Unfolding the Epistemological Meanings and Pedagogical Implications of Geography Textbook Questions

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Abstract

Textbook questions and exercises are quintessential part of every textbook. One can easily locate textbook questions at the end of the every chapter and also in between the text. What are they meant for? Usually we think they are meant for assessing learners' understanding regarding subject knowledge, providing clue to teacher to form other questions. However, besides these popular notions, textbook questions implicitly communicate messages about what is 'worth' knowledge and what learning is about? The present paper takes geography textbook questions as a unit of analysis and tries to analyse the nature of textbook questions with reference to content and cognitive processes perspective.

Textbook questions and exercises form an essential part of every textbook. It is easy to locate textbook questions at the end of the every chapter and also woven in between the text. What are they meant for? Ordinarily, we tend to think that they are meant for assessing learners' understanding regarding subject knowledge and to provide clues to the teachers to form further questions. However, one may take a pause here and try to gauge beyond these popular notions… do textbook questions also implicitly communicate messages about what is 'worth' knowledge and what learning is all about? A cursory reading of related literature informs us that learner comprehend the text with reference to textbook questions (Leonard, 1987). It provides them clues about the critical information and facts and engages them in various problems, thus nurturing their problem solving skills (Jo and Bednarz, 2009), and

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guiding learners' creative thinking process (Ornstein, 1994). Textbook questions helps teacher in designing pedagogic activities and assessment tools (DiGisi and Willett, 1995). However, it is also significant to note that teachers do not assess whether the questions are sensible or useful for their classroom (Wong, 1991). (Mc Carthy, 1995) found that many a time, textbook questions are not well designed. Learners need teacher's assistance to understand them. (Shodell, 1995) found that textbook questions are fact driven and based on input level thinking processes. It was found that most of the researches focused on classroom questioning, teacher's questions and the questions asked by students. But the nature of textbook questions was under- researched. Very few researches in this field have been found. However, most of the researchers used the Bloom taxonomy for analysing textbook questions and focused only cognitive demands posed by textbook questions (Davila and Talenquer, 2010), (Shepardson and Pizzini, 1991), (Dunn, 2011), (Kahveci, 2009)). The kinds of questions that are given in textbooks also influence the type of cognitive processes that students engage in as they grapple with the process of knowledge construction. Textbook questions reflect epistemological underpinning of the content as well as pedagogical implications for the classroom. Against this backdrop, the present paper analyse the geography textbook questions from content perspective as well as cognitive processes perspective.

National Curriculum Framework-2005 — Painting the Canvas of Education with Constructivist Brush

Until recently, classroom processes were dominated by the 'textbook culture', where the textbook is the ultimate source of knowledge. Under the influence of unquestioned authority of textbook, classroom processes are geared to match the learner's level of attainment of information given in the textbook. National Curriculum Framework (NCF)-2005 proposed an epistemological shift in understanding the process of teaching-learning and envisioned a transformation in classroom culture- from the 'textbook-culture' into a 'dialougic-culture'. NCF-2005 views teaching-learning as a process of co-construction of knowledge and classroom as a place which is not isolated from the wider socio-cultural context. It envisioned textbooks as not only a source of knowledge but also as an interactive space of learners, which facilitates the co-construction of knowledge. It is also seen as suggestive framework for teachers to design their pedagogic activities and for understanding the different critical issues in a comprehensive manner. This 'interactive space of learners' is interwoven with different activities and thought-provoking

questions. With the same spirit, NCERT textbooks comprise end text questions and activities for gauging learners' understanding and enabling them to make linkages within different concepts and contexts. In this way, textbooks have been seen as a significant pedagogical aid to change the approach of teaching-learning from imparting information to involvement of learners in debate and discussion.

NCF-2005 envisions that pedagogy of social sciences will be based on the constructivist teaching and learning which will propagate meaningful and conceptual understanding of concepts by connecting subject knowledge with everyday life experiences and thus enable learner to develop critical understanding of societal issues. At the school level, the content of social science is mostly drawn from the disciplines of history, political science, geography and economics. Here, the textbook questions and exercises of geography textbooks are under scrutiny. Geography as a school subject contributes in building learners' perspectives towards the people-environment relationship, resources, and their development. It engages students to understand the relationship between people and their environment and make them aware about the issues related to environment. The central thrust of the new textbooks is on providing the understanding of basic concepts and development of geographical skills. Adopting the constructivist approach, different activities have been given in the form of in-text and end-text questions and exercises are designed to help students develop necessary geographical skills, such as map reading and interpreting, analysing visual representations and data, making linkages between concepts, and drawing inferences and conclusions. Parallel to the NCF-2005 recommendations, new geography textbooks are not 'overloaded' with facts and it is strongly recommended that the facts and information given in the geography textbook should be used as 'means' rather than 'ends'. They also emphasise on real world situations as significant source of learning and embed the 'text' with real word problems. It is intended that such kind of representations will provide scope to the learners to connect their everyday experience with school learning.

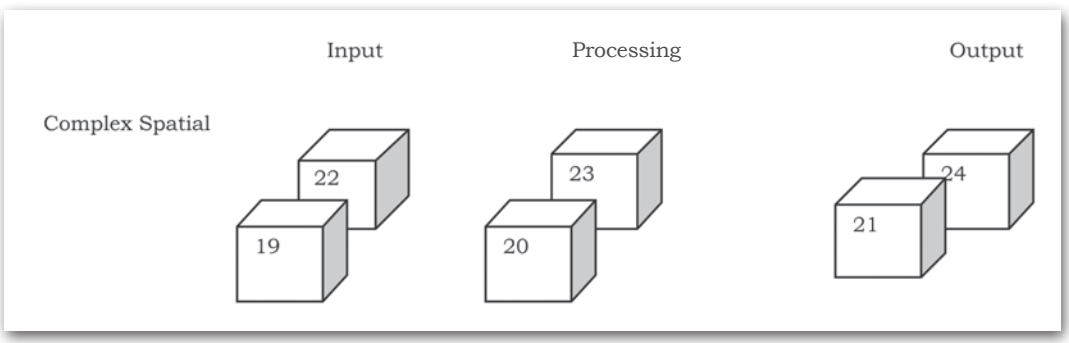
Methodology

The geography textbook of Classes 9th and 10th published by NCERT were selected for the analysis. The Class 9th geography book entitled Contemporary India-1 has six chapters-: India - Size and Location, Physical Features of India, Drainage, Climate, Natural Vegetation and Wildlife, and Population. The Class 10th geography textbook entitled Contemporary India-2 has seven chapters - Resources and Development, Forest and Wildlife Resources, Water Resources,

Agriculture, Minerals and Energy Resources, Manufacturing Industries, Lifelines of National Economy. Questions pertaining to all the chapters have been analysed. There are two locations of the questions in each chapter. First one is the in-text questions which are dispersed throughout the chapter, and second end-text question located at the end of chapter. There were total 293 questions. All of the questions have been content analysed. The taxonomy developed by (Jo and Bednarz, 2009) has been chosen for classifying the questions.

The Taxonomy for Classifying Geography Textbook questions—(Figure 1)

Most of the question-classification systems are composed almost entirely of categories based on the type of cognitive process required to answer the questions. Existing taxonomies classify questions on the basis of cognitive processes in which learner will engage while solving a problem. Yet while analysing questions, the nature of subject and tools of representation are also significant. In the present research, it is insisted to take into account the content dimension along with cognitive processes for analysing questions. The Taxonomy of (Jo and Bednarz, 2009) is suited to this need. In the present paper, taxonomy of spatial thinking developed by (Jo and Bednarz, 2009) has been used for analysing the nature of geography textbook questions. This taxonomy takes account of the three dimensions of geographical thinking: spatial concepts, tools of representation and the processes of reasoning. Any question will be based on some concept; will require some kind of mental operation and that operation will need to be done with some tool. This taxonomy comprises all these three dimensions, that is why it is informed decision of the researcher to use this taxonomy for the classification of textbook questions. The three primary categories were divided in two several sub-categories and finally this taxonomy consists of twenty-four categories. An overview of this taxonomy is as follows—



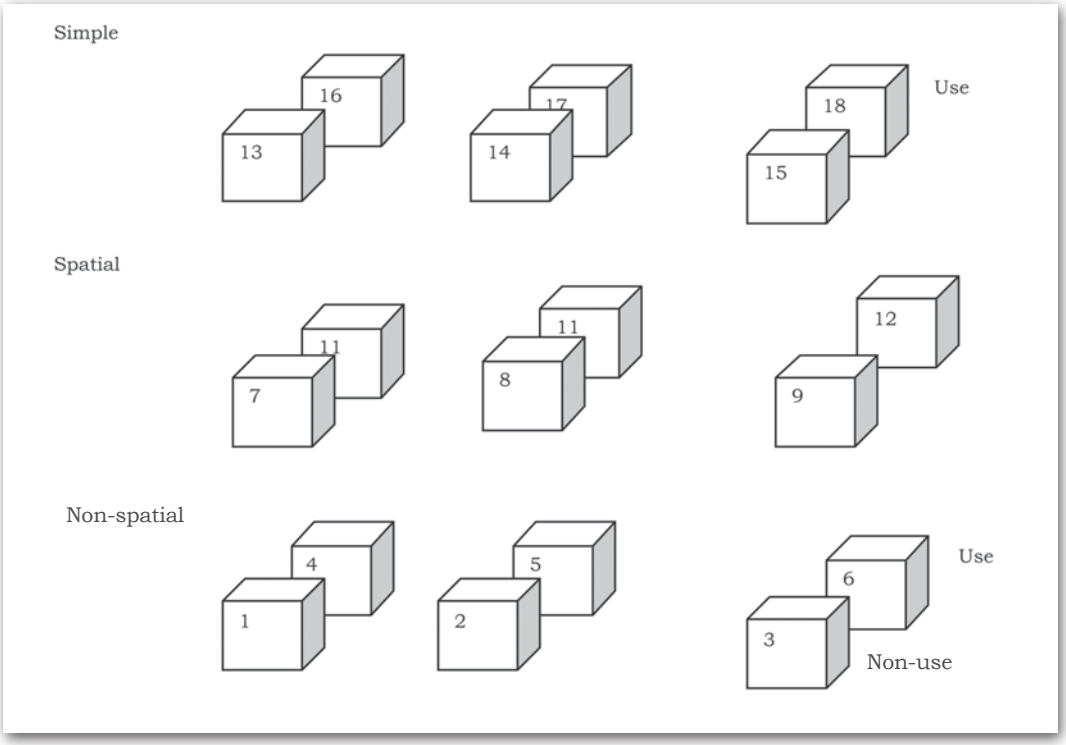


Fig.1: *Taxonomy for Questions Classification (Jo and Bednarz, 2009)*

Concepts of Space

Adopting (Golledge's, 2000) scheme of spatial concepts and classification, they categorise spatial concepts in the four categories-Non-spatial, Simple Spatial, Spatial Primitive and Complex Spatial. The first category comprises concepts not related to space. Spatial primitives represent basic and fundamental characteristics of an existence in space, such as place-specific identity, location, or magnitude. Simple Spatial concepts are concepts established by sets of spatial primitives (e.g., distance is the interval between locations). Complex Spatial concepts are derived by assemblies of sets of simple spatial concepts (e.g., the concept of hierarchy can be derived by combining location and magnitude with connectivity). They identified 31 essential concepts of spatial thinking and categorised them in these four categories.

Tools of Representation

Maps, diagrams, tables, graphs and models, etc. are considered tools of representation in this taxonomy. Two sub-categories have been developed - non-use of tool and use

of tool. For avoiding complexity of the taxonomy, they further did not form sub-categories of 'use of tool category'.

Processes of Reasoning

Three levels of thinking as proposed by (Costa, 2001) have been taken as three sub-categories for classifying processes of reasoning: the input level of thinking, the process level of thinking and the output level of thinking. The input level represents cognitive processes engaged to gather information from the senses or to recall information from memories, such as recognising, defining, identifying, recalling and listing. At the second level, the processing level involves mental processes, such as analysing, classifying, explaining or comparing information acquired at the input level. This type of cognition is associated with reasoning because it requires making sense of collected information, and therefore, going beyond the information. The third level of thinking, the output level, refers to generating new knowledge or products from the information obtained from the first two levels through the processes of evaluation, generalisation and creation.

The example of question coding is given here-
In which of the following states is black soil found?
Concept: Spatial Primitive Tool: Use
Cognitive Process: Input

To ensure reliability, questions were classified twice. There was fifteen days' time gap between these two classifications. Both the classifications were found highly positively correlated. Along with this, another researcher from the same field was asked to classify some of the questions and her classification was matched with the researcher's classification again. There were similarities between both the classifications.

Findings and Discussion

It emerged from the analysis of data that 80 per cent questions focused on non-spatial concepts. Only 4 per cent of total questions dealt with simple spatial and complex spatial concepts (fig.2). The very nature of geographical knowledge inherits to use tools of representation. In present study, it was found that only 22 per cent of the questions provide scope to use tools, such as maps, diagrams and graphs (Fig. 3). Among these 22 per cent of the questions, most of the questions are based on input level of reasoning. If we see the distribution of questions among reasoning classes, it emerged that 45.73 per cent questions are based on input level of reasoning, 32.08 per cent questions are based on process level of reasoning and only 22.1 per cent of total questions are based on output level of reasoning (Fig. 4).

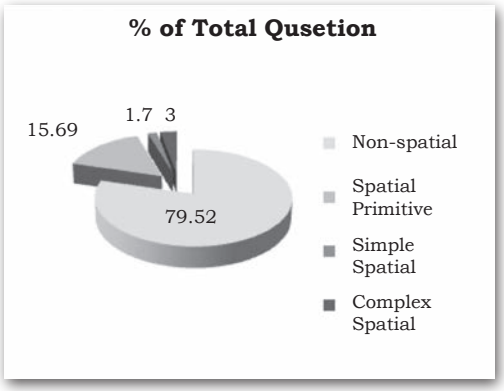


Fig. 2: *Classification of Questions on the basis of Concepts*

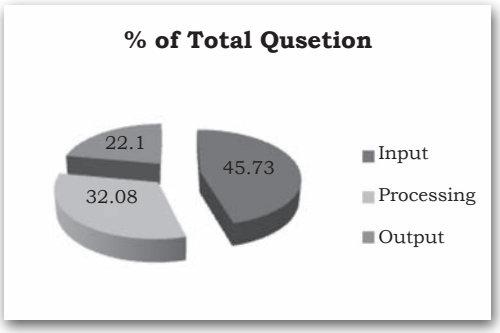


Fig. 3: *Classification of Questions on the basis of Reasoning Process*

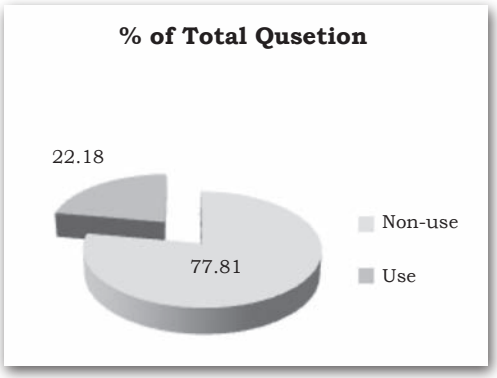


Fig. 4: *Classification of the Questions on the basis of Tools of Representation*

In comparison to other two categories, it encompasses all the forms of reasoning appropriately. Spatial thinking is a complex form of thinking in which a person should integrate knowledge about spatial concepts, abilities to use spatial representations in appropriate and effective ways, and reasoning skills (Jo and Bednarz, 2009). The Geography textbook questions are supposed to be the facilitators of spatial thinking. The cells 10, 11, 12, 16, 17, 18, 22, 23, 24 integrate all the three dimensions of spatial thinking (Fig.1). It is found that only 17.06 per cent questions are in these cells. Among these questions, 72 per cent questions are based on simple spatial and input form of spatial thinking (Fig.2 and Fig. 3). One can easily infer that spatiality of textbook questions is very poor.

There are five categories of end text questions - Multiple choice questions, Short answer type questions, Long answer type questions, Map work and activity/project (Fig. 5). Most of the questions (76 per cent) belonged to the categories of multiple choice questions, short answer type questions and map work. These questions are fixed answers type questions and their answers can be given in a few words or locating an exact point on the map.

These questions demand only input level of reasoning process and reflect that geographical knowledge is objective and given. Questions which are given under the category of long

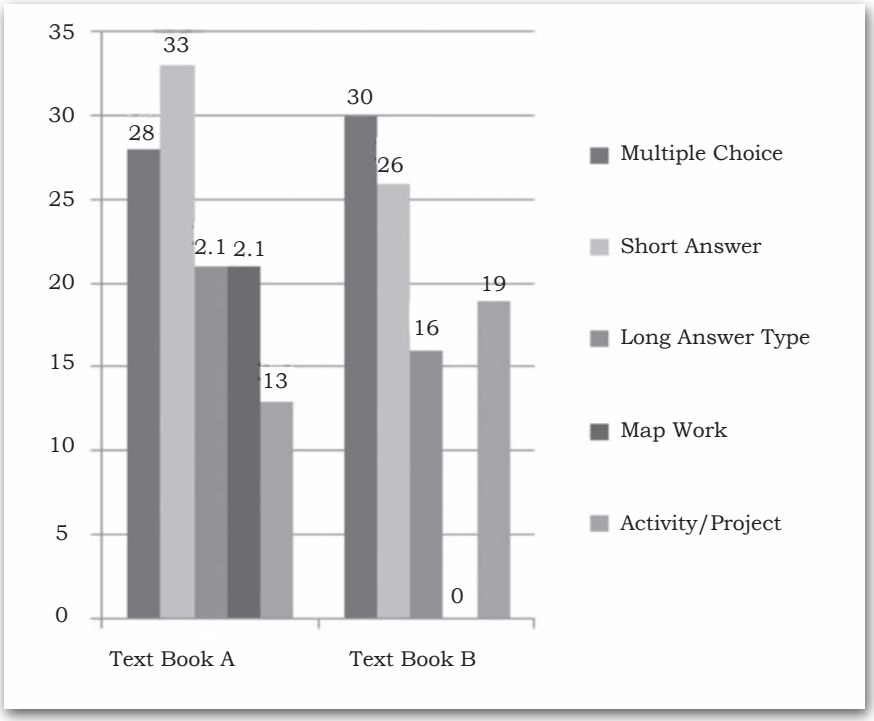


Fig. 5: *Types and Distribution of End-text Questions*

answer type questions use phrases/ expressions such as Explain……, Discuss….. Describe…….. Although these questions show that learner might be engaged in processing or output form of cognitive processes but in-depth analysis shows that they also demand a certain pattern of information inferred by the book in certain defined ways. They are based on given information in textbook and do not provide any scope for 'multiple explanations'. There would be uniformity in the answer of every learner which will be influenced by the information given in the textbook. The answers of these questions demand the argument as given in books and do not allow learner to go beyond it. Although every answer should be informed by facts or information get it should provide scope to learners to make linkages between their experience and understanding. Example:

'Why has the rate of growth population in India been declining since 1981?'

'Where and why is rail transport the most convenient means of the transportation?'

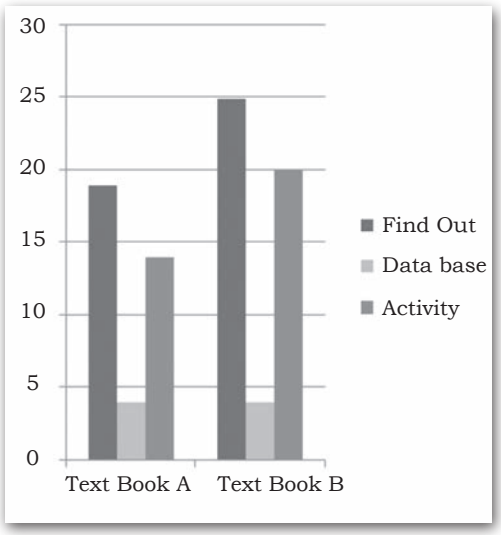


Fig. 6: *Types and Distribution of In-text Questions*

Seventy-five per cent questions given in the category activity/ project are the word games where learners have to find some key words and complete the puzzle box with those words. These forms of questions are only 'encyclopedic' questions which facilitate recall and retrieval of information. As social constructivists argue that activities should be 'authentic' and related to real world problems. The analysis of the activities revealed that essential critical geographical issues have been incorporated but they are loosely designed. The causal relationship has been reinforced and government has been highlighted as a problem solver.

The land under cultivation has got reduced day-by-day. Can you imagine its consequences?

Do you know why food grains production has remained stagnant or fallen for six consecutive years?

Find out from the above newspaper cuttings, the main concern highlighted in the given news items.

(ii) Collect more information about various endangered species from newspapers and magazines.

(iii) Find out various steps taken by the Indian Government to protect them.

The content covered by these questions shows that the importance of any spatial entity lies in its size, quantity and rank, etc. Where does this kind of learning lead the learners to?

Which is the largest river basin in India?

Which one of the following places receives the highest rainfall in the world?

Likewise, it also highlights the 'economic importance' as a dimension which is valued-

State some economic benefits of rivers and lakes?

Why are rivers important for the country's economy?

Why the means of transportation and communication are called the lifelines of a nation and its economy?

Here, we can see that the economic importance and locational importance are validated and

they cannot be questioned. It is objectification of knowledge as well as knower which impedes critical thinking. It promotes linear pattern of knowledge construction which does not allow multiple interpretation.

Most of the in-text questions fall in the category 'find out'. Mostly they focus on finding information regarding specific place, data, landforms, etc (Fig 6). Many a time, the needed information is not given in textbook. In a way, it follows the NCF's assumption to promote learner to move beyond textbook, but at the same time, it asks them to locate required information in certain other source. What source would it be? Does everybody have access to such sources? How does this information contribute in classroom discussions? Information is seen as authentic knowledge. Information can be stored in books; it means books are source of knowledge.

All the questions related to map work ask learners to locate places, rivers, mountains and other geographical features in map which basically reinforce map reading skills. Questions related to map construction and map interpretations are rarely found. The content of Class 10th can provide ample scope for map construction and map interpretation skills but I could not find any of such exercises. Even in map reading exercises, only 'locating' any physical feature is seen as geographical knowledge. It is also significant to note that there is hardly any scope of using map related skills in long answer type questions. It should be taken care of that maps and other tools of representation are very essential for geographical thinking.

If we see the questions from reasoning point of view, it shows an appropriate picture among three forms of reasoning (Fig. 3). It follows the assumption that higher level of questions should be followed by lower level of questions. Lower level of questions, basically input questions, provide base for processing and constructing newer knowledge.

The different kinds of questions are different in nature but, nevertheless, provide a picture of the approach to learning. It is tried to embed learning process within constructivist approach to learning but subject specific knowledge is not given so much focus. There is a mismatch between content approach and pedagogic approach. Most questions are short-answer questions that require the students to recall factual information, while only a small percentage of questions demand higher cognitive skills. In the present study, lower-order questions were most frequently presented in in-text as well as in end-text.

A closer look at the results shows that very less number of questions were concerned with eliciting pre-conceptions or alternative conceptions of students and the application of the learned material in novel or concrete situations.

This means that there is no scope to challenge students to review and resolve inconsistent ideas, or use in-text questions to guide learners to construct new ideas from existing knowledge. On the other hand, while a significant number of application questions were asked, they were not used as a part of the process of effecting conceptual change. They were often used to illustrate how the learned materials can be related to everyday life experiences, rather than to show how the newly constructed conceptions can be fruitfully employed to explain novel and realistic situations. Although it is attempted to give enough space to integrate the learner's personal experience in these questions yet they have to match their experience with pre-defined categories.

NCF-2005 recommends that geography as a school subject will enable learners to critically think about people-environment relationship. Analysis of the questions showed a different picture. In Class 10th, there is one chapter on 'Mineral and Ores'. There is not even a single question which is based on people-environment relationship. For question makers, it is significant to know where the bauxite could be mined. Why the solar energy does has bright future in India but the consequences of mining and other influence of such activities on human beings are not as significant knowledge. Likewise, the questions of the chapter 'Manufacturing Industry' focused only on heavy industries, such as iron and steel industry and its importance and contribution in development. Agro-based industry related questions are as follows-

> '*Why did Mahatma Gandhi lay emphasis on spinning yarn and weaving khadi?'*

This question signifies that yarn and khadi production is important for us because Mahatma Gandhi emphasised it. On the other hands one can find questions such as-

> *'Where would it be economically viable to set up the cement manufacturing units? Find out where the plants are located in other States of India. Find their names.'*
>
> *Find ten occupations getting raw material from forests and wildlife.*

It is the knowledge which is demanded to know where to setup industry and what the viable conditions are for the same without considering its influence on people. It also shows that people's perception or wishes are not significant for setting up an industry. Industry establishment is totally a profit-driven process.

Further, it is analysed how textbook questions position learners with regard to geographical knowledge and learning. For this analysis, the words and phrases used in questions were analysed by adopting the framework of (Elisenman and Wagner, 2007). It

was found that most of the questions were posed in three forms—

1. Verb +you
2. An inanimate object + an animate object + you (e.g., Make a list of all such goods made of steel that you can think off).
3. Without specifying any subject (e.g., Find out the current Railway zones and their head quarters).

The first form includes such phrases as 'Do you know', 'Do you think' or you find, you know, etc. these forms of questions are based on the assumption that there is something to be known which is 'common knowledge' (Edwards and Mercer, 1987) and with the help of these questions, learners will acquire that knowledge. The second and third forms of the questions obscure human subjectivity. It shows that knowledge is something that is constructed on its own without interference of human. While as in reality, it is the learner (person) who constructs the knowledge. It is seen that the auxiliary verb, verbs, adverbs and adjectives used in the questions have 'strong connotation'. Hedges were less used. It shows that questions have a voice of 'certainty' rather than any scope of possibility. (Rotman, 1988) identified two forms of imperatives generally used in text. Inclusive imperatives, such as describe, explain, discuss, etc.; it demands for reader to be a thinker, and exclusive imperatives, such as write, copy, enlist, etc; here the role of learner is that of a scribbler. Most of the analysed in-text questions used inclusive imperatives. Most of the end-text question used exclusive imperatives. Inclusive imperatives used in in-text questions allow learner's actions to be included in a community of learners whereas, excusive imperatives used in end-text questions exclude learners from learning community.

Textbook questions do not situate the content of the questions in any context. They present knowledge as 'truth' independent of context. It is hypothesised that intention of the questions will match the perception of the learner.

E.g.:

> *Study the figure 6.3 and compare it with figure 2.4 and figure 4.7. Do you find any correlation between these maps?*
>
> *What could be the reason of uneven distribution of population in India?*
>
> *Table 6.1 reveals that despite the decline in growth rates, the number of people being added every decade is steadily increasing. Why?*

(Scott, 1998) talked about authoritative and dialogic functions of classroom discourse. In authoritative function, questions demand information; responses to the questions typically consist of

single, detached word and factual information. Whereas, in dialoguic function, questions provide the scope to learners to put forward their ideas, explore and debate points of view. An alternation between these two types of discourses is important for developing conceptual thinking (Mortimer, 1998). The present analysis revealed that in-text questions work in favour of authoritative function as their answers are pre-determined piece of information that should be matched with teacher's expectation. Similarly, most of the project/ activities given as end-text questions also contribute in authoritative function. One of the roles of the in-text question is to help in classroom discussion by providing the scope for interaction and participation. Recall of the information should not be the end-product or goal. It should be the means to the end of achieving critical thinking. The input level questions which are usually recall type questions should be followed by processing and output-based questions so that they all can be used comprehensively for generating classroom discussion. However, it has been found that in-text input level questions were given in isolation. Mostly, they were followed by input level questions. Thus, they are can be used as 'measuring tool' of learners' knowledge and understanding but cannot open the discussion. Further, end-text questions were given as categorised in three sections. All input level questions were given in the beginning of the exercises in the form of multiple choice questions and short answer questions. In next section, processing and output based questions were asked. It is significant to note that processing and output based end-text questions were preceded by input based questions-

> *Make a list of items where substitutes are being used instead of minerals. Where are these substitutes obtained from?*
>
> *What is meant by trade? What is the difference between international and locale trade?*
>
> *Define monsoon? What do you understand by break in monsoon?*

It is found there are only five activities which are based on group work. The group work is necessary for learning processes as it provides scope for dialogue, experiences sharing and motivates learner to come out of their comfort zone. Analysis also revealed that there is a lack of inter-disciplinary questions. Geography is taught in schools as a subject under the social sciences. It is expected that all the sub-disciplines under social sciences will promote inter-disciplinary nature of their subjects.

Conclusion

This study explored one of the under-researched areas of textbook-analysis research tradition that is textbook questions and exercises.

Findings of the study revealed that, at the level of content, geography textbook questions mostly covered non-spatial concepts; at the level of cognitive processes, different forms of processes were represented; at the level of tools of representation, most of the questions focused only on non-tool use type of questions. The nature of content and tools of representations are two very crucial dimensions of geographical thinking. Geography textbook questions, supporting geographical thinking, should cover complex spatial concepts and encourage the use of geographical tools such as maps .The tools of representation should not only be used for graphic displaying but should also include processing and output dimensions of thinking. This study highlighted that textbook questions do not situate the content of the questions in any context. They present knowledge as 'truth' independent of context. The present analysis revealed that most of the textbook questions work in favour of authoritative function where the role of the learner seems only to match her/his knowledge with pre-established context-independent knowledge. Keeping these points in mind, it is suggested that textbook questions and activities should be used for two purposes - first, for gauging and exploiting the resources brought by the learners and, the second, for generating and leading classroom discussions. While using textbook questions and exercises, teacher should keep in mind these questions-

- Whose knowledge is getting reflected in questions and exercises?
- In which manner do the learners engage with the textbook questions?
- How do we provide scope to the learners to integrate their experiences, with subject specific conceptual knowledge and how do they make this integration an integral part of their thinking and acting?

Geography teachers should construct, and use such pedagogic activities which include different levels of spatial concepts from simple level to complex level and engage learners in using different forms of tools of representation. In this way, the classroom processes will become more dialogic, the learner will become capable of constructing knowledge and take an informed position regarding any geographical concept.

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