (laughs) *I have been teaching for many years now.* (implying that she has mastered the content and does not need to study).

LF6: *No, I do not need to study. Besides we read it (the textbook) in the class.*

For the middle fee and high fee schools, it was the major source of science content. Two of the teachers referred to other text sources, including the class 11 and 12 textbooks, five teachers used online material to read.

The teachers are required to write their teaching plans weekly and in 3 of the schools, daily plans; which

are then signed by the principal or department head. The plans which included concepts to be taken up, the activities to be carried out, and the examples also reflected the structure provided in the textbook; The science classes in the LF schools were extremely monotonous, with endless lessons employing the same methods of read-aloud from textbooks instructing students to underline the text or note down from the textbook, scolding students harshly. The endless grind and the stark classrooms served to almost send me into a stupor, and I found myself trying to make excuses to skip the next session.

In one instance, the teacher also wrote the title of the chapter on the blackboard using a very narrow part of the space. This was the only time when the blackboard was used in the entire duration of the lesson. The order in which the teacher first wrote 'Science', then the page number, followed by the chapter number and finally its title revealed the importance given to the page number. Science was not taught with an emphasis on the concept but page-wise. The announcement of the teacher given below illustrates the customary practice followed:

LF2: *We have finished page 21, now come to page 22.*

Next the chapter was read aloud, either by the teacher or by the students or by both. The entire chapter was not read at one go; only a few paragraphs were read at a time followed by the teacher explaining these, then a few more paragraphs, again followed by explanations. Most often the explanations were paraphrased text. The teacher sometimes followed it up by asking questions to determine if the students have understood the text. Occasionally, the teacher would suddenly stop one student who was reading the text and command another to read; this was done to maintain attention toward the task.

Another teacher justified her use of reading out the textbook.

LF1: *They (the students) do not get time to read at home.*

To a large extent her statement is true. The school caters to children living in slum settlements. Many of the students are either first generation learners, or do not have a support system available at home for academic help.

This school has one section, with English as the medium of instruction. Here the teacher herself reads from the textbook, while students follow her using a finger or pen under each word. She then 'explains' by translating the text into Hindi. This feature was observed in grade VIII. According to the teacher, "*the students are put in this section because they have better marks, as such they do not know English well.*"

In one of the Hindi medium schools I observed, one section (containing the "better" students) was delineated as the "English section", i.e. English was the medium of instruction. Rollnick (1998) who has made an in-depth study of the use of the mother tongue in learning science encouraged the need to address the unequal participation of such students when education is conducted in the language of the former colonial influence.

The role of the teacher often gets reduced to that of a translator. The teacher (or if certain students are able to do so), reads out the text aloud, and under the guise of explanation rephrases the entire text in Hindi. The answers to questions asked by the teacher are generated in a mixture of Hindi and English. Yet for the students the textbooks, written work, and examinations become major barriers on account of the language. In addition to the use of English to learn science, the student has also to contend with the jargon of science. A single lesson of 35 minutes may introduce as many as ten new terms.

In the Hindi medium sections, either the teacher or the students would read. There was no apparent pattern. Who would do the reading was decided by the teacher based on her inclination and time of the day (usually teachers read in the sessions before break and students after).

'Substitute for the Teacher'

The textbook also acts as an ideal substitute for the teachers. Thus, when they are busy with administrative or correction work, or is not keeping well or does not feel like teaching, the textbook becomes a handy alternative. At such times, the students are asked to either have a read-aloud session or copy out a table, a figure or provide answers to questions published in the textbook.

The teacher asked students to copy down the table from the textbook. In the meantime, she is busy correcting answer books of a test.

The teacher asks students to copy table 2.3 from the textbook. She then goes out of the classroom to make tea for the staff (*"since the tea-woman employed to prepare tea has not come today"*). The teacher informs me that she is in charge of the tea club in the school.

LF7: *You will now make these drawings, do not copy from the book, but first learn them and then draw* (the figures of tap root and fibrous roots). After a while, the teacher also tells them to *"go home and pluck some plants and examine them."*

A 'good' student is asked to read the textbook aloud while the rest follow the spoken sentences in their own textbooks. In the meantime, the teacher is filling the attendance register.

The middle fee schools showed disparity in the use of the textbooks. One of the schools emphasised using the textbook for concepts, suggested activities and assessment, while another school created their own set of activities which were not given in the textbook necessarily. The teachers in the middle fee school showed maximum variation in use of the textbook and their teaching styles. Here too, variation was seen based on their teaching experiences, school ideology and personal beliefs. The novice teachers tended to use the textbook more often for sequencing how a concept was developed, choice of examples and homework was based on the questions given in the textbook.

MF4: During training (teacher education programme), they told us to develop the concepts ourselves, but I feel that the textbook gives it in the best way.

Others with more years of experience created a context for developing the concept, often basing on the child's knowledge. Here too the level of conceptual development was guided by the textbook.

In instances where textbook reading was the only method followed; the teacher would enter the class and ask a student to give her the book. The day's lesson would begin.

MF6: *Sit down class. Give me a book. Now where were we?*

Each chapter was introduced by announcing the chapter and page number followed by the title of the chapter.

MF6: *Has every child opened the science textbook? Page 132*

In this instance, the teacher also wrote the titles on the blackboard using a very narrow part of the space. This was the only time when the blackboard was used in the entire duration of the lesson. The order in which the teacher first wrote 'Science', then the page number, followed by the chapter number and finally its title revealed the importance given to the page number (see Fig.1). Science was not taught with a focus on the concept but page-wise.

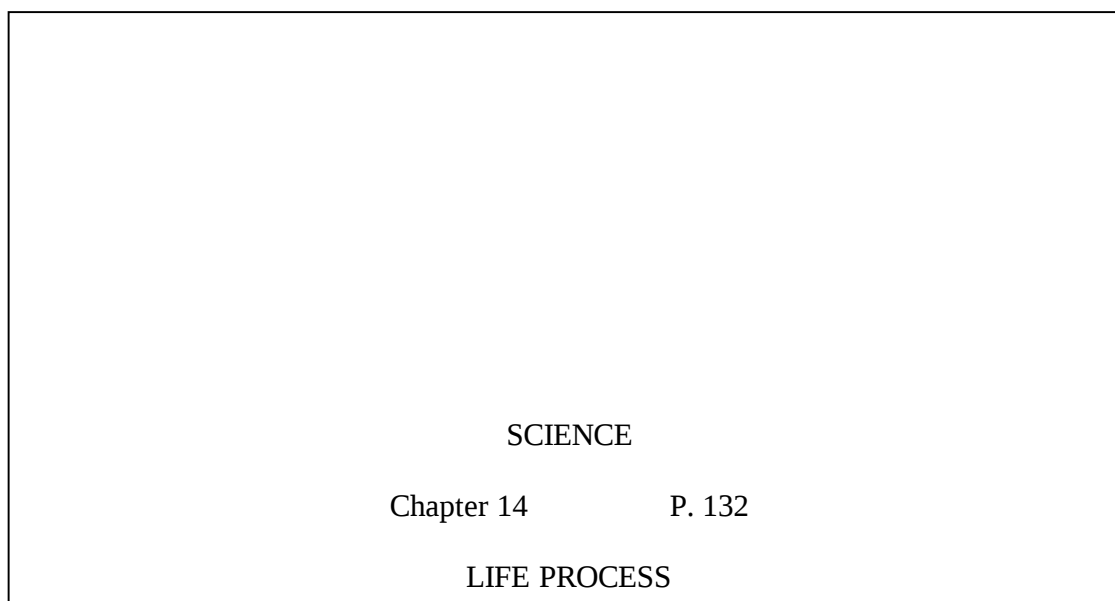


Fig.1. The blackboard work manifests the emphasis given to the usage of the textbook

‘Important Points’

While the text is being read out, the teachers concomitantly instruct students to underline the ‘important’ words, and to delete irrelevant ones. In certain instances, when the text was considered inadequate, the teacher dictated sentences/definitions, which were to be written in the textbook itself. The following examples highlight these aspects.

MF1 had borrowed the textbook from a student. As she read out, she instructed students to underline ‘important’ sentences. She borrowed a pencil, and herself underlined the relevant portions in the student’s textbook.

In some instances, the textbook was also used to write in, to add extra information or to delete certain portions. MF2 dictated definitions from her notes. She asked students to write these down in the textbook itself, as otherwise, “*you will miss it.*”

MF3: *Delete 2nd and 3rd paragraphs of right-side column on this page. They are not important.*

MF9: *This is important.* (pointing out relevant paragraph)

Many teachers, who used the lecture method would also intersperse lessons with textbook reading sessions. According to MF9, this ensured that the students become “*aware of what is in the textbook as otherwise the students do not open the textbook at all.*”

The high fee schools showed wide variation in the use of the textbooks. One of the schools has taken a deliberate and conscious decision not to allow read-aloud sessions in the classrooms. In another school, the decision was not explicitly stated. However, no such session was observed other than in classes with novice teachers and the teachers opined that this was not a desirable approach to teach science. One school emphasised on the preparation of a “practice-copy” by students. Notes were dictated and photocopies of pages were provided by the teacher to be pasted on the practice copy, which also included activities done in the class.

Despite formal and informal discussions on the teaching of science and use of textbooks, read-aloud sessions have been observed in this set of schools also. During the process of teacher interviews, it emerged that the teachers who use reading aloud of the textbook in the classroom as a method have 1-3

years of experience and may therefore be categorized as novice teachers. Research studies carried out with novice teachers elsewhere have shown how many of them spend the first few years just surviving, also that they tend to use the ways of teaching that they experienced as students (Sanford, 1988; Brickhouse and Bodner, 1992). It is interesting to note that teachers, who have taught for five years or more, did not use the reading of textbook in the HF schools.

HF3: *I feel nervous about facing the whole class and the textbook gives me a concrete plan.* (Teacher with 2 years of experience)

Individual needs and school influence contributed to the use of the textbook, laboratory manual and other reference materials by teachers of the HF schools. Most often the textbook was used as a readily available reference in the classroom, in case of a doubt. In these instances, the teacher consulted the textbook to explain the concept, to answer a query or even cite examples.

3. The Textbook and Assessment

The textbook plays a crucial role in helping teachers assess the ‘knowledge’ gained by the student. This was observed in all sets of schools. After the completion of a chapter the teachers usually spend one or two periods eliciting answers to the end-of-chapter questions. Answers to the objective questions were written in the textbook and the short answer questions were answered orally. The teacher would then set home or class assignments from among these questions; especially the ‘IMPORTANT’ (likely to come in the examinations) questions. If the chapter was a long one, then the questions were given as a task after the relevant sub-topic had been dealt with. Additionally, the high fee schools supplied questions prepared by the teacher.

Teachers from the LF and a few from the MF schools had a unique way of dealing with the questions at the end of the chapter. The question was asked, and the answer was lifted entirely from the text.

On many occasions, the teacher would read out the question and then tell the page number on which the answer was to be found. The relevant sentences were also read out; students underlined these and marked the question number in the margin. The answer was provided either by the teacher or the students. In either case, the page number and relevant sentences were noted.

How much this way of dealing with questions-answers has been ingrained in the system can be understood by the following case:

LF5: *Okay question No. 1.*

S1: *Page 205, right side top part 3rd line*

LFC5: *Very good.*

Sitting at the back of the classroom (without a textbook), one could not make out either the question or the answer. Most students obediently turned to the relevant page, column and underlined the words. For question 3 during the same lesson, a student responded with an actual answer.

LF5: *What page number is it?*

S2: *I have read (the chapter) and am giving the answer on my own.*

No praise followed this initiative shown, unlike that of the first question. Here the teacher sent a silent message ‘stick to the textbook’. The entire period continued in the same vein. At the end, the teacher asked the students to “*write the answers in the fair copy and bring*”.

The purpose seemed to be to reduce all, or any variation and focus instead on the one ‘correct answer’ in the format presented in the book. Here is the real tradition of the ‘shishya’ learning shlokas from the Guru. It seemed as though experts in science have written the textbooks and the guru in their authority decides how the student has to learn it. Therefore, the student also learns the facts and reproduces them verbatim.

4. Textbook as Source of Knowledge

For most middle school teachers, science began and ended with the textbook. The textbook decided the content, the concepts, the sequence and even the examples. When teachers said that they did not need to study, or that they glanced through the topics, they indicated that they glanced through the textbook. After many years of teaching the same grades of students most teachers had memorised the contents of the textbook. However, in the process of teaching, if a teacher wanted to confirm a particular point, she would go back to the hallowed textbook. The following observations support the notion of the textbook as the ultimate source of knowledge.

MFT9 was teaching the concept of ‘measurement’. One after the other, the students would get up and read a few paragraphs, which were then ‘explained by the teacher’.

T: *We go to a shop to buy potato, he may add one more (tuber) when we buy one kilo (gram), so (the weight is) not too accurate. If we buy gold, he will be accurate.*

S1: (calls out) *because of cost.*

T: *Yes because, it is too expensive. For measurement for science, it will be accurate. So, for science, gold or medicines, accuracy of measurement is (necessary) needed.*

S2: *What is physical balance?*

T: *It is like this only.*

S2: *Then why is it called physical? Is there any other kind also?*

T: *Let her (student reading aloud) read. I will think about it.*

-pause – as the student continues to read.

T: *OK so there is a beam balance – there is a beam but has support from lower side (referring to book).*

S3: *Lower side there is electronic meter showing as is in Mother Dairy.*

T: *Physical balance is what is used in Physics. They have given photograph of physical balance. Check textbook page No. 54 says ‘d’ is a physical balance.*

According to Yager (1983), “the major curricular decision that most teachers make is the choice of a textbook Textbooks determine the order, the examples, the applications of science topics Science is the facts and concepts ... restricted to that between two covers of a textbook.” In these schools, the teacher does not even get to choose the textbook. that is provided by the State.

An alternative to the textbook was the kunji (guidebook), used extensively in the LF schools. The kunji served as a reference for the teacher who also recommended it for the students. In the following example the teacher referred to the annual examination for class VIII, in which the questions are not restricted to those contained in the textbook.

LFT7: *Questions come from outside.*

Students are expected to learn both questions and answers from these guidebooks; quite a few students seem to prefer these since it was easier to use, even the answers were provided along with the questions.

5. Relationship between the Teacher and the Textbook

Most teachers gave the textbook a status of unquestioned authority encompassing the syllabus. For them, the content of the textbooks defined the way in which the concept was taught and the sub-concepts to be included and the sequence of presenting them. The examples given to concretize the concept were also defined by the textbook as were the diagrams and tables provided. The levels of dependence on the textbooks also varied according to the method of teaching. The teacher who read out text derived a greater help and support from the textbook than the one who lectured.

When the teachers were asked whether they needed more time to prepare or study for classes many replied in the negative, or stated that they glanced through the topics in the textbook. This was the only book used by a large number of teachers to prepare for their classes.

The reliance of teachers on the textbook could be gauged by the manner in which even the activities were read out. At the same time, the act also revealed the decision-making of the teacher who did not actually carry out the activity. Hence the activity was given importance insofar as it served to verify a concept, but it largely remained a theoretical exercise.

For most of these teachers, the textbook was a source that had been provided to them by the State. The teachers themselves had no choice in the matter. The only decision they could take was to occasionally add or delete portions of the text for the students according to the importance and the likelihood of the concept appearing in the question paper during the examination.

The textbook remained a source of knowledge, be it the concepts in science or the activities it suggested. The importance given to this single book fosters the notion of science as a body of knowledge that is unchangeable.

The universal truth that was present in the prescribed textbook was presented to the students. In some schools, teachers used other textbooks (class IX onwards) that elaborated the concepts in a better manner. During my observations, I met only four teachers (2 from MF schools and 2 from HF schools) who used multiple references to teach. However, this referencing was confined to the teachers who used it to develop their own knowledge base.

MFT7: *We came across a set of books where the concepts were better elaborated. NCERT gives the same concepts but in precise form. Anyway, we have to elaborate. These books are easier for understanding.*

MF3: *I like biology, so I see some videos to see how the concepts are taught.*

HF6: *I don't know chemistry that well, so I take help from U-Tube lectures.*

For most teachers, the textbook guided a teacher's presentation of concepts, yet it failed to induce her to perform the numerous activities suggested even in the book. Instead, she merely read them out. The teacher has transposed her views of what is important in teaching science. However, in the case where the school promoted doing activities, the teachers did carry out activities.

DISCUSSION

The study found that in many classrooms particularly in the LF schools; and in the MF and HF schools where the teacher was a novice teacher, transmissive teaching assuming no active cognitive engagement by the students were routine. In most cases, the lessons were dominated by the teacher either by a lecture or constantly focussing on the textbook with read aloud sessions and paraphrasing text. The students are expected to listen submissively, copying material into their notebooks, with their inputs restricted to answering questions posed by the teacher.

The "textbook constrained" teacher starts with chapter 1, page 1 and proceeds page wise through the book over the year. Further, some teachers omit selected portions of the chapters as not important since these would not appear as questions in the exam. The novice teachers did not feel equipped to teach and found it easier to use the textbook to plan, teach and assess students. Only two teachers each from the MF and HF schools used other materials for developing their own conceptual understanding.

When a science teacher reads the textbook, she does so with a certain amount of knowledge already present. The text serves as a revision for her. However, for students, the concept is a new one and needs an approach best suited for the concept to become discernible. At this point, the teacher needs to address

the concept from the context of the learner. Thus, a focus on learning and not on teaching would enable the teacher to plan for the most suitable strategies. Reading the text should not be the only strategy.

According to Shymansky et al. (1991), elementary school teachers view reading in science as any other reading narrative. They suggest that the teacher should combine reading in science with asking questions that would require students to “search, analyze, and explain the ideas in the text utilizing generative processes”. Further, they recommend that “elementary teachers may not be facilitating such purposeful student action and may need special in-service help to learn new strategies for teaching science and reading.”

In general, the textbook determined the concepts and sub-concepts as well as the sequence in which these were taught. It also decided the examples to be given. This was reflected in the plans that were written by the teachers.

For many teachers, science is a systematic study of natural phenomena. For them the inter-connections of a concept with the life of the child were not relevant to the issue at hand which is mainly “covering the syllabus”. At this juncture the textbook becomes very significant since the teachers use it as the sole guide to direct learning. Thus, it is only when the textbook provides a linkage with the child’s life, is the aspect included in the classroom discourse. In disparate classrooms, across all the schools with the exception of one teacher of the MF school, the content was taught in the same manner without contextualising it for the diverse students/ learners in the classroom. The NEP-2020 emphasises a need to take into account the needs of students from different backgrounds. Yet in the classes I observed, science was taught in the same pattern. According to Batra (2005), a fundamental change in the school curriculum is inadequate by itself unless teacher education is transformed.

The lack of diversity among the teachers in the manner in which they use the textbook is unsatisfactory and displays their disinclination to adapt text to make it relevant for the students in their class. This also reveals, that when policymakers create significant changes, it is sifted by teachers and does not result in essential modifications in their teaching. When teachers and students work together to create learning, it gives recognition of learners’ knowledge within the course.

Ball and Feiman-Nemser (1987) explored how two teacher education programmes emphasized that "good teachers don't follow textbooks." In one case the student teachers were taught that the focus should be on how students think, and textbooks can only be used as a partial source. In the other program they were taught that teachers should depend on their own understanding of the discipline and about the students, and accordingly develop instruction to teach. These student teachers were not prepared in using textbooks. The authors determined that novice teachers need to be taught how to use textbooks as a resource and suggested that this aspect be included while training student teachers.

The microethnographic study by Gottfried and Kyle (1992) concluded by stating most teachers operated as “passive, uncritical technicians who are ready and apparently willing to disseminate knowledge in an authoritarian tradition.” (p 46). The present study concludes that the same is true even 34 years later. This implies that somehow research is not guiding teacher education programmes where changes can be implemented.

Assessment was carried out whether orally or as home assignment from the questions given in the textbook. additionally, in one HF school, additional questions were asked based on the ‘extra notes’ provided to the students. Learning from a textbook will become effective if it is adapted for the learners. Teachers should adapt the textbooks to match the needs of their students and contextualize the broad conceptual development. The relationship between the teachers and the textbook was one of co-

dependency. 24 teachers have been observed and only four among them used other materials to develop their own understanding.

There were differences in the ideas of 'good pedagogy' among schools of the MF and HF categories which impacted the use of textbooks by the science teachers. Over the years, the school policies influence the teachers' activities and strategies of teaching. If a teacher were to join a school where she would be explicitly told not to read out a textbook in the class, the teacher is unlikely to do so. Further observations of her colleagues would not show this pattern of teaching. However, if the same teacher joined a school where she notices her colleagues practicing this mode of teaching, she is likely to continue to use the textbook in the class. This aspect can be researched at length.

CONCLUSIONS

The heavy orientation on the textbooks by teachers, and students necessitates that their preparation and production be given greater importance than at present. No special effort has been made by the agencies producing the textbooks to contextualize learning differences. NCF-2023 suggests that the textbook should be supplemented by a version for the teacher. The present study implies the importance to create such materials which may provide multiple perspectives as well as provide suggested literature.

The teacher education programmes should also provide space and training about how to use the textbooks. The emphases should not only be on conceptual development, but also on contextualising and making it relevant for the diverse students in the class. The student teachers should also be guided to use multiple texts for developing content, creating and using activities both inside and outside the classroom.

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