A Critical Appraisal of General Science Content of Class VII Textbooks

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ABSTRACT

General Science is being taught as an integral part of general education, as it equips the learner with the basic awareness of his physical and biological environment. In this Endeavour, the 'Content' aspect of General Science plays a crucial role as it provides a theme or keynote for the instructional process. Thus the effectiveness of any instructional process is largely determined by the content and it presentation. Content of General Science with special emphasis on the term 'General' is a finest essence of those scientific facts, concepts and principles that are of general importance to a learner, providing general awareness of his environment. In order to remain realistic it needs to accommodate the ongoing changes in the environment to let the learner be conscious of recent evolution occurring as a result of scientific and technological progress. It is its auto accelerating nature and the fact that nothing is absolute in science that makes an urgent and recurring demand for periodical updating of its content. Thus to remain relevant and meaningful, content needs to be critically evaluated, updated and restructured on the regular basis. Textbooks being an effective tool to present the content, researcher felt the need to critically appraise the General Science content of Class VII textbooks prescribed by Rajasthan Board of Education in terms of its relevance and adequacy. Content was found to be environment oriented making an attempt to develop a basic awareness and understanding of the environment in the learner.

Introduction

General Science is now being treated as one of the curricular areas that are indispensable for any school curriculum. It provides the learner with the ability to identify various phenomena (biological as well as physical) operating in his environment and understand their

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casual relationships, classify, interpret and make reasonable conclusions. In this endeavour, the 'content' aspect of General Science plays a crucial role as it forms the pivot around which teaching learning process facilitates. It provides a **theme** or **keynote** for the instructional process. It is a medium through which a teacher interacts and communicates subject knowledge to a learner. So the effectiveness of the instructional process largely depends on the worthwhileness of the content in any discipline in context of objectives to be fulfilled through its transaction. Thus, Content in order to remain realistic and meaningful needs to be restructured on the regular basis. Such restructuring should be done on the basis of the outcomes of critical evaluation of the content.

Important considerations for critical appraisal of General Science 'content' at Upper Primary Stage (Class VII) are as follows:

(a) Nature of content in General Science at upper primary stage

The understanding of nature and structural arrangement of scientific knowledge can become a framework for planning, evaluation and consequent, restructuring of the content. Content of General Science is an ordered knowledge of natural phenomena and relations between the concepts and conceptual schemes that have developed as a result of experimentation and observation and thus explains the objects and events with in our natural environment. Looking deeply into the structure of general science content, its components can be visualised in a hierarchical arrangement where the smallest unit but largest in number are **facts.** Innumerable facts when organised have led to the forming of various **concepts** which are abstract idea about complex phenomena. In trying to understand the behaviour or occurrences of these concepts in various interrelationships, certain **constructs** are created. On the basis of experimentation, with empirical proof, **principle** and **laws** governing phenomena have been identified. When these stated in a complete universally applicable and proven explanation these are called **theory.**

Theory
Principles
Constructs
Concepts
Facts

Hierarchical arrangement of knowledge in Science

Content of General science is an accumulated systematised body of knowledge including facts, concepts, principles, formulae, figure and diagrams etc. All these form the **product of science** which has developed as a result of experimentations observations and measurements called **process of science** in the course of explaining events within our natural environment. Products of science are never final, but in fact they are fluid in nature and tentative. Theories and laws which are proved wrong in the course of time are discarded or replaced by new ones. Science is not only a product but also a process by which this product of science is obtained. Science as a process involves classification, experimentation and measurement etc.

Thus, an ideal General Science content should have a close link between the conclusions of science (**science product**) and inquiry that produced them (**science process**).This can be achieved if the content have along with adequate amount of conceptual input, lot of picture illustrations and variety of activities and experimentations.

(b) Learner's characteristic at upper primary stage

The learner's maturity level (psychomotor ability and stage of cognitive development) make a very important point of consideration for planning and evaluating the content. Learners learning ability, his limitations and strength determine the expected learning outcomes. What to expect say from a child of 3 or 5 can only be determined, keeping in mind the level of development of child. The objectives of teaching the content, difficulty level of the elements of content and the content presentation should be determined on the basis of learner's maturity level. How relevant and appropriate is the content in the context of stage of development it is meant for, forms the important criterion for the evaluation of the content. In the present paper researcher is dealing with the upper primary stage(11 to 14 years of age). As per the Piagetian theory of intellectual development, in Class VII (upper primary stage) child is in formal operational stage. He is no longer tied to concrete situation and capable of developing conceptual understanding of the general science content. Student at this age has an ability to conceptualise the way in which the component parts of the General Science content are interlinked, so as to draw a meaningful idea about it. This should be an ultimate aim of General Science teaching at upper primary stage.

Thus, an ideal science contents should have appropriate and adequate conceptual input to enable the child to conceptualise and draw a meaningful idea about it.

(c) Objectives of General Science teaching at Upper Primary Stage

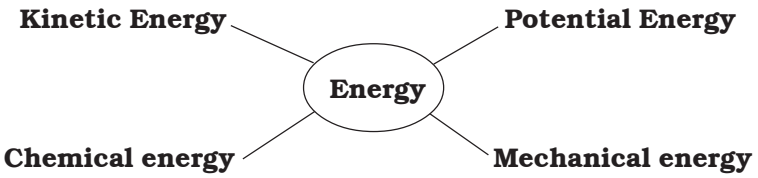
Critical evaluation of content should be done in the light of objectives of teaching it, which in turn need to be appropriate in context of National development goals, pedagogical goals and educational priorities. Therefore researcher made a comprehensive survey of literature to find out the objectives of Science teaching at upper primary level. Education commission (1964-66) in its report mentioned the objective of teaching science at upper primary stage as to develop among children a proper understanding of main facts, concepts, principles and process in the environment. Objective mentioned in the guidelines and syllabi for upper primary stage prepared by NCERT in 1988 was to acquaint students with some basic concepts, principles, laws of science relevant for understanding and interacting with the environment. According to Narendra Vaidya (1971), to develop functional understanding of scientific facts, concepts, conceptual schemes and their application to new phenomena is an important objective of teaching science at this level. Having studied the reports of various other committees and commissions as well as suggestion by eminent scientist, researcher concluded that '**Attainment of science concepts'** should be an objective of science teaching at this level.

Thus, Ideal General Science content at upper primary stage should enable a child not only to recall, recognise and define concepts but also to understand, interpret, explain and apply his conceptual understanding in new situations**.**

Having studied the philosophical and psychological basis of General Science content, researcher decided to critically appraise the General Science content in respect of following:

(a) Is Content Relevant?

Content is relevant if it makes sense to a learner at this stage. It should be **complete in itself** and should be capable of forming logically a properly organised **'Whole**' or a meaningful **'Gestalt'** in the mind of a child. Relevance can be assessed in terms of the amount of interrelatedness with in the content. Inter linking with in the content should be such that learning of one concept leads to the development of second, second into third and so on, until the main idea of that unit is eventually attained. For e.g. a conceptual statement like 'energy can change from one form to another' summarises a great number of concepts



Conceptual statement (idea) Ÿ # Energy can change from one form to another

(b) Is content Adequate?

Content is adequate if it is provided with broad and variety of learning experiences. To develop and understanding of any idea it is required to provide adequate learning experiences so that one can recognise and apply the concept being used. Along with the adequate the conceptual input it should be supplied with adequate number of picture and verbal illustrations. Figures and diagrams, presents the content in the concrete form, performing activities would provide first hand experience and increase students participation, thus help in developing and idea about the concept. Ideal science content has an adequate amount of conceptual input along with adequate number of picture illustrations (figures and diagrams), verbal illustrations (activities) and thought provoking questions. Conceptual learning of the content can only occur if it is adequate in terms of the above. Researcher would judge the adequacy of the content in terms of amount of conceptual inputs, amount of its being activity oriented and number of figure and diagram been presented.

RATIONALE

If the content is evaluated and restructured on the above parameters, there are maximum possibilities that learner having studied General Science for 10 years of General education will come out with full scientific understanding of the environment. But in order to have developed such strong understanding of science, one needs to have strong scientific base. Thus one of the basic priorities is to review the science status at lower levels of academic set up like 'upper primary level' where the foundations for the scientific understanding can be strengthened. This is why this stage was chosen for study by the researcher.

STATEMENT OF THE PROBLEM

A critical appraisal of General Science content of Class VII textbooks

OBJECTIVE OF THE STUDY

To critically appraise the Class VII General Science content in respect of its relevance and adequacy.

HYPOTHESIS

Content of General Science of Class VII is relevant and adequate.

POPULATION

Textbooks of Class VII of all boards of education in India.

SAMPLE

Textbook of Class VII prescribed by Rajasthan Board of Education published by Rajasthan Rajya Pathyapustak Mandal, Jaipur.

DELIMITATION OF THE STUDY

The researcher was fully conscious of the wide scope of subject area as well as various constraints and so the study was delimited in terms of follows:

1. The study was conducted only on Class VII content of General Science.
2. The study was conducted only on General Science textbook of Rajasthan Board of Education.

SOURCE OF DATA

In the present study, researcher analysed the substantive dimension of the General Science curriculum at upper primary stage. Thus the source of data was the content of General Science textbook of Class VII of Rajasthan Board of Education.

TOOL FOR THE DATA COLLECTION

As the objective of the study was to critically appraise the content of general science at upper primary level, it was essential to analyse it, for which the content analysis was done. Thus the tool used for the collection of the data was the **content analysis Performa** and the technique used was **qualitative content analysis.**

(a) Qualitative Content Analysis

It is a qualitative research technique in which researcher analyses the presence, meanings and relationships of concepts. To conduct a content analysis on any textbook content, it is broken down, into manageable categories on a variety of levels to identify the concepts and then relationships are examined among concepts. In structural terms, content refers to organised set of statements or proposition and in General science content these statements are about interrelated scientific facts, concepts and principals that are of general importance to a child. Thus, in order to make a qualitative General science content analysis, General Science textbook of Class VII was examined and distilled (analysed) thoroughly for facts, concepts, laws/principles, process (cyclic and linear processes), relationships (direct, inverse, concurrent and cause-effect relationships) and categorisations with the help of Content Analysis Proforma. Data thus obtained as a result of such exhaustive content analysis was too massive. Therefore, compilation of data was done where all the concepts as well as ideas were sorted out from the above Proforma and tabulated. From the above tabulated data concept clusters were identified where each concept cluster comprised of a 'central' concept and various related concepts and ideas clustered around it. There were total 14 concept clusters identified where each concept cluster seemed to be complete in itself and conveying some meaningful ideas. Interrelationship among various concept clusters was identified to judge the interrelatedness within the content and how far it is successful in forming a meaningful 'Gestaltic' view of the environment in the mind of the child. This enabled researcher to assess the relevance of the content with respect to learner at upper primary stage. Below each concept cluster a table was formed which depicted the concepts and ideas involved in the cluster and nature of details been provided for each one of them in the textbook. This enabled researcher to assess the adequacy of the conceptual input. Figure and diagram analysis was done to assess the adequacy of the picture and verbal illustration.

(b) Content Analysis Proforma

This was the tool used for data collection. It was a tabular presentation of the content. It was divided into six columns namely Facts, Concepts, and Laws, process, Relationships and categorisation. Relationships column was further divided into concurrent, inverse and cause effect relationships columns while process column was further divided into

cyclic and linear process. All the facts found were listed under the columns of facts, all concepts found were listed under concept column and so forth in the content analysis Performa as shown in the Table No.1:

TABLE 1
Content Analysis Proforma

Facts	Concepts	Laws	Process		Relationships				Categorisation
			Cyclic	Linear	Direct	Inverse	Concurrent	Cause-effect	

NATURE OF DATA

Data obtained after the systematic and detailed examination and analysis of the content of General Science textbooks of Class VII of above mentioned Board was found to be purely **qualitative** in nature.

PROCEDURAL DETAILS

Procedural details have been elaborated in what follows:

(a) Content Analysis

Content of General Science textbook was found to have been presented in a topical fashion. There were 20 chapters in the textbook. Content analysis was done chapter wise. Each chapter was analysed thoroughly for facts, concepts, laws/principles, process (cyclic and linear processes), relationships (direct, inverse, concurrent and cause-effect relationships) and categorisations. All the facts found were listed under the columns of facts, all concepts found were listed under concept column and so forth in the content analysis Proforma. Data thus obtained as a result of such exhaustive content analysis reflected each and every aspect of the content of textbook but at the same time it was too massive. Researcher found it impractical to present it in its original form, thus compilation of data was done.

(b) Compilation of Data

In order to make the data obtained, more refined and presentable, all the concepts as well as ideas were sorted out from the above Proforma and tabulated. Two tables exhibiting all the concepts and ideas along with their way of presentation in the book were prepared (**Appendix II-A & II-B**). Framework of the table is as follows:

TABLE 2

Concepts	Definitions	Descriptions	Differentiation/ Categorisations	Process	Relationship

TABLE 3

Ideas	Mode of Presentation		
	Illustrative	Descriptive	Explanatory

(c) Identification of Concept Clusters

On the basis of tabulated data obtained from the preceding step, researcher tried to represent the content in more meaningful pictorial format i.e. in the form of **concept clusters.** Each concept cluster comprised of a 'central' concept and various related concepts and ideas clustered around it. Each concept cluster seemed to be complete in itself and conveying some meaningful ideas. The assumptions behind the clustering of concepts and ideas were that various concepts and ideas in the content are interrelated.

(d) Tabulation of Nature of Details in Each Concept Cluster

Below each concept cluster a table was formed which depicted the concepts and ideas involved in the cluster and nature of details been provided for each one of them in the textbook.

Concepts/Ideas	Nature of Details

(e) Interlinking of Concept Cluster

An attempt was made to identify interrelationship among various concept clusters. This was done to judge the interrelatedness within the content and how far it is successful in forming a meaningful 'Gestaltic' view of the environment in the mind of the child.

(f) Figure and Diagram Analysis

This was done in order to determine adequacy of the content in respect of figurative component. Each figure and diagram was analysed and assigned to one or more of the following categories:

(i) Figures used strictly for illustrative purpose.

(ii) Figures requiring students to perform some activity or to use data.

(iii) Figures illustrating setting up the apparatus for an activity.

Data obtained on figures and diagram analysis has been presented in **Appendix III**.

DATA ANALYSIS

General Science textbook of Class VII, fourteen concept clusters were identified. Each concept cluster could be characterised distinctly and found to be conveying a meaningful idea.

Identification of Concept Cluster

Concept cluster no. 1 (Life Processes) was 'process' centered conveying an idea, that various life processes allow life to continue. **Concept cluster no. 2 (Heat)** is 'relational' type conveying an idea of cause and effect relationship among various phenomena operating in the environment. This cluster showed Melting, boiling, expansion and change of state as the effect of heating .**Concept cluster no. 3 (Electric Current)** was 'categorisation' based conveying an idea that materials can be categorised into good or bad conductor as per their ability to conduct electric charge. **Concept Cluster no. 4 (Living Organism)** was found to be 'organisation' based projecting an idea that our body is an organised structure where cell as a structural unit is organised into tissues, tissues into organs and organs into organ system. Finally proper organisation of organ systems makes an individual. **Concept cluster no. 5 (Matter)** was 'classification' type depicting an idea that matter can be classified into elements, compound and mixture all of which are made of atoms and molecules. **Concept Cluster no. 6 (Chemical Representation)** was based on 'symbolic representation' giving an idea that chemical can be represented by symbols and chemical equation is nothing but symbolic representation of chemical reaction. **Concept Cluster no. 7 (Cell)** was 'function' based giving an idea that cell is a functional unit of organism. A cell functions through its different organelles like mitochondria, ribosome, centrosome etc. in such a way that whole organism continues living and reproduce through mitotic and meiotic cellular division. **Concept Cluster no. 8 (Constituents of Air)** was 'composition' based giving an idea that air is a mixture of gases. **Concept Cluster no. 09 (Chemical Reaction)** was 'Reaction' based depicting various reactions occurring naturally like nitrogen fixation, photosynthesis, oxidation etc. **Concept Cluster no. 10 (Diseases)** was 'relational' type giving an idea of disease, its causes, symptoms

and precautions. **Concept Cluster no. 11 (Imbalance in Nature)** was again 'relational' conveying an idea of interdependence of living and nonliving components of nature thus emphasising on environmental consciousness. **Concept Cluster no. 12 and 13 (Sound and Light)** gave an idea that light as well as sound travels in all direction from their source where sound needs medium while light can propagate without medium. **Concept Cluster no. 14 (Machines)** generated an idea that machine makes our work easier.

Below each concept cluster a table was presented that mentioned whether the concepts in the cluster had been presented in content as description, definitions, relationships, process, and categorisation. With the help of the table, researcher could make out whether the details been provided regarding concept cluster (all concepts within the cluster) were adequate and appropriate to develop the idea that each cluster seemed to be conveying.

Interrelationship among Concept Clusters

All the fourteen concept clusters were identified to be interrelated generating one major idea of **'unity of biological, physical and chemical phenomena operating in the environment'.** The interrelationship among these concept cluster have been presented in the Figure-1

This figure depicted the conceptual interlinkage with in the content. These relationships were identified in the following manner. As shown in **Concept Cluster no. 1(Life Processes)** all living organisms perform various life processes like respiration, nutrition, excretion etc. to keep themselves alive. They require energy to perform these life processes which is obtained from food through chemical reactions. In order to get chemical energy from food, it has to be broken into smaller and soluble molecules through the process of digestion. These smaller molecules as described in **Concept Cluster no. 09 (chemical reactions)** then take part in chemical reaction called oxidation that take place in mitochondria of the cell as described in **Concept Cluster no. 7 (Cell)**. Food molecules are oxidised with oxygen taken up by the organism through aerobic respiration from air. The oxygen percentage in the air maintained through another chemical reaction called photosynthesis as described in **Concept Cluster no. 09 (Chemical reactions)**. During this process green plants synthesise an organic compound called carbohydrate using carbon dioxide and water from the environment and heat energy from sunlight, as described in **Concept cluster no. 2 (Heat)** facilitate these

chemical reactions**.** Oxygen is released in this process. Chemical representation as described in **Concept Cluster no. 6 (Chemical representation**) of this process can be done as following chemical equation.

$$6CO_2 + 6H_2O \xrightarrow{\text{Sun Light}} C_6H_{12}O_6 + 6O_2 + \text{Energy}$$

Oxygen thus released causes food molecules to oxide and release energy which is used for various life processes to carry on among which are mitosis and meiosis. Mitosis helps in growth and development from cell to organ system while meiosis causes organism to reproduce its own kind leading to population growth as described in **Concept Cluster no. 7 (Cell)**. The uncontrolled exploitation of natural resources by human population has led to environmental pollution as described in **Concept Cluster no. 11 (Imbalance in nature)**. Although machines make our work easier as described in **Concept Cluster no. 14 (Machines)** but indiscriminate use of machines leads to enormous sound ,water and air pollution .Consequently, the natural composition of air as described in **Concept Cluster no. 8 (Constituents in air)** has been disturbed due to mixing of various harmful gases and compounds .This in turn are affecting all living organism, various life process and causing various diseases among human population .

Figure and Diagram Analysis

Overall ninety five figures and diagram were found in the content that was covered in 17 chapters as shown in **Appendix III**. Not even a single chapter was without figure. There were 7 chapters which had large number of figures and four chapters which had very less number of figures. Sixty five figures were presented for only illustrative purpose. There were twenty one figures which required students to perform activity while fifteen figures illustrated the way of setting up apparatus for activity. Ratio of figures for illustrative purpose only to the figures calling for performing some kind of activity was (65:36). In some chapters figures were lacking in clarity for eg. Figure exhibiting human respiratory system in chapter 7, figure for human heart etc.

DATA INTERPRETATION

Thus, overall it was found that content of General Science textbook rendered itself for meaningful representation in the form of fourteen 'consistent wholes' which were referred to as 'concept clusters'. Each one of these conveyed some meaningful idea about the content. This

proves the relevance of the content to an extent. When seen in totality, all the above fourteen concepts clusters were found to be interrelated forming a 'Gestaltic' view of the content in general science textbook of Class VII. One major idea found to be emerging out was environment being an integrated whole comprising physical, biological, and chemical phenomena.

RESULTS

Overall content was found to be **relevant**. It was complete in itself forming logically a properly organised 'Whole' or a meaningful 'Gestalt' in the mind of a learner. Interrelatedness with in the content was such that learning of one concept leads to the development of second, the second into a third and so on eventually emerging into one major idea i.e. **"There is oneness and unity in all nature".** Content was **adequate** except few concepts like atoms, load, fulcrum, work etc. found to be lacking adequate description. Content was adequate in its figurative component but proportion of illustrative figures was higher than activity based figures. Content was appropriate except few concepts like machines, kinds of asexual reproduction whose description seemed to be too heavy and vast for the upper primary stage. But still textbook was found to be bit authoritative and less investigative offering few challenges to students

BIBLIOGRAPHY

1. Begum, K. 2000. Problem of teaching new Science syllabus for standard VII in Andhra Pradesh and their impact on pupils achievement. NCERT, Fifth Survey of Educational Research, Vol. II, NCERT, p.1238.
2. Bharti, M. 2000. Uchch Madhyamic star Par gruha Vigyan Pathaykram Ka Samalochnatmak Vishileshan. Unpublished M.Ed dissertation submitted to Banasthali Vidyapith.
3. Chhikara, M.S. 1991. An investigation into the relationship of reasoning abilities with achievement of concepts in life sciences. Buch, M.B. (ed.), Fourth Survey of Research in Education, NCERT, p. 820.
4. Das, Ajit.K. 2000. Modernisation themes in primary textbooks. Fifth Survey of Educatonal Research,Vol.II, NCERT, p.1234.

5. EDWARDS, CLIFFORD H., ROBERT L. 1977. Teaching Elementary School Science: A Comparative Study. Praeger, New York.

6. GOPAL KRISHNAN, K.R. 1987.Critical analysis of the new Mathematics syllabus and textbook in upper primary classes in Kerela. Buch, M.B., Third Survey of Research in Education, NCERT, p. 565.

7. JOSHI, B.P. 1991. Development of Science Education for upper primary classes based on the environment approach. Buch, M.B. (ed.), Fourth Survey of Research in Education, Vol. I, NCERT, p. 735.

8. JOSHI, M.G. 1987. Content analysis of General Science textbook for standard IV. Buch, M.B. (ed.), Third Survey of Research in Education, NCERT, p. 541.

9. MASIH, A. 1998. New Trends in Science Curriculum. Manak, New Delhi .

10. MASIH, S. 2000. A study of attitude towards Science, understanding the nature of and concept attainment in Science of middle school students in M.P. : A Comparison of effects of HSTP Curriculum and NCERT. (adopted) Curriculum. Fifth Survey of Education Research, Vol. II, NCERT, p. 1267.

11. MOHAN, R. 2000. Effective Concept learning in Science Education : A theoretical instructional mode. NCERT, Fifth Survey of Educational Research, Vol. II, NCERT, p. 1252.

12. MOHANTY, S. 2000. An appraisal of teaching science in the high schools of Cuttack city. NCERT, Fifth Survey of Education Research , Vol.-II, NCERT, p. 1253.

13. MUKHOPADHYAY, B.1991. The relationship between Comprehensibility of language used in the Science textbook and Science achievement in terms of learning objectives at primary level in state of Rajasthan. Buch, M.B. (ed.), Fourth Survey of Research in Education, Vol. I, NCERT, p. 735.

14. NCERT 1985. Curriculum load at the School level: A quick appraisal. NCERT.

15. NCERT 1991. Minimum level of learning at primary stage – Report of the committees set up by the HRD ministry (Department of Education) Government of India. NCERT.

16. NCERT 1990. Science Teaching Guidelines for Educational Functionaries of states. NCERT, New Delhi, 1990

17. POKHRANA, KAMAL, PRATAPMAL, DEVPURA, NAND KISHORE SRIVASTAVA: Vigyan, Kaksha 7, Rajasthan Rajya Pathaypustak Mandal, Jaipur, 2001

18. RICHMOND, P, E. (ed.). 1973. New trends in Integrated Science teaching. Vol. II, UNESCO, Paris .

19. ROMEY D. WILLIAM .1968. Inquiry Techniques for teaching Science. Prentice-hall, New Jersey, U.S.A.

20. SCERT (A.P.) 1987. Evaluatory study of in service of Secondary school teachers in Science teaching centers attached to colleges of Education. Buch M.B., Third Survey of Research in Education, NCERT, p.561.

21. SCERT (A.P.) 1991. Evaluatory study of textbooks in Environment studies of classes III & V based on revised curriculum in Science. Buch M.B., Fourth Survey of Research in Education, p.745.

22. SAXENA, A.B. 2000. A Critical study of textbooks for environmental studies at the primary level. Journal of Indian Education Vol. II, NCERT , p.79.

23. SHISTA, R. 2000. An Investigation into the effectiveness of guided discovery learning vis-à-vis the conventional approach to the teaching of scientific concepts in life Sciences. Fifth Survey of Educational Research, Vol. II, NCERT, p.1262.

24. SRIVASTAVA, K. 2000. Impact of Science teaching on the child's concept of physical causality: An experimental study. Fifth Survey of Educational Research, Vol. II, NCERT, p. 1266.

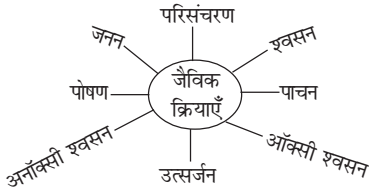
25. SWARNAMMA, G. 1987. An Inquiry into the teaching of Biology in upper primary school of Kerela. Buch, M.B (ed.), Third Survey of Research in Education, NCERT, p.568.

26. VAIDYA, N. 1996 .Science teaching for the 21st Century, Deep & Deep Ltd., New Delhi.

27. VAIDYA, N. 1970. Some aspects of Piaget's Work and Science Teaching, S. Chand and Co. Ltd., New Delhi.

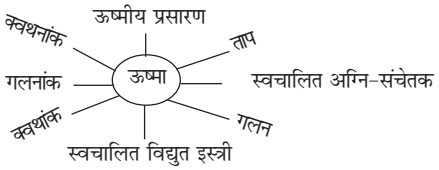
28. WALVALKAR, Y.N. 1987. Critical evaluation of mathematics textbooks for standard II, III & IV. Buch, M.B., Third Survey of Research in Education, NCERT, p. 542.

Concept Cluster No. 1



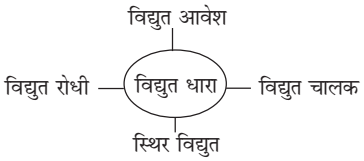
S. No.	*Concepts/Ideas*	*Nature of Details*
1.	जैविक क्रियाएँ	Descriptions
2.	पाचन	Process
3.	ऑक्सी श्वसन	Process
4.	जनन	Process,Categorisation
5.	पोषण	Process,Categorisation
6.	अनॉक्सी श्वसन	Process
7.	उत्सर्जन	Process
8.	श्वसन	Process
9.	परिसंचरण	Process

Concept Cluster No. 2



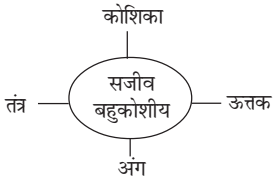
S. No.	*Concepts/Ideas*	*Nature of Details*
1.	उष्मा	Descriptions
2.	क्वथन	Descriptions,Definition
3.	गलन	Descriptions,Definition
4.	गलनांक	Descriptions,Definition
5.	ताप	Definition
6.	स्वचालित विद्युत इस्त्री	Description
7.	स्वचालित अग्नि-संचेतक	Description
8.	ऊष्मीय प्रसरण	Description

Concept Cluster No. 3



S. No.	*Concepts/Ideas*	*Nature of Details*
1.	विद्युत आवेश	Definition,Descriptions, Categorisation
2.	विद्युतरोधी	Definition
3.	स्थिर विद्युत	Description definition
4.	विद्युत प्रवाह	Definition
5.	विद्युत चालक	Definition

Concept Cluster No. 4

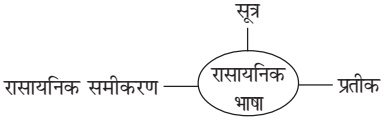


S. No.	*Concepts/Ideas*	*Nature of Details*
1.	सजीव बहुकोशीय	Descriptions,Definition,Categorisation
2.	कोशिका	Descriptions,Definition,
3.	ऊत्तक	Descriptions,Definition,
4.	अंग	Descriptions,Definition,
5.	तंत्र	Descriptions,Definition,

Concept Cluster No. 5

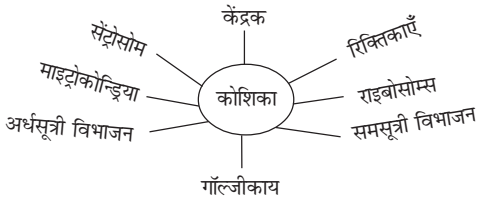
S. No.	*Concepts/Ideas*	*Nature of Details*
1.	पदार्थ	Descriptions, Categorisation Definition,
2.	तत्व	Descriptions,Definition, Categorisation
3.	मिश्रण	Descriptions,Definition, Categorisation
4.	यौगिक	Descriptions,Definition, Categorisation
5.	परमाणु	Definition,
6.	अणु	Definition,

Concept Cluster No. 6



S. No.	Concepts/Ideas	Nature of Details
1.	रासायनिक भाषा	Descriptions, Definition,
2.	सूत्र	Descriptions, Definition,
3.	प्रतीक	Descriptions, Definition,
4.	रासायनिक समीकरण	Descriptions, Definition,

Concept Cluster No. 7



S. No.	Concepts/Ideas	Nature of Details
1.	कोशिका	Descriptions, Definition,
2.	माइट्रोकोन्ड्रिया	Descriptions, Definition,
3.	सेंट्रोसोम	Descriptions, Definition,
4.	अर्धसूत्री विभाजन	Descriptions, Definition,Process
5.	समसूत्री विभाजन	Descriptions, Definition,Process
6.	गॉल्जीकाय	Definition
7.	राइबोसोम्स	Descriptions, Definition,
8.	रिक्तिका	Descriptions, Definition,

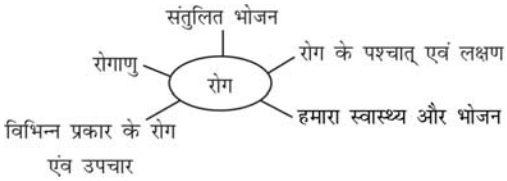
Concept Cluster No. 8

S. No.	Concepts/Ideas Nature of Details	
1.	वायु के अवयव	Descriptions,
2.	वायु के सक्रिय भाग ऑक्सीजन है	Descriptions,
3.	वायु में जलवाष्प और निष्क्रिय गैसें	Descriptions,
4.	वायु में जलवाष्प और कार्बन डाईऑक्साईड है	Descriptions,
5	नाइट्रोजन वायु का सर्वाधिक भाग	Descriptions,

Concept Cluster No. 9

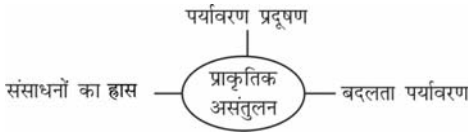
S. No.	*Concepts/Ideas*	*Nature of Details*
1.	रासायनिक क्रियाएँ	Descriptions
2.	नाइट्रोजन यौगिकीकरण	Descriptions , Definition
3.	उदासीनीकरण	Description, Definition
4.	खाद्य संश्लेषण	Description, Definition
5.	आक्सीकरण	Description

Concept Cluster No. 10



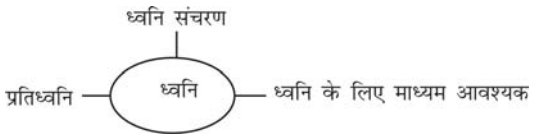
S. No.	*Concepts/Ideas*	*Nature of Details*
1.	रोग	Descriptions
2.	रोगाणु	Descriptions
3.	संतुलित भोजन	Description
4.	हमारा स्वास्थ्य और भोजन	Description
5.	विभिन्न प्रकार के रोग एवं उपचार	Description
6.	रोग के पश्चात् एवं लक्षण	Description

Concept Cluster No. 11



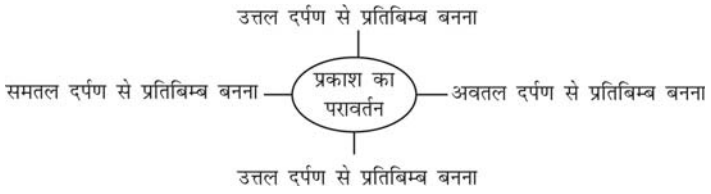
S. No.	*Concepts/Ideas*	*Nature of Details*
1.	प्राकृतिक असंतुलन	Descriptions
2.	पर्यावरण प्रदूषण	Descriptions, Example
3.	संसाधनों का ह्रास	Description
4.	बदलता पर्यावरण	Description

Concept Cluster No. 12



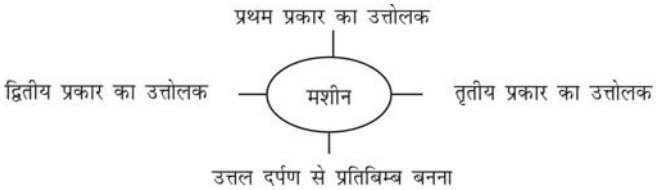
S. No.	*Concepts/Ideas*	*Nature of Details*
1.	ध्वनि	Descriptions, Categorisation
2.	प्रतिध्वनि	Descriptions
3.	ध्वनि के लिये माध्यम आवश्यक	Description, Example
4.	ध्वनि संचरण	Description

Concept Cluster No. 13



S. No.	*Concepts/Ideas*	*Nature of Details*
1.	प्रकाश का परावर्तन	Descriptions,Definition, Categoration
2.	पार्श्व परिवर्तन	Descriptions,
3.	समतल दर्पण से प्रतिबिम्ब बनना	Description
4.	अवतल दर्पण से प्रतिबिम्ब बनना	Description
5.	उत्तल दर्पण से प्रतिबिम्ब बनना	Description

Concept Cluster No. 14



S. No.	*Concepts/Ideas*	*Nature of Details*
1.	मशीन	Descriptions, Example
2.	प्रथम प्रकार का उत्तोलक	Descriptions, Example
3.	द्वितीय प्रकार का उत्तोलक	Description, Example
4.	तृतीय प्रकार का उत्तोलक	Description, Example

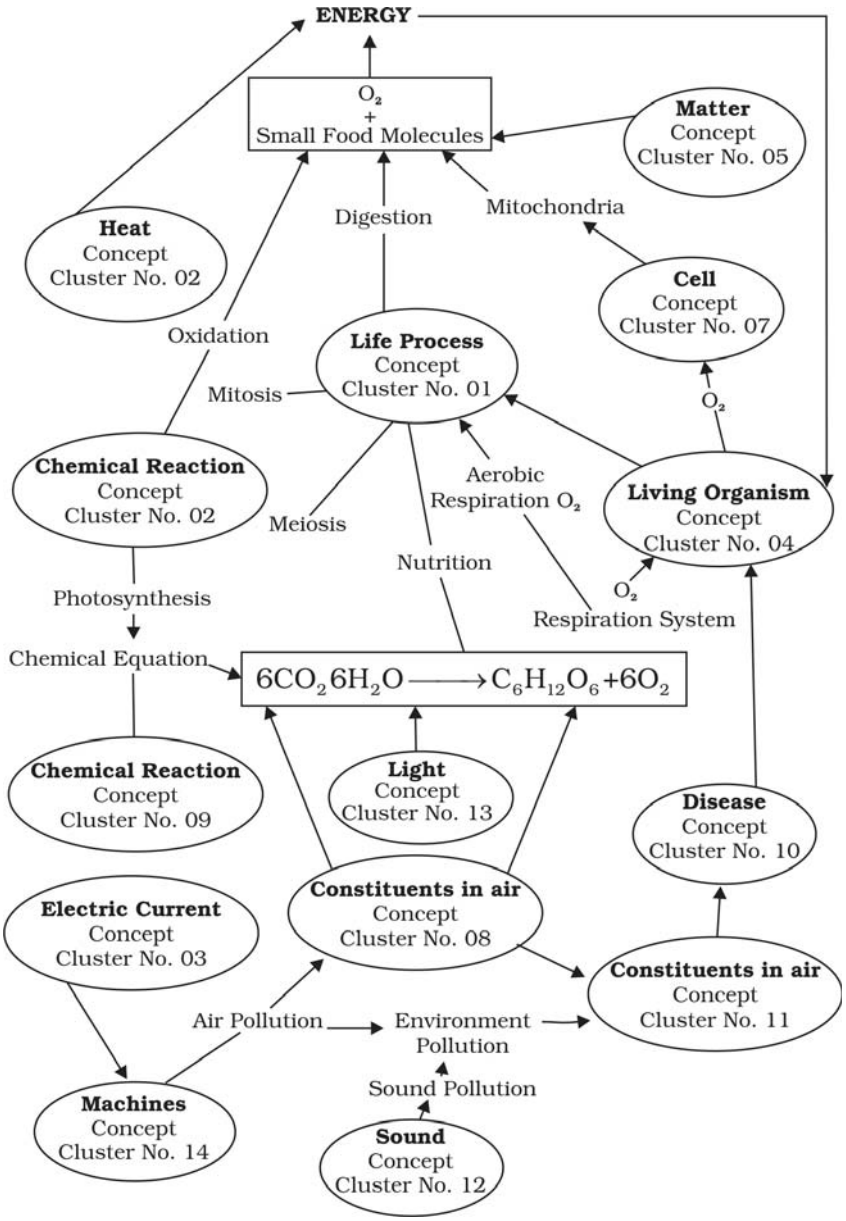


FIGURE 1
Interrelationship among concept cluster of Class VII content of General Science

APPENDIX-I

TEXTBOOK DETAILS

In the present study, content analysis of General Science textbook of Class VII prescribed by Rajasthan Rajya Pathypustak Mandal, Jaipur was made. Details of the above mentioned books are as follows:

विषय सूची

APPENDIX-II-A

Concept in Class VII General Science Textbook and their description

S.No.	*Concepts*	*Definitions*	*Description*	*Differentiation/Categorisation*	*Process*	*Relationship*
1.	पदार्थ	√	Examples	पदार्थ in terms of their state शुद्ध पदार्थ और अशुद्ध पदार्थ Composition शुद्ध पदार्थ in terms of their Composition अशुद्ध पदार्थ in terms of their Composition		
2.	तत्व	√	Examples	तत्व in terms of physical and chemical Characteristic		
3.	मिश्रण	√	Examples	समांग मिश्रण और असमांग मिश्रण : Constitution		
4.	यौगिक	√	Examples, Illustration		√	
5.	रासायनिक क्रिया	√	Examples		√	
6.	प्रतीक	√	Examples			
7.	अणु सूत्र	√	Examples			

8.	रासायनिक समीकरण	√	Examples		√	
9.	उदासीनीकरण अभिक्रिया	√	Examples, Illustration		√	
10.	लवण	√	Examples			
11.	नाइट्रोजन यौगिकीकरण	√	Examples		√	
12.	कोशिका	√	Structure, Function			
13.	समसूत्री विभाजन	√			√	
14.	अर्धसूत्री विभाजन	√			√	
15.	राइबोसोम्स	√	Structure, Function			
16.	गाल्जीकाय	√	Structure, Function			
17.	रिक्तिकाएँ	√	Structure, Function			
18.	माइट्रोकोन्ड्रिया	√	Structure, Function			
19.	केंद्रक	√	Structure,			
			Function			
20.	सेंट्रोसोम	√	Structure,			
			Function			
21.	ऊतक	√	Structure, Function	जन्तु ऊतक और पादक ऊतक :Structure, जन्तु ऊतक in terms of their structure and function, पादक ऊतक in terms of their structure Location and function, जन्तु विभाज्योतक ऊतक और स्थायी ऊतक in terms of structure		
22.	श्वसन	√	Structure, Function			
23.	ऑक्सीश्वसन	√				
24.	अनॉक्सी श्वसन	√			√	
25.	पोषण	√	Examples, Illustration	सजीवों में पोषण एवं पादप में पोषण	√	
26.	खाद्य संश्लेषण	√			√	
27.	परिसंचरण	√	Structure, Function		√	
28.	उत्सर्जन	√	Structure, Function		√	
29.	जनन	√	Structure, Function	अलैगिंक जनन और लैगिंक जनन जंतुओं में लैगिंक जनन और पादपों में लैगिंक जनन मादा जनन और नर जनन	√	

30.	संतुलित भोजन	√	Definition, Example			
31.	रोग	√	Definition, Example			
32.	रोगाणु	√				
33.	ऊष्मा	√	Example			
34.	ताप	√				जब वस्तु को ऊष्मा देते है तो उसका ताप बढ़ जाता हैं।
35.	गलंन	√	Example, Illustration		√	
36.	गलंनाक	√				
37.	क्वथन	√	Example,		√	
			Illustration			
38.	क्वथनांक	√			√	
39.	उष्मीय प्रसारण	√		ठोस, द्रव अंर गैसीय उष्मीय प्रसारण	√	
40.	स्वचालित	√	Structure,			
	अग्नि संयतक		Function			
41.	स्वचालित	√	Structure,			
	विद्युत इस्त्री		Function			
42.	प्रकाश परावर्तन	√		नियमित परावर्तन और विसरित परावर्तन	√	
43.	पार्श्व परिवर्तन	√				
44.	प्रतिबिम्ब	√				
45.	ध्वनि			क्षीण एवं प्रबल ध्वनि मंद एव तीक्ष्ण ध्वनि	√	
46.	ध्वनि संचरण	√	Illustration		√	
47.	प्रतिध्वनि	√				
48.	प्राकृतिक असंतुंलन	√	Example			मनुष्य की अनियोजित आर्थिक गति-विधि से प्राकृतिक असतुंष्ट
49.	पर्यावरण प्रदूषण	√		पर्यावरण प्रदूषण in terms of component of environment		
50.	प्राकृतिक संसाधन	√	Example, Illustration			
51.	स्थिर विद्युत	√	Example, Illustration			
52.	विद्युत आवेश	√	Example, Illustration	घन आवेश और ऋण आवेश		
53.	विद्युत चालक	√				

54.	विद्युत-रोधी	√				
55.	मशीन	√	Example, Illustration	साधारण मशीन और जटिल मशीन	√	
56.	उत्तोलक	√		प्रथम प्रकार उत्तोलक द्वितीय प्रकार उत्तोलक और तृतीय प्रकार उत्तोलक	√	
57.	जैविक क्रियाएँ	√	Example, Illustration		√	

APPENDIX-II-B

Other ideas in Class VII General Science textbook and their description

S.No.	Ideas	Descriptive	Illustrative	Explanatory
1.	पदार्थ अत्यन्त सूक्ष्म कणों से मिलकर बनते है।		√	
2.	ऊष्मा परिवर्तन से पदार्थ की अवस्था बदल जाती है।		√	
3.	वायु के अवयव वायु का सक्रिय भाग ऑक्सीजन नाइट्रोजन वायु का सर्वाधिक भाग वायु में जलवाष्प और कार्बन डाइऑक्साइड एवं धूल के ठोस कण निष्क्रिय गैसें	 √ √ √	 √ √	
4.	जैविक क्रियाओं के लिये ऊर्जा जरूरी	√		√
5.	अंग एवं तंत्र का निर्माण	√		
6.	बदलता पर्यावरण	√		
7.	संसाधानों का ह्रांस	√		
8.	विभिन्न प्रकार के रोग एवं उपचार	√	√	
9.	व्यक्तिगत एवं सामुदायिक स्वास्थ्य	√		√
10.	रोग की पहचान एवं लक्षण	√		
11.	हमारा स्वाास्थ्य और भोजन	√		
12.	महान विज्ञानी चन्द्रशेखर वेंकटरमन के जीवन का वर्णन	√		
13.	व्यक्तिगत एवं सामुदायिक स्वास्थ्य एवं पर्यावरण स्वच्छता	√		

APPENDIX-III

Figure and diagram analysis of Class VII General Science textbook

Chapter No.	Figure & Diagram Analysed	Figures that illustrate only	Figures Requiring students to perform activity	Figures illustrating way of setting up apparatus for activity
1.	1 विभिन्न वस्तुएं 2 ऊष्मा से पदार्थ को विभिन्न अवस्थाओं में परिवर्तन 3 प्रकृति में विभिन्न तत्वों की प्रतिशत मात्रा	√ √ √		
2.	1 सोडियम व क्लोरिन परमाणु की संरचना 2 नमक बनने की प्रक्रिया	√ √		
3.	1 ऑक्साइड बनाने की विधि	√	√	√
4.	1 वायु का प्रतिशत संघठन आयतन के अनुसार	√		√

	2 प्रयोगशाला में ऑक्सीजन बनाना 3 ऑक्सीजन के उपयोग	√		√
5.	1 जन्तु कोशिका (साधारण सूक्ष्मदर्शी द्वारा देखा गया) 2 जन्तु कोशिका (इलेक्ट्रान सूक्ष्मदर्शी द्वारा देखा गया) 3 अंत: प्रदव्यी जालिका 4 माइट्रोकोन्ड्रिया 5 गॉल्जीकाय 6 केंद्रक 7 पादप कोशिका 8 विभिन्न आकृति की कोशिकाएँ 9 समसूत्री विभाजन 10 अर्द्धसूत्री विभाजन	√ √ √ √ √ √ √ √ √ √		
6.	1 उपकला ऊतक कोशिकाएँ 2 अस्थि ऊत्तक 3 रूधिर ऊत्तक 4 पेशीय ऊत्तक 5 तंत्रिका कोशिका 6 तने की अनुप्रस्थ काट 7 विभाज्योतक ऊत्तक 8 मृदुतक 9 स्थूलकोणोत्तक 10 दृढ़ोतक 11 दारू जायलम ऊत्तक 12 पोथवाह ऊत्तक 13 आमाशय में उपस्थित ऊत्तक 14 ऊत्तक अंग तंत्र	√ √ √ √ √ √ √ √ √ √ √ √ √ √		

Figures & Diagrams from chapter No. 7 to chapter No. 17 of Class VII General Science textbook were also analysed in the above manner.