SCIENCE INSTRUCTION FOR MAKING CHILDREN THINK AND DO

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Jaipur 302015

Introduction

It is matter of great concern that in this age of science and technology, aspects of science teaching are not getting the proper attention in our country. The emphasis is still on rote learning of science. On the other hand, in many advanced countries the cognitive development practices have become an important area of linking of science instruction with students' cognitive development. Goods (1980) observes the following:

> Where 'thinking' is a desired outcome, the teacher must have an understanding of the general cognitive characteristics and range of abilities of the children. Many textbooks and materials that have been developed for science instruction assume a level of thinking that is not available to many or, in some cases, to all children in the classroom.

Thus, the blame for science curricula not catering for the cognitive development lies squarely on the outdated textbooks and classroom instructional techniques, like lecture and discussion methods. These practices do not provide opportunities for scientific investigation and experimentation. Therefore, it becomes imperative to switch over from the lecture method to the problem-solving and project methods of instruction.

Some people and investigatory experiments can be easily set for students to collect observations and interpret those on their own. For this purpose a deliberate attempt should be made to familiarise students with the variables and controls in the experimental situations.

Role of Science Project Work

Furthermore, the idea of project work in India has been so devalued that all sorts of normal pieces of school work are being taken as project work. Even preparing charts, writing a story and preparing scrap-books, etc. are being designated as project work. In respect of the meaning of project, Ponts E.M. *et. al* (1971) observe the following:

> The educational philosophy underlying the project method is that children learn best by trying out their ideas in the practical solutions of real problems which have freely

chosen to tackle. In science teaching its great value may be the opportunity it provides for direct creative activity. In carrying out the projects, the students would learn a good deal of science, by studying many sources of information, by devising experiments, making trails of apparatus and by a critical examination of results leading to redesigning of the experiment.

Thus, it becomes evident that the project work must form a part of science curriculum and children should be encouraged to do simple projects related to the problems around them. This kind of activity results in developing their higher levels of cognition like comprehension, application and synthesis.

Focus on the Child

Child-centredness

Another method of cognitive development through science teaching is by making classroom instruction child-focussed. Teachers can identify the individual needs of students and develop science curricula catering to the needs of each child. The individualised curricula should be based on certain tested assumptions and principles. In this connection, Good (1980) further suggests the following assumptions on which science teaching should be based.

1. It is possible to logically derive learning conditions from goals and characteristics of learners.
2. Learning conditions must reflect what is not known as well as what is known about students.
3. Teacher behaviours and learning materials are dominant factors in determining learning conditions since these two factors communicate to the students' conceptual and operational meanings of learning.
4. Learning how to learn can be facilitated by school experiences.
5. Self-actualised learning should be the goal of education.
6. Learning conditions can be tested by studying interactive processes and outcomes of educational activities.

An Example

A good model of think-and-do science has been developed under the Andhra Pradesh Primary Education Project (APPEP) which has now been replaced by District Primary Education Programme (DPEP). Six instructional (APPEP, 1993) postulates derived on the basis of practical implementation of the project are summarised in the following table.

Table 1

The Survey of the Six Instructional Postulates for Think-and-do Science (Adapted Version)

S.No.	Postulate	Components	Details
1.	Providing	1.1 Activity	• Relevance of the activity • Appropriate concept pitching • Process learning emphasis

		1.2 Planning	• Sub-activities are steps • Sequencing • Time framing
		1.3 Providing materials	• List of materials • Quantity of materials • Availability of materials • Norms and rules for the use of materials
2.	Promoting learning by doing	2.1 Observing	• Use of two or more senses • Observing objects: properties, features, attributes • Observing actions, events, happenings, phenomena
		2.2 Raising questions	• Promoting children's questions • Raising questions on children's discussion • Asking questions from students
		2.3 Generating ideas	• Thinking divergently • Providing alternatives and extension activities • Conjecturing, hypothesising forecasting, predicting
		2.4 Investigating	• Putting things together for experimenting • Verifying hypothesis • Collecting information
		2.5 Recording	• Words and numerals • In diagrams
		2.6 Interpreting	• Looking at data for relations • Finding patterns • Making sense
		2.7 Communicating	• Through talking, report writing, dramatising • Through models, displays, charts, graphs, pictures
3.	Developing task	3.1 Individual task	• Personal assignments • Individual study for remediation and enrichment • Special interest activity
		3.2 Group work	• Share ideas • Discuss problems • Peer-tutoring • Process review
		3.3 Whole class	• Giving overview and instructions for tasks • Summing up • Making presentations • Organising camps and fairs
4.	Recognising individual differences	4.1 Self-pacing	• Preparation of graded material • Self-evaluation exercises • Demonstrating mastery on given task

		4.2 Addressing to multiple intelligence	• Puzzles, games • Music, singing • Role plays, performing arts • Guided visualisation and fantasising • Making and doing things
5.	Using local environment	5.1 Natural surroundings	• Study visits, field visits • Nature hunt • Gardens, nurseries
		5.2 Physical surroundings	• Using discarded, low-cost and no-cost materials • Using local available inexpensive materials
		5.3 Societal resources	• Local artisans for making teaching aids • Community resources • Museums, science parks, fairs
6.	Creating interesting classroom	6.1 Wall displays	• Children's work • Posters, charts, pictures, drawings, paintings • Pocket board
		6.2 Suspended displays	• Mobiles, kites • Cut-outs, masks • Puppets • String-library • Self-made big books
		6.3 Self-displays	• Collected objects, materials, equipments, instructions • Models, toys

In Conclusion

Thus, we see that science teaching can be effective in the cognitive development of students only when project work is done seriously and science curriculum is made child-centred. In such circumstances alone, students will acquire the abilities to sense problems, collect observations, make interpretations and arrive at conclusions which are basic to effective learning of science.

References

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