CHAPTER-III

SCIENCE INSTRUCTION RESEARCH IN INDIA

3.1   Introduction

India is facing one of the sternest challenges in
the history of education. What has been accomplished in the
last few decades is not very highly commendable. The worst
affected part of the curriculum is science education. The
basic insufficiencies in science education cannot be solved
only by lengthening of the time students are in school,
making science courses and science tests more difficult,
increasing the science graduation requirements, modifying the
teacher training programmes refurnishing science laboratories
or rewording traditional statements of educational goals.
Science education reforms should be supported by research
finding as to why, what and how of science instruction.
Science teaching continues in our schools with contrasting
goals and with students populations that have quite
different reasons for being in science classrooms. Science
education research has to look more closely at how the
students learns in known contexts and how much learning
actually takes place in those contexts. There is a need to
find out what helps whom and under what conditions.

Learning in science is influenced by both instructional interactions and those expectations from other areas of schooling experiences. Learning is also influenced by home community and broader social pressures. Thus science learning includes what is happening in a science learning context which is part of a much larger environment. It is in the total environment that many cues from research are available to help, understand and nurture learning in science. In our science education research, we may limit our research to just the student or science teacher, and the learning environment. Science education research can also focus on linking student, "products" with "teaching behaviours". Usually called "process product research", this research attempt to equate what teachers do (processes) with what students accomplish (products). Science teacher behaviours may include their questioning strategies, clarity of explanations or task orientation. Thus the teacher behaviours which may be included for research includes both teacher characteristics and teacher actions. Science education research can also focus on science student task behaviour and how teachers influence it. If the teachers influence, what students learn by controlling what, how and how long the student studies science, then the link between the teacher behaviour and the student classroom behaviour needs significant attention and study.

In the previous chapter, we have reviewed some
of the theoretical aspects as related literature. In this
section, a general review of the researches into science
teaching and instruction in India is presented. The amount
of research done in science education in India is very
less. We are still, it seems, in the first stage of
research in this field. Wanchoo and Sharma (1974) point
out through their study that the quantum of science
education research done was meagre. Though there has been
an awareness in India of late, for the need for more and
more and research work to be done into the areas of science;
lot more work have to be done in the field of instruction
and learning.

3.2   Reported Researches

The review of the science education researches
have been carried out by the following consideration.

(i) Science education improvement should be a
major component of the research.

(ii) Direct relevance to science teaching in general
and in particular to the subject matter under
study.

(iii) Continuous evaluation processes such as
that done in NCERT as part of text book
development programmes are not included.

Based on the above considerations researches when
reviewed was categorized into the following major groups :

(i) Survey type which reveals the state of affairs
of science education in our country.

(ii) Concerned with the development of various
cognitive abilities in the learning of science.

(iii) Design, development and implementation of
instructional strategies.

The limitation faced by the investigator was mainly,
I must confess, about the non-availability of information.
Hopefully, many more investigations must have been done than
reviewed below, in various parts of the country, which
for many reasons may not have been reported. But the
following reviews give a general trend of science education
research in India.

3.2.1 Survey Type Studies

Veerappa (1958) conducted a study to examine the position of science education in India and to assess the new trends in the field as observed in some advanced countries like U.S.A., U.K., etc. An attempt was also made how these advancing trends could be introduced in Indian institutions. Some of the findings were: (i) the popular way of teaching science in secondary school is according to Herbartian Plans, (ii) dividing science instruction into theory and practicals was one of the reasons for inefficiency and (iii) the teachers generally adopt lecture demonstration method for teaching of science and (iv) the examination papers were generally loaded with essay type questions.

Patole (1967) had undertaken a study to explore the weaknesses of teaching science in primary schools and devise methods: for improvement in the existing situation. The study looked into existing facilities available for teaching of science in rural primary schools, (ii) to study the effectiveness of activity based method and traditional method of teaching the subject, (iii) ways to improve teaching of science in rural primary schools. Some of the findings were: (i) about 74% teachers and 61% teacher trainees were of the opinion that science should be

separate subject from Standard I and should not be integrated with social studies in the first four grades, (ii) no significant difference between boys and girls as regards their interest in science at that stage, (iii) the topics, the pupils were interested were their immediate environment like,- air, water, food, plants, diseases etc., (iv) the activity based method was found superior to traditional one.

Wanchoo and Sharma (1974) carried out a survey to find the developments in science and mathematics education researches. The important findings were : (i) the quantum of research done at primary level was meagore, (ii) research work done in the area of evaluation was mostly confined to test construction and (iii) work done in the area of concept development was practically negligible.

Patel (1976) looked into the readability indices of the prescribed science material for Std. VIII and its effectiveness on reading comprehension and found that pupils could comprehend low readability material than high readability material. Singh (1977) evaluated the science curricula of Std. VIII of Maharashtra State and brought out a modified form of it with a view to achieve skill oriented objectives of teaching of science.

Pillai (1980) conducted an analysis into the physics curriculum of the Central Board of Secondary Education (CBSE) followed in its affiliated schools at the senior secondary level and compared it to Nuffield advanced level physics taught in the schools in U.K. The study revealed the need for an extensive change in the way the curriculum decisions are made, and how the learning materials are prepared. The study also had shown that the curriculum was more information oriented, divorced from practical aspects.

Singh (1983) conducted a study to evaluate the appropriateness of placement of different aspects of the physics concept : work and energy. This concept and their subconcepts have been concentrically developed for different grades in NCERTs science books from Class III to XII. The study succeeded in categorizing various concepts related to work and energy into five groups: very easy, easy, moderate, difficult and very difficult.

3.2.2 Cognitive Ability Studies

Vaidya (1974) conducted a study on some aspects of thinking (problem solving) among science students of adolescent age. The main findings were: (i) the average

performance increased with grade; (ii) each pupil
solved the problem in his/her unique way except when the
problem was solved mechanically; (iii) it was possible to
identify the stages in the solution of any problem empirically,
pupils committed many errors, especially when ignored,
forgot or failed to grasp the main demand of the problem;
(iv) depending upon the nature of the problem adolescent
pupils, contrary to Piaget, were affected by a varying
degree by the content of the problem; (percentage of pupils
so affected by the content however declined with age);
(v) the adolescent pupils were in a position to set up
hypotheses; (vi) barring few cases, the ability to test
hypotheses did not appear among pupils from grades VI to
VIII; (vii) more than 70% pupils of the pupils of Grade X
could not manifest the ability to test hypotheses which
meant that to that extent, the individual minds of even
Grade X children had not become experimental.

Pandey (1981) studied the effect of teaching
style on the science concept attainment at various levels.
He found that (i) the teaching styles had varying effect
on both the levels of concept attainment as well as on
total concept attainment; (ii) the effect of teaching
style was not significant for the attainment of problem

segment of the concept; (iii) empathic and democratic
teaching styles were found on par as regards their effect
on concept attainment eventhough empathic style was
slightly superior to democratic style; (iv) oratorial and
traditional styles were inferior to empathic and democratic
styles; (v) of the four teaching styles considered empathic
style ranked first and oratorial style the last;
(vi) giving background information, encouraging student
participation and student response and giving ample
opportunity to think were conducive to better concept
learning.

Vaidya (1982) reported a study of problem solving
behaviour among certain groups of adolescent pupils. The
study of the problem solving behaviour of pupils having
different intellectual abilities in relation to the problems
of different complexities in each discipline is an exciting
challenge for psychologists and science educators. The
major findings were as follows: (1) the problem solving
abilities differed significantly among the different IQ
groups; (2) providing hints has shown significant changes
in problem solving.

Pillai (1985) studied the science achievement of
secondary school pupils in relation to their attitude
towards problem solving. The main findings were:
(i) there exists a positive and low relationship between
attitude towards problem solving and science achievement,
and (ii) high, average and low achievers in science differ
significantly in their attitude towards problem solving.

3.2.3 Strategy Implementation Studies

Gupta (1968) conducted a study to teach physics
for Standard VIII through programmed learning material
prepared. He found, on evaluation, no clear cut difference
in effectiveness of PLM over other usual methods. But in
a similar study, Pandya (1974) and Sondhi (1977) found that
programmed learning material (PLM) could be effectively
used in the learning of science.

Dave (1975) conducted a study to evaluate the
effectiveness of physics resource materials (PRM) developed
at the R.C.E., Mysore and to assess the feasibility of
advanced curriculum model cognitive learning (ACMCL). The
following significant findings were made: (i) while
overall data supported that knowledge, understanding and

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application were hierarchically related, the same data, partitioned conditionwise did not support that the assumption for the control group,thereby indicating a difference between the process hierarchy (developmental goals) and tne product hierarchy (developed goals) and there is a need for making conscious attempts at developing them and (ii) there was some sort of a relationship existing between content and hieararchy.

Sonar (1975) found that the use of filmstrips in the teaching of science enhanced the learning activity. Prakash (1976) conducted a study on the discovery oriented approach at school level science teaching. A curriculum aimed at improving the process of learning science and inculcating positive scientific attitude, among students as well as teachers, was developed. Menon (1978) tried to find the relative effectiveness of different instructional media in teaching physics at secondary level using charts, self-instructional written material and visual projection and taped commentary. The visual projection and taped commentary clearly showed superiority over other media.

Arunkumar (1978) developed a strategy for teaching the content Nuclear Chemistry, one single unit to Standard X students. The strategy included components such as PLM

in the main, along with certain other components such
as introduction by the teacher, project work and discussion.
An important feature of the study was PLM has been developed
in line with principles of heuristic method of teaching.
It was found that execution of strategy as a whole could
develop better application ability than PLM alone.

Ravindranath (1982) studied a multimedia strategy
for teaching of science. The instructional components were :
(1) introduction by the teacher, (2) programmed learning
material, (3) tearn teaching, (4) enquiry technique,
(5) pupil activities with teacher demonstrations,
(6) discussions and audio-visual presentation, (7) narration
of biographical sketches of sciences, (8) summary,
(9) criterion tests, (10) feedback, (11) exercises and
(12) assignments. It was found that the strategy was
highly effective.

Vardhini (1983) developed a multimedia instructional
strategy for teaching science (physics and chemistry) at
secondary level and found it feasible when seen in terms
of its reproducibility and cost management by individual
schools. The investigation revealed that students liked
visual projection with teacher explanation compared to
visual projection with taped commentary. It also found

the strategy which included also programmed learning

and discussion sequence, apart from those mentioned above,

was highly effective.

One of the ongoing studies reported, is by

Mathur (1983) on individually guided system of instruction

(IGSI). In the IGSI, the course content for one year is

split into units such that each unit could be covered in

1 to $1\frac{1}{2}$ week's time. The entire class XI physics syllabus

of CBSE is split into 21 units. For each unit, the student

is given a 'study guide' which contains an introduction to

the unit, objectives of the unit, suggested procedure for

achieving the objectives, notes, problems and self

assessment. The student interacts with the suggested

material on his own and takes the help of a tutor on

individual basis when needed. The tutor is generally a

senior student who has chosen tutoring as a part of his

socially useful productive work (SUPW). The students were

allowed to progress at their own pace until they are able

to demonstrate mastery. The main stress in this system was

mastery learning individualization. The results of

try-outs have shown that IGSI had positive impact on

the achievement level of the students.

3.3   Conclusion

The review represents an exploration, with the reports, readily available, to understand the status of science education research in India. It is clear from the reports that there are only a few reports on science education to bring out any significant pattern. A few surveys and some developmental studies constitute our research in this field. Researches based on learning theories and its application to classroom teaching is almost nil. Even where the programmed learning material is prepared and used, the work in science subjects are not much. A few studies have definitely attempted to develop new instructional strategies but the number is too few.

Thus, from what is reported during the last few decades we see that science education research has not perhaps done enough to improve the science instruction in India. In fact, the quantum of research work done itself is very small to be of practical significance. What is required is a concerted attempt to revitalise this very important area of educational research and to link this with science education programmes.