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Indira Gandhi
National Open University
School of Education

BES-125
Understanding Disciplines
and Subjects

Block

1

UNDERSTANDING KNOWLEDGE AND DISCIPLINES

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BES-125 UNDERSTANDING DISCIPLINES AND SUBJECTS

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Introduction to the Course

"Understanding Disciplines and Subjects" is one of the core Courses of B.Ed. Programme. From time to time different documents on School and Teacher Education curriculum have stressed the need of understanding the perspectives of various disciplines by school teachers. It is also equally important for teachers to understand how knowledge within and among the disciplines are framed; nature of content included in school curriculum; and the pedagogical strategies to transact school curriculum.

Focusing on the above concern, the National Curriculum Framework (NCF), 2005, has highlighted making connections across disciplines and bringing out the interrelatedness of knowledge for school experiences of the children. The National Curriculum Framework for Teacher Education (2009), has also underlined, "teachers need to be prepared to view subject content critically, within the frame of disciplines as well as within inter-disciplinary frames" (NCTE, 2009). The present Course has been designed specially to enable you to reflect on the nature and role of disciplinary knowledge and its processes to acquire knowledge in the school curriculum with discussion on various perspectives (Historical, Philosophical, and Socio-cultural) of teaching subject areas in schools.

Keeping in view the above, the Course BES-125, 'Understanding Disciplines and Subjects' comprises two Blocks. The first Block, **"Understanding Knowledge and Disciplines",** focuses on the concept and meaning of knowledge, its sources, and categorization of knowledge; constitution of disciplinary knowledge; evolution of disciplines with their perspectives and framing of knowledge; inter-relationships between and among the disciplines; and incorporation of specific disciplinary knowledge for framing school subjects. The second Block, **"Subjects in School Curriculum",** explains the concept of curriculum, syllabi, and school education; broad areas of school subjects; curricular materials and its implications for practicing learner-centered pedagogy. It also includes discussion on the bases of organizing subjects in school curriculum; addressing the needs of the stakeholders in transacting school curriculum; and elaborating the factors leading to subject choices of the students.

The Course will make the you understand and explain:

- knowledge and how it differs from information;

- the ways in which knowledge is acquired;

- the structure of knowledge as reflected in different disciplinary streams and subjects;

- the process of evolution of disciplines and also the inter-relationships with their distinctive identities;

- the interlinks between and among different disciplines and school subjects;

- the nature of various school subjects and curricular materials;

- inter-relationships between curriculum and syllabus;

- what constitute curricular materials?;

- the pedagogical demands of disciplinary knowledge at different stages of school education;

- the delineation of content of various subjects and its organization in school curricula; and

- the factors that influence choice of streams and subjects by students.

BLOCK 1   UNDERSTANDING KNOWLEDGE AND DISCIPLINES

Introduction to the Block

The Block, **"Understanding Knowledge and Disciplines",** deals with answers to the following questions:

- What is knowledge and how does it differ from information?

- How is knowledge acquired?

- What does disciplinary knowledge comprise?

- How did disciplines evolve?

- What perspectives does a discipline carry?

- How are disciplines inter-related with each other?

- How is disciplinary knowledge mediated by pedagogical approaches at different stages of school education?

- How are specific areas of kowledge included in school curriculum?

- What constitutes a school subject and how is it framed?

The above questions have been addressed in three different Units of the Block. The first Unit, **"Knowledge and Disciplines",** focuses on the concept of information and knowledge. The sources and the processes of acquiring knowledge have been discussed in this unit. For constituting disciplinary knowledge, teachers need to know how to categorize knowledge. The Unit ends with discussion on the implications of knowledge for teaching and learning process in Schools.

The second Unit of this Block, **"Perspectives of Disciplinary Knowledge",** discusstion how disciplines such as History, Geography, Physics, Mathematics etc. have evolved and studied under broad areas of knowledge such as Humanities, Sciences and Social Sciences. The Unit also focuses the Historical, Socio-cultural, Political and the Philosophical perspectives that have been responsible for the evolution of disciplines. The Unit demonstrations the linkage that exists between and among the disciplines.

The third Unit, **"Disciplinary Knowledge and School Education",** discusses how disciplinary knowledge becomes and part of the teaching-learning processes at different stages of school education. Especially, discussion focuses on the behavioural, cognitive and constructivist approaches and their implications for teaching and learning in school education. The difficulties and the ways of accommodating specific areas of knowledge such as art and craft education, works' education, peace education, life skills' education, sports and physical education, and value education, etc. have also been discussed in this Unit. The Unit also describes the framing of school subjects.

UNIT 1 KNOWLEDGE AND DISCIPLINES

Structure

1.1   INTRODUCTION

Today's society is generally perceived as 'knowledge society'. It is observed that the students' understanding about information and knowledge is almost blurred and they are unable to distinguish information from knowledge. Therefore, there is a need to have clear understanding about the information and knowledge and the differences between them. In this Block, we will discuss the meaning of information, knowledge and discipline. Information means data used in a context and with some relevance. Knowledge is created by attaching meaning to information.

Note: *Few sections of the Unit have been taken from MES 012 - Education: Nature and Purpose, M.A. Education, IGNOU, (2005)*

Knowledge can be defined of as an individual's understanding of the subject matter and its concepts and how these concepts relate to form the larger body of knowledge. Knowledge can also be defined as a set of understanding in a particular domain or a field.

'The term 'discipline' originates from two Latin words '*discipulus*', which means pupil and *'disciplina'*, which means teaching (noun). Related to it is also the word 'disciple' like the disciples of Jesus. The dictionary definition gives a whole range of different meanings of the term, 'discipline' such as training, submission to an authority, and self-control of behaviour' (Krishnan, 2009). Academic discipline can be seen as a form of specific and rigorous scientific discourse.

In addition, 'discipline' also means training of one's own thought. Categorisation of a particular form of knowledge constitutes a discipline. All disciplines have its domain of knowledge, followers and history. A discipline has certain knowledge base and it consists of a substantial body of knowledge. The Unit starts with discussions on understanding knowledge, proceeds to categorise knowledge and finally discusses the formation of disciplines with a knowledge base.

1.2 OBJECTIVES

After going through this Unit, you will be able to:

- explain the concept of knowledge and its divisions;

- differentiate between knowledge and information;

- explain the sources and the ways and processes of acquisition of knowledge;

- describe the categorization of knowledge;

- explain the concept of a discipline and its formation with a knowledge base;

- discuss the characteristics of a discipline; and

- discuss the implications of knowledge on teaching and learning.

1.3 CONCEPT OF KNOWLEDGE

The nature of knowledge has been a central concern in philosophy from the earliest time. In the history of thought, 'Theory of Knowledge' has been considered as a branch of philosophy known as Epistemology. 'Epistemology' comes from the Greek word '*episteme'* meaning knowledge and *'logos'* meaning discourse or science. Epistemology is an area of philosophy concerned with the nature and justification of human knowledge. It is that field of philosophical inquiry which investigates the origin, nature of knowledge, methods, validity and limits of knowledge. Epistemologists, historically, have concerned themselves with such questions as:

What is knowledge?

What is the structure of knowledge and what are its logical categories?, and so on.

1.3.1 Defining Knowledge

According to the most widely accepted definition, knowledge is justified true belief. That, it is a kind of belief, is supported by the fact that both knowledge

and belief can have the same objects and that what is true of someone who believes something to be the case is also true, among other things, of one who knows it. For example, sun rises in the east is the knowledge or true belief which is supported by the fact arrived through daily observations since millions of years .

It is obvious and generally admitted that we can have knowledge only of what is true. If one admits that a proposition (p) is false, it must be admitted that the person did not 'know' it and that no one else did, although the person may have thought and said so. Beliefs that merely happen to be true cannot be regarded as knowledge, because knowledge is justified belief.

First of all, *knowledge is expressed in propositions.*

A meaningful sentence that conveys truth or meaning is said to be *proposition.* For a sentence to be meaningful, the words in a sentence should be meaningful. That is, the concept expressed in the form of words should be true. They should correspond to the state of affairs that is existing at present or existed once upon a time.

A proposition (p) is what the sentence means. Two or more sentences can be used to express the same proposition. It is the proposition that is true or false, but it is the sentence that has meaning or fails to have it. Not every sentence states a proposition. But the sentence that we use asserts something to express proposition. For example,

A square has four sides that are equal.

I know that ice melts on heating.

But in order to understand any proposition, we should first of all know the concept involved in a proposition.

According to John Hospers, there are two requirements for knowing: (a) objective requirement (p must be true) and (b) subjective one (one must believe p). Let us discuss the two requirements for knowing.

1.3.2 Requirements of Knowing

(a) A proposition (p) must be true:

One cannot 'know' p if p is not true. If one says 'I know p, but p is not true' then the statement becomes self-contradictory, for a part what is involved in knowing p is that p is true. Therefore, 'knowing p means p to be true'.

John Hospers in his analysis of requirements of knowing differentiates the term 'know' from other verbs like 'believe', 'wonder', 'hope' and so on. For example, one can wonder whether p is true, and yet p may be false; one can believe that p is true, though p is false and so on. Hospers states that believing, wishing, wondering and hoping are all psychological states, which are occurrent and dispositional in nature. Unlike these psychological states, knowing is not merely a mental state. It requires that the proposition one claims to know is true. But the truth requirement, though necessary is not sufficient. One may not know certain concepts, though they are true, for example, in Physics like 'energy' and 'light wave' unless one happens to be a specialist in that area though they are true. But the fact that they are true does not imply that one knows them to be true. Though there are many true statements, one may not be a position to know that they are true. There are

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other conditions that are required for knowing a proposition.

(b) Not only a proposition (p) must be true, but we must believe that p is true:

This is the subjective requirement, which implies that one must have certain attitude towards p – not merely wondering or speculating about p, but positively believing that p is true. There may be numerous statements that one believes but do not know them to be true. There can be even none which one knows to be true, but does not believe them, since *believing* is a part (a defining characteristic) of knowing. 'I know p' implies 'I believe p' and 'he knows p' implies 'he believes p', for believing is a defining characteristic of knowing. For example, 'I know that the sun rises in the east'; it implies that I believe in it. But believing p is not a defining characteristic of p's being true; p can be true even though one does not believe in it.

(c) Necessity of evidence or a reason to believe p:

There is necessary for evidence or a reason to believe a proposition to be true. For example, 'I know that the sun will rise tomorrow' and 'I know that ice melts on heating'. There are excellent reasons or evidences to believe them to be true, because of their certainty. The knowledge that we gain about the physical world through our senses and our judgements about them amount to be true. But there are other kinds of propositions where only self-experience is involved; such as 'feeling headache' or 'feeling drowsy' or 'feeling depressed', to which one may not require evidence. Knowing these propositions is not well covered by the definition of knowing that require evidence. To say; 'I feel pain', the experience itself constitutes all the evidence that one requires. One can know the statement to be true, simple on the basis of having an experience. This holds only for propositions reporting the occurrences of sense-experiences. There are also statements, which are analytical in nature for which evidence is not claimed. The statements of this class are called 'truth of reason' for which evidence is not required. Even if it is required, it is not in the sense as described above. These are truth in the 'realm of necessity'. Based on the above analysis of knowledge, one can distinguish three divisions of knowledge which are as follows:

1.3.3 Three Divisions of Knowledge

Based on the way and manner in which it is obtained, knowledge can be classified under three heads:

A Priori Knowledge:

A priori knowledge is knowledge whose truth or falsity can be decided before or without recourse to experience (a priori means 'before'). Knowledge that is priori has universal validity and once recognised as true (through the use of pure reason) does not require any further evidence. Logical and Mathematical truths are a priori in nature. They do not stand in need of empirical validations.

A Posteriori Knowledge:

A posteriori knowledge is the knowledge based upon observation and experience. This is the knowledge of the scientific method stressing accurate observation and exact descriptions. The propositions that fall under this category can be locked at from the point of view of whether they contain any factual content and from

the standpoint of the criteria employed for deciding their truth or falsity. For example, we have propositions like;

Ice melts.

Snow is white.

Metals conduct heat and electricity.

These propositions give us factual information whose truth or falsity can be decided only through observation and verification. These are called synthetic propositions.

Experienced Knowledge:

Experienced knowledge is always tentative and cannot exist prior to experience or be conducted from observation. It must be experienced to have value.

Basic to the three types, is propositional knowledge (a priori and a posteriori) and it is to this type that the structure of knowledge question is addressed. This has important implications to curriculum planning.

Check Your Progress 1

Notes: a) Write your answer in the space given below.

b) Compare your answers with the ones that are given at the end of the unit.

1. Differentiate between 'a priori' and 'a posteriori' knowledge?

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2. Explain 'experienced knowledge' with an example.

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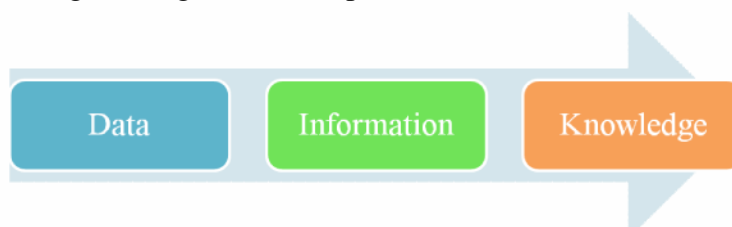

1.4 KNOWLEDGE AND INFORMATION

Many of us fail to differentiate between the concepts of 'knowledge' and 'information'. Sometimes, we use both synonymously. But both are different in their nature and meaning. There is a connection between 'information' and 'knowledge'. Both these concepts are preceded by understanding of data. Let us see the linkage among these concepts.

Data can be defined as 'fact' or 'description of a phenomenon'. Unless data is interpreted, it has very limited meaning or no meaning at all. For example, the data regarding height or colour of a person or data relating to different crop production in a country in a year can have meaning when they are interpreted and understood in a given context. Therefore, raw data do not provide meaning about a phenomenon.

Information is the interpretation of data pertaining to a given context. It involves manipulation of the raw data. To add meaning to the raw data, many a times, we interpret it, correlate it, and differentiate it from other forms of available data. For example, heights of the students in a particular class constitute the data. When we interpret them in relation to the heights of other students in the group, calculate the average height of the students in the class, compare them with the age of the students, and find out, how many of them are above the average height and how many of them are below the average, it means we are interpreting the data and getting information about the heights of the students. Data on different crop production in a year can simply be defined as data or raw data, but when the data are interpreted relating to a particular context or relevance, like to establish a comparative figure of crop production of the current year with earlier years or compare crop production with the amount of rain fall may be defined as an information. Data is used and organised to create information for certain purpose and use. We get such type of information from the internet, newspaper, or from other media sources.

Knowledge is created by attaching meaning to the information. Information can be used as a necessary medium or material to construct knowledge. Knowledge is information which has been processed and integrated into an existing structure. Dubin (1976), explains 'information is descriptive while knowledge is predictive, that provides the basis for the prediction of future with certain degree of certainty based on information about the past and the present'.

It can be concluded that, knowledge is created through a process of collection of information and attaching certain meaning to it for a particular purpose by human cognition. Analysing, synthesizing, and consolidating the data; linking it with personal experiences; connecting it with one's thinking and cognition and presenting it in an understandable form are the processes involved in construction of knowledge. Information itself is not knowledge but it becomes knowledge when meaning is attached to it.

Check Your Progress 2

Notes: a) Write your answer in the space given below.

b) Compare your answers with the ones that are given at the end of the unit.

3. Differentiate between Knowledge and Information with suitable examples.

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1.5 SOURCES AND WAYS OF ACQUIRING KNOWLEDGE

There are many ways to acquire knowledge. Some of the major sources of acquiring knowledge are personal experience, reason, tradition, authority and inquiry. Some other sources are intuition, tenacity, rationalism, revelation, faith, empiricism and science. In this section, we discuss how knowledge is acquired.

1.5.1 Knowledge through Intuition

Intuition is a certain kind of experience when a conviction of certainty comes upon us quite suddenly like a flash. Here also we should exercise certain precautions. Intuitions can sometimes be conflicting. For example, two people can have different intutions about tomorrow's weather. How do we decide which one is true in that case? One can intuit that tomorrow will be a rainy day whereas the other can intuit that tomorrow will be a sunny day. In this case, it is always difficult to accept any one's intuition. This can only be accepted through experience. Again, knowing through intuition does not really explain 'Knowing how'. It does not explain about the validating procedure.

Many a times intuitive knowledge is later on validated as truth. For example, scientific investigation (Archimedes principle), which was an intuition was validated as truth later on. Thus intuition is a way to acquire knowledge.

1.5.2 Knowledge through Authority

We know that home, school, and community are the agencies of education. From the very beginning, children acquire various knowledge from home, school as well as from the community. Whatever they listen from their parents, elders at home, teachers/principals, religious and social leaders are knowledge for them. We can say that the authority with whom the children come in contact becomes the source of knowledge. But certain precautions are required in case of getting knowledge from the authority. The person from whom we acquire knowledge must really be an authority or is a specialist in his/her field of knowledge. Again, there must be validation mechanisms available to validate the knowledge received from the source of authority. These precautions should be taken care of.

1.5.3 Knowledge through Tenacity

Tenacity is something, which psychologically force the people to accept it. You must have observed the slogans of various political parties, advertisement of different commercial products, and repetitive propaganda for something. When such things are repeated many times in media such as in newspapers, televisions, or even in rallies, people believe them to be true. But the problem with getting knowledge through tenacity is that we do not know the claim made is true or not, and we also do not know when the knowledge received can be validated. This is a problem with knowledge acquired through tenacity.

1.5.4 Knowledge through Reason

Knowledge through reason can only be acquired through two ways: inductive reasoning and deductive reasoning. In both types of reasoning, knowledge is acquired through arguments and logic. In deductive argument, the conclusion

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logically follows from the premises. If the premises are true, the conclusion that follows must be true. For example:

a)   If it is raining, the streets are wet.

It is raining.

Therefore, the streets will be wet.

b)   Men are mortal.

He is a man.

Therefore, he is mortal.

In inductive reasoning, the premises provide evidences for the conclusion. For example:

Iron conducts heat and electricity.

Copper conducts heat and electricity. Aluminium conducts heat and electricity.

(and so on for all metals).

Therefore, all metals conduct heat and electricity.

In this case, the fact is true in terms of inductive reasoning, but it may be false also. There may be metal, which does not conduct heat and electricity. Therefore, we acquire knowledge through deductive and inductive reasoning.

1.5.5   Knowledge through Empiricism

The process of acquiring knowledge through observation and experiences is called empiricism. The knowledge that we gain through scientific experiment, validating, re-validating, testing etc. are based on the empirical knowledge. Empirical knowledge is acquired scientifically through systematic methods of scientific inquiry. Again the knowledge that we acquire through sensory processes like seeing, hearing, tasting, smelling, and touching, etc. are the examples of knowledge through empiricism. Empirical knowledge is the best knowledge which can be tested, verified, observed, experimented, and also can be experienced. The conditions underlying here is that the process of validation needs to be objective and systematic. If there is error in investigation, the validation of knowledge may not be possible.

1.5.6   Knowledge through Revelation

Revelation has the same problem as intuition. Sometimes one claims to know something by means of revelation. For example, 'it was revealed to me in a dream'. What if one person had a vision that told him the opposite? The fact, that the person had a dream or a vision, does not show that its message is true or can be validated. If what it says is true, its truth can be discovered only by other means.

1.5.7   Knowledge through Faith

Our belief and faith sometimes become the base for acquiring knowledge. Very often we say that, 'I believe in it, it will work', 'I know this through faith', 'I have faith in it, so it must be true', and 'I believe it through faith, and this faith gives me knowledge'. Just like intuition, the same difficulty also arise here. People have faith in different things and the things they claim to know by means of faith often conflict with one another. Faith is a firm belief in something for which there is no evidence. So it cannot be a valid source of knowledge.

Check Your Progress 3

Notes: a) Write your answer in the space given below.

b) Compare your answers with the ones that are given at the end of the unit.

4. Explain intuitive knowledge with an example.

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5. How knowledge through rationalism is possible?

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6. Explain the knowledge gained through empiricism.

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1.6 CATEGORISATION OF KNOWLEDGE

Knowledge is the sum total of human beings' interaction with the environment, social conditions where they live and also interactions with themselves. It is, therefore, said that knowledge cannot be unified or grouped in one category. Different approaches to classification of knowledge suggest different aspects of the process of knowledge acquisition and their significance to the curriculum planner. These classifications and categorisations have been characterized differently by various philosophers as 'disciplines', 'forms of knowledge', 'realms of meaning' and so on.

'Knowledge' is used in a variety of ways and this suggests that knowledge may be of different types. There are three types of knowledge:

(a) Propositional Knowledge ('knowledge that' or 'knowledge of what' is expressed in true statements)

(b) Procedural Knowledge (knowledge 'how' or knowledge of how to do things)

(c) Direct Knowledge (knowledge of persons, one's own mental states)

Propositional knowledge is 'Knowledge that' or 'knowledge of what' is expressed in true statements. It is not all of one logical type knowledge, no one would

seriously dispute, but the actual number of such logically different knowledge 'forms' is still a contentious issue. Let us consider, for illustration purpose, the propositions of Mathematics and Physical Science. A proposition can be looked at in two ways, from the point of view of whether it contains any factual content and from the standpoint of criteria employed for deciding its truth or falsity. In the first class, we have propositions like, 'sodium chloride dissolves in water' which gives us factual information (synthetic propositions) and also those like 'bachelors are unmarried people' that simply analyse the meaning of the words used (analytic propositions). From the standpoint of criteria, we have propositions whose truth can be decided only with reference to observation and verification of facts (a posteriori proposition) and those whose truth or falsity can be decided by pure reason without recourse to verification with experience (a priori propositions). It can be clearly demonstrated that Mathematical knowledge is of the analytic or a priori type; and scientific knowledge is of the synthetic or posterior type.

Encouraged by this clear-cut logical distinction between propositions of Science and Mathematics, and its consequences for teaching and curriculum, several philosophers of education have addressed themselves to the questions of identification of the different forms of knowledge and designing a curriculum on the basis of these. One of the most influential theories in this regard has been put forward by the Cambridge Professor of Education, Paul H. Hirst (1974).

Hirst's (1974) thesis is that the domain of human knowledge can be differentiated into a number of logically distinct 'forms' none of which is ultimately reducible in character to any of the others, either single or combination. According to him, there are seven such forms:

- Formal Logic and Mathematics

- Physical Sciences

- Human Sciences, which includes:

    - History

    - Moral understanding

    - Religious knowledge

    - Philosophy

    - Aesthetic

The features that distinguish these different forms are:

1) They involve certain central concepts that are peculiar to the form. There are different types of concepts that characterize different forms of knowledge.

2) They have distinctive logical structures. The concept occurs within different networks, where relationships determine what meaningful propositions can be made.

3) They have distinctive criteria for truth in terms of which their propositions are tested.

4) They have developed particular techniques and skills for production of true propositions.

On the basis of the above, different knowledge can be combined/categorised for creating a substantial body of knowledge of the same form and which later helps to constitute a discipline. As like, we can exemplify as follows:

Table 1.1 : Categorisation of Knowledge for Constituting a Discipline

Categorisation of Knowledge and its processes	Constituting a Discipline
Observation, inquiry, experimentation, scientific discovery, scientific exploration, scientific innovations, personal experiences, intuition, empiricism, rationalisation, etc.	Broad discipline of Science
Problem solving, analytical and synthetic thinking, logical reasoning, inductive and deductive thinking, etc.	Discipline of Mathematics
Observation, social inquiry, historical discovery, social exploration, social innovations, narratives, socio-personal experiences, etc.	Broad discipline of Social Sciences
Thinking, creating, narrating, appreciating, reflecting, realising, etc.	Discipline of Humanities

We will discuss more details about the forms of knowledge and constitution of discipline at the next section of this Unit.

Activity 1

Discuss with at least one example of the form of knowledge from each discipline.

Science: ....
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Social Science: ....
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Mathematics: ....
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Humanity: ....
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1.7   CONSTITUTION OF DISCIPLINARY KNOWLEDGE

We often use the concepts such as discipline, disciplinary knowledge, academic discipline, etc. during our academic deliberations. We need to understand carefully, what does a discipline mean? How did disciplinary knowledge evolve? In this section, firstly we will try to understand the concept of 'discipline' and next we will proceed to examine the process of construction of disciplinary knowledge. We will further elaborate on disciplinary knowledge in Unit-2 of this Block.

1.7.1   What is a Discipline?

An academic investigation of the concept of 'disciplinarity' starts off with an exploration of the etymology of the term 'discipline'. The term 'discipline' originates from the Latin word 'discipulus'- which means pupil, and 'disciplina' - which means teaching (noun). As a verb it means training someone to follow a rigorous set of instructions, but also enforcing obedience (Krishnan, 2009).

A discipline is an organised body of knowledge with a logical structure. It is a network of concepts and generalisations which explain the relationships among a body of facts. We learn by seeing relationships among different events and processes, and by generalizing about them. We see relationships among different facts and events with the aid of concepts and conceptualize by classifying them. We link concepts belonging to a class together and form conceptual structure of the concepts. It is these conceptual structures that constitute disciplines. A discipline is an organised body of knowledge, characterized by a domain, a method, and a tradition.

Academic discipline has been seen as a form of specific and rigorous scientific learning that will turn out practitioners who have been 'disciplined by their discipline' for their own good. In addition, 'discipline' also means policing certain behaviours or ways of thinking. However Michel Foucault (1991) has famously interpreted 'discipline' as a violent political force and practice that is brought to bear on individuals for producing 'docile bodies' and minds. Foucault uses the term 'discipline' in a very general and also fairly specific sense; it clearly includes the academic disciplines and their contributions to bringing about 'discipline' in society.

The term 'academic discipline' certainly incorporates many elements of the meaning of 'discipline' discussed above. At the same time, it has also become a technical term for the organisation of learning and the systematic production of new knowledge. Often disciplines are identified with subjects taught in universities, but clearly not every subject taught at university can also be called a discipline. There is more to disciplines than the fact that something is a subject taught in an academic setting. In fact, there is a whole list of criteria and characteristics, which indicate whether a subject is a distinct discipline or not.

1.7.2   Characteristics of a Discipline

The characteristics of a discipline are the following:

- Every discipline has a history. It implies the development of that particular discipline and the chronology of its growth and modification.

- Each discipline has certain domain of knowledge (cognitive, affective and psychomotor).

- Discipline has a particular object of research, though the object of research may be shared with another discipline.

- Discipline has a substantial body of knowledge and research, which is specific to it and not generally shared with another discipline.

- Discipline has theories and concepts that organise the accumulated knowledge effectively.

- Discipline uses specific terminologies or a specific technical language to define and explain the concepts and facts included in that discipline.

- Discipline has developed specific research methods according to its specific research requirements.

- Discipline must have some institutional manifestation in the form of subjects taught at universities or colleges, respective academic departments and professional associations connected to it.

- A discipline has a group of intellectual followers, who have strong belief in that discipline. They conduct new researches in that discipline, and bring changes in that discipline with new facts and innovations.

In short, a discipline must have a body of accumulated knowledge which is specific to that discipline and not generally shared with another discipline. But in many cases, many forms of knowledge keep overlapping across the disciplines; like Science and Mathematics; and even Science and Social Sciences. Also, a discipline must have theories and concepts that can organise the accumulated knowledge effectively and use specific terminologies or a specific language to explain its disciplinary body of knowledge. A discipline must have some institutional manifestation in the form of a specified body of knowledge.

Activity 2
You as a teacher, highlight at least five characteristics of a discipline that you have studied.

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1.7.3 What Constitutes a Discipline?

We discussed in the previous section that a discipline has its own characteristics. It has a substantial body of knowledge, based upon which researches are conducted. A discipline is always dynamic in nature. The followers of a discipline conduct research and further develop that discipline from time to time. Very often, there are examples of emergence of many new disciplines from the parent discipline like; 'Nano Technology' from the discipline of 'Physics', 'Microbiology' from the discipline of 'Biology', 'Biochemistry' from the discipline of 'Chemistry' etc. A discipline has also philosophical, historical and political bases/perspectives. A

discipline has a domain of knowledge. In this section, we will discuss more on the distinctive features of a discipline and its constitution.

A discipline is characterized by its structure which includes domain, method and history.

- First, it has a domain, a field of phenomena (subject matter), with which it deals. This may refer to different aspects of reality – scientific, logical (Science and Mathematics) or with different degrees of overlapping between them.

- Second, every discipline has its own methods and modes of inquiry and also a set of rules to validate the knowledge. The use of methods again implies the form/type of knowledge it deals with. The rules of one discipline cannot be applied to other, but similar practices of methods in different contexts can be used across the disciplines.

- Third, a discipline has its own history which describes its domain of knowledge, rules and philosophy.

The detailed explanation of a structure of a discipline is as follows:

As mentioned earlier, each discipline has a domain. Not only has every discipline a domain, but every theory within a discipline has also a domain, upon which the intellectual operations of the researchers are carried out. For example, the biological theories are concerned with the organisation and movement of matter in living systems. 'Knowledge' may be regarded as the set of assertions or verifiable truth-claims which researchers in the discipline have cumulatively built up for the domain. The followers of the discipline operate upon the domain by means of a substantive structure and a syntactical structure.

The substantive structure of a discipline is the interrelated connection of powerful ideas that guide research in a discipline.

The syntactical structure of a discipline is concerned with issues such as the way in which new substantive concepts are formed and the ways in which different kinds of knowledge statements are generated. In short, it is concerned with the methods of thinking and reasoning used in the discipline.

Knowledge is also the product of a social structure. Though the believers of a discipline individually conduct research and theorise ideas in that discipline, but still it is the function of the group of scientists / social scientists to critically assess and validate the ideas by using scientific or social inquiries/observation and decide whether or not to incorporate them into a discipline.

In short, discipline involves groups of creative people who interact among themselves for the growth of the discipline. Disciplines are not simply the products of rational machines. The production of knowledge within a discipline has psychological, sociological as well as logical bases.

1.7.4 Forms of Disciplines

Disciplines can be classified into the following broad categories:

Basic Discipline:

Some disciplines have their own networks of concepts which are distinctive and unique in nature. Such disciplines are categorised as 'Basic Disciplines'. Thus have their own logical structure of knowledge. For example, Mathematics is a

basic discipline which has distinct and abstract concepts and the criterion of testing truth in Mathematics is deductibility within an axiom system.

The discipline of 'Science' consists of its own concepts, facts, principles, generalizations, laws and theories which are empirical in nature. Observation is employed as the criterion for verification of knowledge. Science is an organised body of knowledge that deals with nature and nature's law. This body of knowledge has been divided into various science disciplines with more specialised characteristics like 'Physics', 'Chemistry', and 'Biology'.

Social Sciences, include awareness and understanding of our own and others minds, and include concepts that are essential for interpersonal relationships. The Social Sciences are divided into 'Sociology', 'History', 'Anthropology', 'Political Science', 'Psychology' and so on.

Applied Disciplines or Fields:

The applied disciplines are those wherein the knowledge of basic disciplines are used. For example, scientific knowledge is used in technological applications. The areas of Bio-engineering, Biotechnology, Applied Physics, Environmental Biology are some of the examples of applied disciplines.

As knowledge advances, new areas of knowledge and disciplines emerge new specialisations are created having their roots in basic disciplines and merge with other relevant areas.

Multidisciplinary and Interdisciplinary Areas:

The recent approaches to designing the curriculum in schools are inter, multi or trans-disciplinary. For example, 'Economics' is not studied independently. The knowledge of the disciplines of other branches of Social Sciences like; 'History', Political Science', 'Geography', and 'Sociology' are integrated into designing and transcting Economics in a better way. This is an interdisciplinary approach in which one discipline serves as the principal organiser, with related disciplines serving supplementing to the principal organiser.

Multidisciplinary approach concepts are selected from various disciplines to create a new field of study. For example, the area of Population Education requires the use of Biology, Economics, Psychology, Sociology, Geography and so on. There are many other areas, which are multi-disciplinary in nature like Home Economics, Social Biology, etc.

Check Your Progress 4

Notes: a) Write your answer in the space given below.

b) Compare your answers with the ones that are given at the end of the unit.

7. Define discipline.

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8. What constitutes a discipline?

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9. Explain the characteristics of a discipline.

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10. What is a basic discipline?

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1.8 IMPLICATIONS OF KNOWLEDGE FOR TEACHING AND LEARNING

Mostly all educational institutions and schools are engaged in the transaction of knowledge among students. As stated earlier, the question of knowledge brings in its terrain a host of other contentious issues.

What is the nature of knowledge?

How is it acquired?

What are its sources?

How do we judge the validity of knowledge?

These are questions which have evoked multiple responses from the people concerned (Jha, 2005). Understanding these questions about knowledge helps a teacher how to choose appropriate contents to be taught to the students and how to organize learning activities so that students can not only acquire knowledge but also become able to construct knowledge in respective field of study. It helps to know 'learning about learning', 'knowing about knowing' and 'thinking about thinking' (meta-cognitive ability) around which all teaching and learning practices revolve.

In other words, we can say that, deeper understanding of knowledge can help teachers organise teaching and learning from the disciplinary point of view. A sensible and committed Mathematics teacher would like to ask himself or herself questions like:

What is the nature of Mathematical knowledge?

How is Mathematical knowledge acquired?

What are the sources of Mathematical knowledge?

How do we judge the validity of Mathematical knowledge?

These are questions which will certainly help a Mathematics teacher to make his/ her teaching logical based on reasoning, and consequently he or she would like to use such pedagogic strategies which are not only exciting but also truly constructive. This process of understanding knowledge of a particular subject and its transactional aspect is not only applicable to the discipline of Mathematics only, it can also be applicable to other disciplines. Accordingly, the knowledge of the disciplines of Social Sciences, Humanities, etc. requires appropriate pedagogies for organising teaching-learning activities in the schools.

Activity 3

Relating to your discipline of study and teaching at school, suggest sources and ways of acquiring knowledge in that discipline and pedagogies for effective transaction of learning experiences.

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1.9 LET US SUM UP

Understanding knowledge helps a teacher how to choose appropriate contents to be taught to the students and organize learning activities so that they can not only acquire knowledge but also construct knowledge in respective field of study. It helps to know 'learning about learning', 'knowing about knowing' and 'thinking about thinking' around which all teaching and learning practices are organized. In other words, we can say that deeper understanding of knowledge can help teacher organize teaching and learning activities from the disciplinary point of view.

In this Unit, we discussed the concept of knowledge and the sources and ways of acquiring knowledge. This Unit further elaborated the categorization of knowledge which helps to constitute a discipline. We explained the basic characteristics of a discipline. The Unit also acquainted you with the typology of knowledge or discipline. Finally, the Unit ended with a discussion on implications of knowledge for the teaching-learning process.

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1.11   ANSWERS TO CHECK YOUR PROGRESS

1. A priori knowledge is knowledge whose truth or falsity can be decided before or without recourse to experience (a priori means 'before'). A posteriori knowledge is the knowledge based upon observation and experience. This is the knowledge of the scientific method stressing accurate observation and exact descriptions.

2. Experienced knowledge is always tentative and cannot exist prior to experience or be conducted from observation. It must be experienced to have value. Put example of your own.

3. Information is the interpretation of data with certain context and relevance. Knowledge is information which has been cognitively processed and integrated into an existing human knowledge structure. Put example of your own.

4. Intuitive knowledge is a label for a certain kind of experience when a conviction of certainty comes upon us quite suddenly like a flash. Put example of your own.

5. Knowledge through rationalism can only be done through two ways: inductive reasoning and deductive reasoning. In both types of reasoning the knowledge is validated through arguments and strong logic .

6. Knowledge gained through empiricism involves objective observation and experiences.

7. A discipline is an organised body of knowledge with a logical structure. It is a network of concepts and generalisations which explain the relationships among a body of facts.

8. A discipline is constituted with a substantial body of knowledge, a history of its development, a group of followers, and with certain forms of knowledge and approaches to its transaction.

9. Self-exercise.

10. Each discipline has its own networks of concepts which are distinctive and unique in nature. Such disciplines can be categorised as Basic Disciplines, which have their own logical structure of knowledge, like Mathematics, Science, Biology, Sociology etc.

UNIT 2 PERSPECTIVES OF DISCIPLINARY KNOWLEDG

Structure

2.1 INTRODUCTION

Understanding the perspectives of disciplinary knowledge is as important as understanding content of the subject for the teachers. Framing a discipline is not an independent task. As you know most disciplines are inter linked with each other. Therefore, teachers need to understand the way the disciplines are conceptualized and the perspectives that constitute to generate the knowledge in that discipline. In the previous Unit, you have learnt about the sources of acquiring knowledge, categorizing knowledge and constitution of disciplinary knowledge.

Keeping in view the above, we will explain the concept, nature and evolution of the disciplines. In the section on 'evolution and framing of disciplines', you will find specific descriptions which are given in framing the individual disciplines like, English, Mathematics, Physics, Social Sciences, and Humanities. The philosophical, socio-cultural and the historical perspectives of evolution and framing of the disciplines have also been discussed in this Unit. Apart from these, the inter-relationships between and among the disciplines taught at the school level have also been discussed.

2.2   OBJECTIVES

After going through this Unit, you will be able to:

● explain the concept of discipline specific knowledge;

● discuss the evolution and framing of disciplines;

● critically analyse various perspectives of evolution of disciplines; and

● establish relationships between and among various disciplines.

2.3   DISCIPLINE SPECIFIC KNOWLEDGE

Discipline specific knowledge can be defined as a set of understandings that are more than broad knowledge of a field, rather, it is the sort of knowledge that is specific to the discipline or profession (Koehler, 2012). The discipline specific knowledge in the discipline of 'Science' is more or less different than the discipline specific knowledge of the discipline 'Languages' and so as with 'Mathematics' and 'Social Sciences'. It is based upon the aims and objectives of studying the specific disciplines and also the nature of the discipline. The processes of acquiring knowledge in the 'Science' discipline like; scientific inquiry, experiment, scientific exploration, discovery, problem-solving, etc. may not be the same with disciplines of 'Social Sciences' or 'Languages'. In 'Social Sciences', we deal mostly with the social issues and involve ourselves in observations, social surveys, social inquiry, social explorations, interviews, narrations, anecdotes, case analysis, and reflections on happenings, events and ideas.

Each discipline has a way of looking at the world that influences how research and teaching within that discipline are pursued. Only in recent decades the key features of the discipline have been identified. These are:

● Disciplines identify certain things that they study, like the discipline of Social Sciences are engaged with exploring the social realities and establishing relationships within the social groups, communities, institutions, families, and also individuals.

● Disciplinary knowledge comprises a few theories, like the discipline of Science consists of knowledge about theory of 'Gravity', theory of 'Relativity' etc.

● Disciplinary knowledge is transacted through a few methods, like knowledge in discipline of Science is transacted through the method of experiments and scientific inquiry whereas knowledge in discipline of 'Social Sciences' is transacted through the methods like social inquiry, narration cum discussion, strong telling, etc.

● Key concepts in a discipline are defined according to the nature of the discipline. The concepts in Science are defined from scientific perspectives; the concepts in Social Sciences are defined from socio-political perspectives; whereas the concepts in psychology are defined from psychological perspective.

● Disciplines take their own ontological stance toward the nature of reality, like the discipline of 'Philosophy' defines the world from a metaphysical perspective, the 'Religion Studies' perceives the world from a spiritual perspective, whereas the discipline of 'Science' takes the world as a material reality.

- Disciplines take their own epistemological stance regarding the possibilities of human understanding, like all disciplines have their own epistemological bases as well as their own ways of validating the knowledge. For example, method of validating knowledge in 'Science' is different from that of 'Philosophy'.

- Disciplines, to varying degrees, may also be associated with particular ethical, ideological, or aesthetic practices, like the discipline of 'Science' is having certain ethical practices and the same is with the discipline of 'Social Sciences'.

- Disciplines are identified with some major thinkers, and followers, like the major thinkers of the discipline of 'Philosophy' are Plato, Aristotle, Kant, Socrates, and Karl Marx whereas the thinkers of the discipline of 'Science' are Einstein, Newton, Copernicus, Galileo, and Darwin.

Activity 1

As per your understanding, add a few more features to the discipline as discussed above.

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In the section 1.6 of Unit-1 of this Block, you have studied the categorization of knowledge for constituting a discipline (Table 1.1). On the basis of the above descriptions as well as categorization of knowledge for constituting a discipline (section 1.6, Unit-1), we present the discipline specific processes to acquire knowledge of major disciplines as follows:

Table 2.1: Major disciplines with discipline specific processes to acquire knowledge

Major Disciplines	Discipline Specific Processes to acquire Knowledge
Science	- Critical observation of the natural phenomenon - Developing inquiry on observable phenomenon - Establishing linking and correlating the scientific ideas with physical happenings

	● Engaging in scientific experimentation
	● Natural and scientific exploration of facts and ideas and their validation
	● Validating the result of scientific inquiry
	● Developing scientific thinking and ability to make abstract concepts/ideas
Social Sciences	● Critical observation of the social phenomenon, like social happenings; norms of the society; inter-personal relationships; issues pertaining to the society; changes and dynamics of the society; diversities and inclusiveness; understanding gender, caste and class, culture and religion; etc.
	● Engaging in social inquiry, exploration, and understanding cross cultural and cross sectional dimensions of the society
	● Understanding social, cultural, and economic diversities of the society
	● Understanding individual's rights and duties
	● Understanding civic responsibilities, ethical practices, and love for the entire world
Mathematics	● Connecting mathematical principles with the daily life of the children
	● Making children think rationally, and do thing inductively or deductively
	● Developing logical reasoning and make the children to solve mathematical problems
	● Developing the skills of analyzing and synthesizing the mathematical principles
Languages	● Making the children communicate themselves in different situations
	● Developing the skills of listening, speaking, reading and writing
	● Understanding and reflecting on literature
	● Appreciating literature and engaging in creating literature
	● Linking similar literatures and also developing meta-cognitive skills

Four broad disciplines have been discussed in Table 2.1 with their processes to acquire discipline specific knowledge. Accordingly, discipline specific knowledge can be identified with other disciplines included in the curriculum taught at universities/schools.

Check Your Progress 1

Notes: a) Write your answer in the space given below.

b) Compare your answers with the ones that are given at the end of the unit.

1. Define discipline specific knowledge.

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2. Explain discipline specific processes to acquire knowledge in the discipline 'Science'.

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2.4 EVOLUTION AND FRAMING OF DISCIPLINES

Based upon the broad areas of knowledge, specific disciplines have evolved. All disciplines have their own history and evolution. In this section, the evolution of the disciplines taught at the universities and schools and how they have been framed are discussed:

2.4.1 Discipline of English

English as a discipline deals with the fundamental issues of human existence – realizing the essence of life and living; developing a sense of beauty and tolerance; engaging individuals in inter-personal relationships; making people express their sufferings, pains, pleasure, and adventures; appreciating the literary creation of others and also making the individuals create new literatures; and also spreading the essential values for living.

The evolution/history of 'English as a Discipline' is quite old. In the beginning, English language was the family language of the Indo-European people of West German. If we divide the history of English language, it can be divided into three main periods: 'Old English', 'Middle English' and 'Modern English'. It is observed that over the centuries, the language English has been influenced by many other languages. Let us try to understand the development of English language as mentioned in the Figure 2.1.
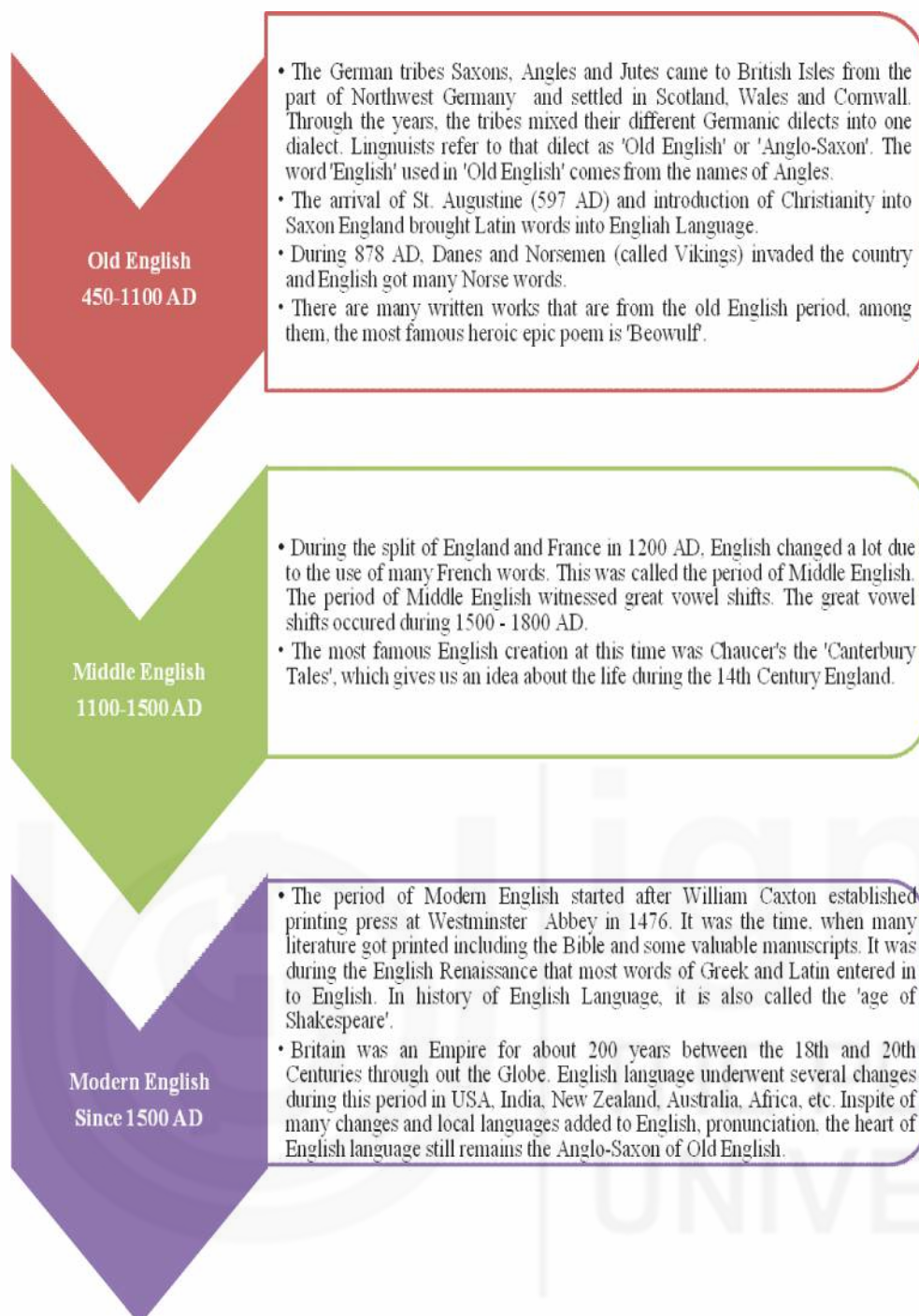
- The German tribes Saxons, Angles and Jutes came to British Isles from the part of Northwest Germany and settled in Scotland, Wales and Cornwall. Through the years, the tribes mixed their different Germanic dilects into one dialect. Lingnuists refer to that dilect as 'Old English' or 'Anglo-Saxon'. The word 'English' used in 'Old English' comes from the names of Angles.
- The arrival of St. Augustine (597 AD) and introduction of Christianity into Saxon England brought Latin words into Engliah Language.
- During 878 AD, Danes and Norsemen (called Vikings) invaded the country and English got many Norse words.
- There are many written works that are from the old English period, among them, the most famous heroic epic poem is 'Beowulf'.

**Old English
450-1100 AD**

- During the split of England and France in 1200 AD, English changed a lot due to the use of many French words. This was called the period of Middle English. The period of Middle English witnessed great vowel shifts. The great vowel shifts occured during 1500 - 1800 AD.
- The most famous English creation at this time was Chaucer's the 'Canterbury Tales', which gives us an idea about the life during the 14th Century England.

**Middle English
1100-1500 AD**

- The period of Modern English started after William Caxton established printing press at Westminster Abbey in 1476. It was the time, when many literature got printed including the Bible and some valuable manuscripts. It was during the English Renaissance that most words of Greek and Latin entered in to English. In history of English Language, it is also called the 'age of Shakespeare'.
- Britain was an Empire for about 200 years between the 18th and 20th Centuries through out the Globe. English language underwent several changes during this period in USA, India, New Zealand, Australia, Africa, etc. Inspite of many changes and local languages added to English, pronunciation. the heart of English language still remains the Anglo-Saxon of Old English.

**Modern English
Since 1500 AD**

Figure 2.1 : History of English Language

[*Source: Boyanova, M. (2002), A Brief History of the English Language, retrieved from http://www.studyenglishtoday.net/english-language-history.html on 15.09.2016]*

The above development of English as a discipline makes us understand how languages survive over the centuries. At the present time, English is taught as a discipline in the university curriculum as well as it is taught as a compulsory subject in school education. The literary, non-literary, narrative, expository, technical, persuasive, and literary discourse texts are taught in School curriculum.

2.4.2 Discipline of Science

Like the discipline of English language, the discipline of Science has its own history and evolution. Over the years, the discipline of Science has been more

popular at university and school levels. Due to development of Science and Technology and findings of many fundamental researches in science, different new branches of science studies have evolved. In this section, we discuss development of different branches of Science and their evolution.

As you know, the body of knowledge included in Science is all about theoretical and practical knowledge about the natural world. Most branches of knowledge/studies have evolved from the parent discipline of 'Philosophy'. Earlier, the philosophers investigating nature were called as 'natural philosophers', whereas empirical investigations of the natural world were described as 'classical antiquity' (For example, the works by Thales, Aristotle, and others). During the middle age, rigorous scientific methods have been employed in Science discipline (For example, the works of Ibn al-Haytham and Roger Bacon). The real scientific revolution took place in Europe during the 16th and 17th century. From the 18th century to the late 20th century, significant works in physical as well as biological sciences have taken place. Let us now discuss the specific disciplinary areas of Science.
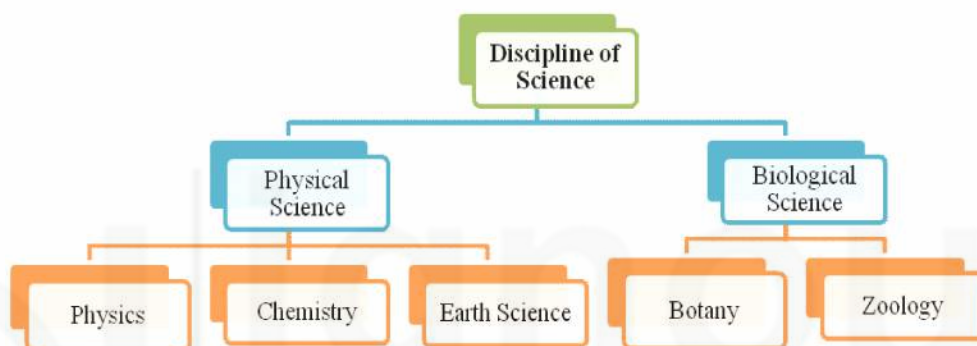
Figure 2.2 : Branches of Discipline of Science

The Figure 2.2 highlights the basic disciplines of Science. Of late, many sub-disciplines of different disciplines of Science have also emerged and are being taught in universities across the globe. Let us have a look at disciplines of Science and their sub-disciplines.
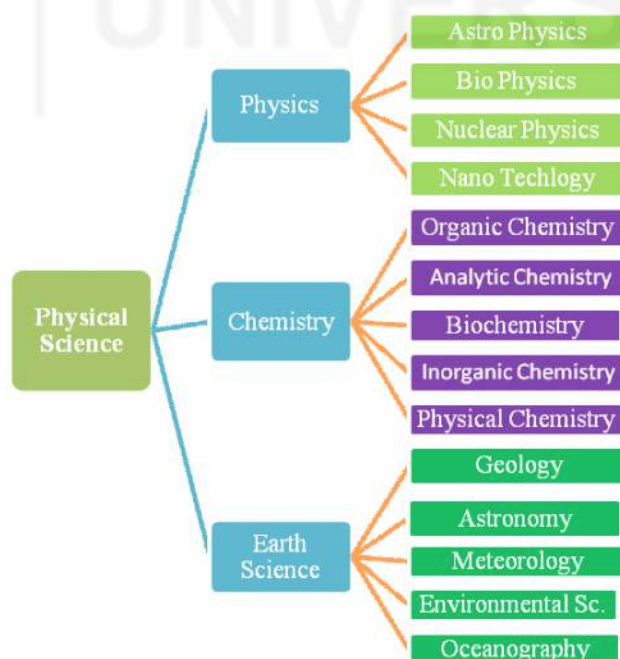
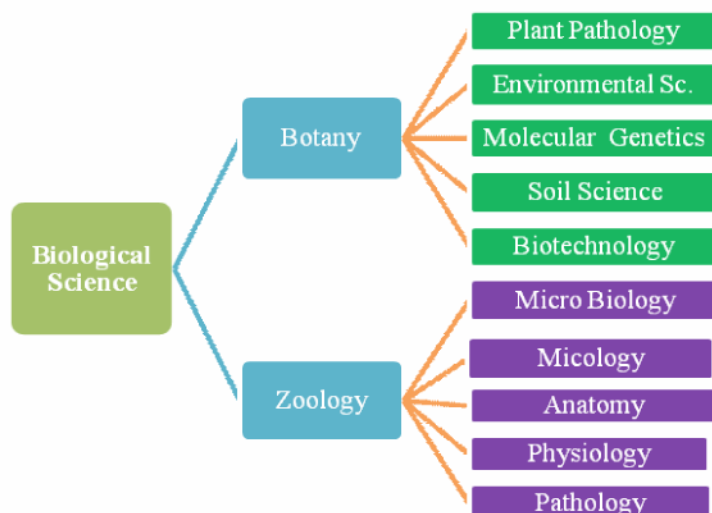**Figure 2.3 : Sub-disciplines of Physical Science**

Figure 2.4 : Sub-disciplines of Biological Science

From the Figures 2.3 and 2.4, it is evident that the disciplines of Physical and Biological Sciences have further been divided into many sub-disciplines. The sub-disciplines of Physical and Biological Sciences have not evolved haphazardly, rather they have evolved with substantial knowledge base and of late, these special and applied sub-disciplines are becoming more popular areas of studies. Keeping in view the importance of the applied branches of Science, these are also included in school curriculum to acquaint the learners with the specialized areas of studies.

2.4.3   Discipline of Mathematics

Mathematics is considered as a human and cultural endeavour. Mathematical ideas develop everywhere because people may live in different cultures, but they do similar things. As quoted by Panda (2006), six operations which people engage across all cultures are counting, measuring, designing, locating, playing and explaining.

These activities involve an enormous amount of Mathematics. In fact, mathematical understanding is culturally conditioned and created across cultural contexts. There is a rich history of human development of mathematics and mathematical uses in our modern society. (Panda, 2006)

Mathematics as a discipline or field of study includes conceptual understanding and study about numbers, operations and theorems. The study of Mathematics can also be used as a tool for understanding other disciplines. The knowledge of Mathematics is highly used for developing logical reasoning, creativity and doing the practical works. The study of Mathematics touches human mind and life because we use mathematical calculations in our daily life. This can also be used for intellectual challenge which the professionals of Mathematics usually encounter. Professionals like engineers and technocrats always apply Mathematics in their own works. Since Mathematics plays a central role in modern culture, some basic understanding of the nature of Mathematics is required for scientific literacy. There is a need to understand Mathematics as part of the scientific and human endeavor. Mathematics is a broad discipline that has applications in other disciplines.

2.4.4   Discipline of Social Sciences

The history of the discipline of Social Sciences are as old as other disciplines. Discipline of Social Sciences are always an important area of studies for the

scholars as it touches the life of the people and their living in the community. The discipline of Social Science includes varieties of subject areas (also called disciplines) like History, Economics, Political Science, Sociology, Anthropology, Psychology, and Geography. The disciplines of the Social Science though address different issues relating to society, still the process of conceptualizing knowledge, applying it in social context, using methods and techniques to transact learning experiences and conducting research differ from one discipline of Social Science to other. They have also different and unique disciplinary identities and definitions to understand. Each discipline of Social Sciences satisfies the characteristics of a discipline. They have their own body of knowledge, group of academic practitioners/ followers, and also have their own history. The disciplines of Social Science are also called as the discipline of Humanities. Let us discuss the evolution of different disciplines of Social Science and major concepts they deal with.

Table 2.2 : Evolution of the disciplines of Social Science

Discipline(s)	Evolution
History	**[Period of Prehistory]** ▪ Events starting from the formation of the universe ▪ Events starting from formation of planet to the rise of modern human ▪ Events starting from the first appearance of Home sapiens to before the invention of writing **[Period of History]** ▪ Ancient History [3200 BC to 500 AD] ▪ Middle Ages [500 to 1499 AD] ▪ Early Modern History [1500 to 1900 AD] ▪ Modern History [1900 AD onwards]

Sociology	▪ A scientific study of all forms of human social life
	
	▪ Sociology evolved as an academic discipline of study emphasizing:
	
	  - people with various social characteristics
	
	  - the ways of different types of relationships in the society
	
	  - interaction in and through groups
	
	  - various spatial/physical locations and time frame
	
	  - an array of institutions
	
	  - societal-level entities and the world system
	
	▪ It also evolved as a discipline in order to understand modernity and particularly to study the modern societies and tracking their changing characteristics.
	
	*(**Source:** Charles Crothers, 2010, The Historical Development of Sociology: Sociological Traditions. retrieved from http://www.eolss.net/sample-chapters/c04/e6-99a.pdf on 16.09.2016).*

Political Science	▪ The historical journey of the discipline of Political Science continues from the foundations of ancient theorists to the contemporary political scientists.
	▪ The ancient Greek thinkers (Plato and Aristotle) had laid the foundation to politics as one of the systematic science of study.
	▪ Further the Christian thinkers like St. Augustine and St. Thomas Aquinas had also dwelt upon the ideas of ideal State.
	▪ During the fifteen century, the Italian Political thinker, Niccolo Machiavelli established the tradition of studying the historical as well as the existing political institutions.
	▪ The work of Francis Lieber (Civil Liberty and Self Government) has made significant development for the growth of Political Science as an academic discipline.
	▪ The contribution of 'Political Science Quarterly', one of the Journal published by the Faculty of Political Science, Culumbia University (considered as the first scholarly journal of Political Science) in 1886 had provided a platform to the political scientists to express their views on the contemporary political developments and issues.
	▪ The establishment of 'American Political Science Association' in 1903 had also equally contributed to establishing Political Science as a discipline.
	▪ By 1920s, a great paradigm shift occurred in the discipline of Political Science as because the positivist movements. New methods and ways of studying Political Science due to empirical and statistical techniques to conduct research in Political Science were introduced.
	▪ After the Second World War and early fifties, Political Science got closely associated with Sociology as both had the common issues to deal with but they remained as independent disciplines of study with multi-disciplinary perspectives and understanding.
	▪ Though the history of Political Science as a discipline is not so old but it is as an important discipline of study at university as well as in schools.
	(Source: KKHSOU, 2011)

Geography	▪ The term 'Geography' was first coined by Eratosthenes, a Greek scholar (276-194 BC). The ancient Greek scholars first systematically studied Geography.
	▪ The tales of Miletus, Herodotus, Eratosthenes, Aristotle, Strabo, and Ptolemy had contributed a lot to Geography.

- The contributions of Romans for exploration and mapping of the unknown lands were also equally significant for understanding Geography.

- The journey of Marco Polo during the Middle Age arose interest among the scholars of geography.

- The introduction of textbooks and geographical maps during the 16th and 17th centuries had sensitized the scholars about sound theories of geography.

- During the 18th century, geography was recognized as a discipline of study at university level.

- The modern period of Geography started during the end of the 18th century with the works of Alexander von Humboldt and Karl Ritter.

- Since the end of World War II, Geography was well recognized as a popular discipline of study catering to the important content elements such as: aerial photography, remote sensors, satellite photography, and quantitative analysis and mapping through computers.

- During 1950s, the use of quantitative methods in conducting geographical research gained much popularity among the Geography scholars.

- Today, Geography is studied in universities as well as schools across the globe and is established as a unique discipline carrying the common characteristics of Science and Social Science.

(Source: The Columbia Electronic Encyclopedia, 2012)

Activity 2

Like the evolution of different disciplines of Social Sciences, write how the discipline of 'Economics' has evolved and is recognized as a disciplinary study.

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Check Your Progress 2

Notes: a) Write your answer in the space given below.

b) Compare your answers with the ones that are given at the end of the unit.

3. Explain the concept of 'Modern English'.

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4. Example the nature of contents which are included in the discipline of 'Earth Science'.

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5. Explain Mathematics as a human endeavour with an example.

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6. When did the evolution of the discipline of 'Political Science' take place?

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2.5 PERSPECTIVES OF DISCIPLINES

The evolution of a discipline is a continuous process. A discipline is formed with certain perspectives. We need to understand those perspectives in order to have a comprehensive understanding of a discipline and its nature. In this section, we discuss the perspectives of a discipline which contribute to its formation.

2.5.1 Philosophical Perspective

Every discipline has its own philosophy. You might be familiar with the terms: 'Philosophy of Science'; 'Philosophy of Social Science'; 'Philosophy of Mathematics'; and 'Philosophy of Language'. What do they mean? Do they mean

the knowledge base of those disciplines? Do they discuss the details of the contents in those disciplines? Such questions provide answers which explain the philosophical perspectives of a discipline. Let us try to get the answer to the above questions.

When we explain philosophy of Science, we explain the types of knowledge it deals with and the processes involved in acquiring those knowledge. For example; Science deals with empiricism, logical positivism, observations, the processes of inquiry and experimentation to validate the empirical findings. The above knowledge and processes form the discipline of Science. Such knowledge and processes can also be used in teaching different contents in Science. For example, to teach 'Germination', school children may be taught to observe how germination takes place? They can learn it by conducting an experiment with a seed.

Like Science, the discipline of Social Science is also based upon certain ideas and philosophy. Social Science involves processes like social observation, understanding inter-personal relationships, critically analysing the socio-political and economic issues, etc. The processes of acquiring scientific knowledge are different from the processes of acquiring Social Science knowledge. We can teach socio-political issues by organising debates, discussions, role plays, and critically analysing the issues. They can also be taught through social inquiry and critical observations.

Similarly, the processes of acquiring knowledge in Mathematics and Language are also different. Mathematics solves the problems by using inductive or deductive methods. It also uses the knowledge and processes of analysis to solve the problems. Mathematics helps us to deal with the numbers and calculations which we face in our day to day life. Language helps children acquire the skills of listening, reading, writing and speaking. They also develop within the children a sense of understanding literature, appreciating as well as creating new literature.

To conclude, it can be said that every discipline has its own philosophy and the process of acquiring knowledge. It is therefore, important to know the disciplinary knowledge of various disciplines.

2.5.2 Socio-political and Cultural Perspectives

Education is closely related to the society, its norms and principles, traditions and cultures and ways of living. All these contribute to the formation of academic discipline. Academic discipline can not be formed without the socio-cultural and political practices. Many a times, socio cultural practices form the part of our school curriculum. The goals of education are based upon the goals of the socio-political system of the country. National Policy on Education (1986) says:

> '*every country develops its system of education to express and promote its unique socio-cultural identity and also to meet the challenges of the time. There are moments in History when a new direction has to be given to an age-old process. That moment is today. Education is the highway to realize the cultural as well as socio-political goals of the country.*'

It is, therefore, you might have observed the following in Indian education system:

▪ We have a common educational structure starting from school to higher education.

- The national system of education is based on a national curriculum framework.

- National integration, international understanding and universal brotherhood are the basic principles of our education system.

- Issues of diversity, equity and equality form the essence of our education system.

- Further the socio-political and economic issues have also been included in various disciplines/school subjects.

The above features though broadly characterize the education system of our country, they also constitute the socio-cultural perspectives of forming the disciplines. The political ideologies of various political parties influence the education system of country and also contribute to formation of academic disciplines. Many a times, it is observed that certain contents/subjects are included or deleted from the broad curriculum or discipline because of ideologies and visions of the political party forming the government. So it can be said that the political perspective is also important for formation of the disciplines.

2.5.3   Historical Perspective

Like any other social phenomena, academic disciplines do have a history. Every discipline can be analysed by looking at its historical development (Kenneth, 1974). The journey of the specific academic discipline starting from its inception to the present form and practices of the discipline is called the history and development of that discipline. In the previous section (2.4), we got an idea about the evolution of various academic disciplines. The evolution of a discipline reflects the historical perspective of that discipline. A historian of Science or Social Science, or the Humanities narrates the specific historical contexts that have led to formation of that discipline. You might be knowing that most disciplines, which are taught in universities as well as colleges had, in fact, evolved from the parent discipline of 'Philosophy'. Historically, Philosophy subsumed all bodies of knowledge. Disciplines of 'Astronomy', 'Medicine', 'Physics', 'Mathematics', 'Psychology', 'Sociology', 'Education', 'Linguistics', 'Economics' etc. evolved from philosophy. The historical perspective of the discipline not only discusses the history of the development of the discipline but also describes the contexts in which it has evolved.

The changing need of the society, development of science and technology, emergence of new ways and techniques are certain conditions for emergence of new disciplines. For example, Social Science discipline evolved because of the political need of getting more information on the population, which could be used for effective government and stabilizing emerging social and political structure. Similarly, the discipline, 'Area Studies' emerged in USA during the second world war aiming to train the area specialists. Accordingly, evolution of the discipline of 'Computer Science' took place because of its link with the military applications at that time (Paleeri, 2015). We all know that 'History' is a discipline, which has its own background as an academic discipline. But in due course of time, the new sub-disciplines like, 'Ancient History', 'Medieval History' etc. have also emerged.

The above discussion emphasizes that the evolution of any discipline has certain historical perspective. The historical perspective of any discipline is also based upon the contexts prevailing at that time when it evolved.

Check Your Progress 3

Notes: a) Write your answer in the space given below.

b) Compare your answers with the ones that are given at the end of the unit.

7. Explain philosophical perspective of a discipline with an example.

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8. Explain the concept of socio-cultural perspective of a discipline.

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9. Explain, with an example, the historical perspective of a discipline.

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2.6 INTER-RELATIONSHIPS BETWEEN AND AMONG DISCIPLINES

The objectives of teaching-learning process can only be realized if contents of a discipline are taught with linkages within and between the disciplines. In school, Social Science cannot be taught independent of Science. Similarly, Language cannot be taught without integrating with Mathematics. We are proceeding towards the multi-disciplinary and trans-disciplinary approaches to curriculum organization and pedagogical practices. The knowledge of basics of Science, Mathematics, Social Science, as well as Language is important for the teachers to teach a discipline irrespective of the disciplines they belong to. It is therefore, important to understand the inter-relationships between and among the disciplines.

2.6.1 Inter-relationships between the Disciplines of Social Sciences

As we know, Social Science comprises the disciplines of History, Political Science, Economics, Geography, Sociology, etc. To teach Social Science, a teacher needs to understand the linkage among the disciplines of Social Science. For example, when we teach History of a particular time, we need to teach the socio-economic conditions of the people during that time, their socio-geographical diversities, system of governance within the community, language that they spoke, etc.

Moreover, to teach the disciplines of Social Science, teachers need to understand the relevant concepts of Science and Mathematics. For example, to teach 'Economics', teachers need to understand calculation, use of various figures/graphs, use of statistics for data analysis and interpretation. While teaching 'Geography', teachers deal with the contents like population parameters, weather report, climate change, rain fall, demographic dividends, measurement of distance etc. All these need understanding of Mathematics, Science, as well as Statistics. Again the knowledge of Language is also very much important to understand various themes of Social Science. Language plays an important role in teaching various disciplines of Social Science. So to conclude, the disciplines of Social Science are inter-related with each other and also related with other disciplines of Science, Mathematics, and Language.
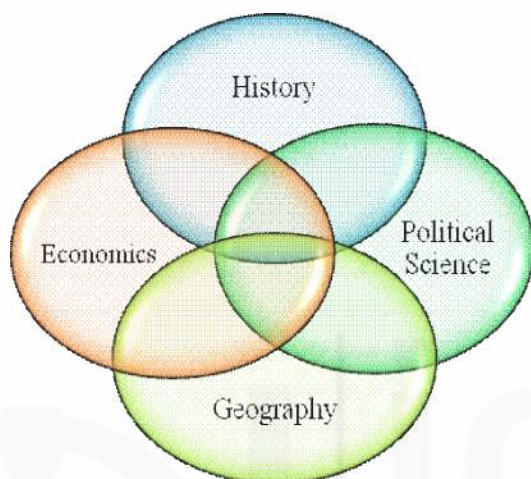
Figure 2.5 : Interrelationships of Social Sciences within the discipline
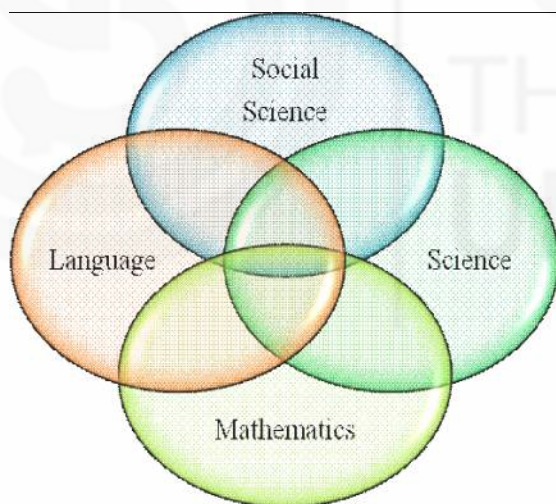
Figure 2.6 : Interrelationships of Social Sciences among the disciplines

Within the discipline, different branches of Social Science are related with each other, whereas, Social Science is also related with other disciplines such as Mathematics, Language and Science.

2.6.2 Inter-relationships of Language with other Disciplines

Language learning is always important for academic as well as other related works. The need of learning language is not only limited to that language but also extends to teaching of other disciplines or subjects. A teacher of Physics can only be an effective teacher if he/she uses discipline specific language to teach Physics.

Accordingly, a teacher from any discipline needs to know the specific terminologies and language used in other disciplines. Unless a teacher has mastery over the language and skills of using language across the curriculum, he/she can not be an effective teacher. Language is as important as content to connect discipline to discipline and subject to subject. For example, one needs to understand Mathematics for teaching English and vice versa. You will learn more about the functions of language Across the Curriculum in the course BES-124 'Language Across the Curriculum'. The linkage of language across the curriculum can be shown as follows:
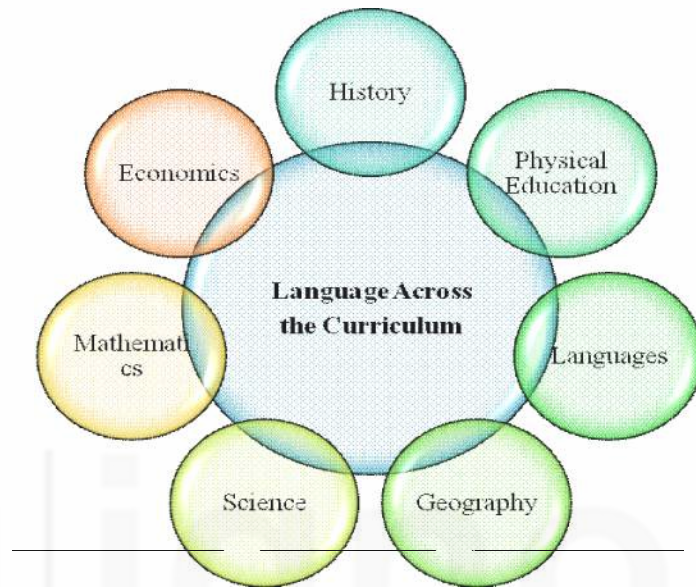
Figure 2.7 : Language Across the Curriculum

Activity 3

Referring to the Figure 2.7, explain with an example, how does language function across the curriculum?

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2.6.3 Inter-relationships between Physics and Mathematics

We often discuss about the close relationship between Physics and Mathematics. Without Mathematics no physics related problems in Physics can be solved. Similarly, to measure objects, distance, and to show relationships between different functions and properties in Physics, knowledge of Arithmetic, Algebra and advanced Mathematics can be used. Teachers and students often consider that the knowledge of Physics is difficult and complex. However, learning Physics can be made easy,

simple and interesting with the application of mathematical knowledge. It is often called the language of Physics is the Mathematics

Let us understand it with an illustration:

Connection of Einstein's general Theory of Relativity with the discipline of Mathematics

For eight years Einstein did nothing but tinker with Newton's theory of Gravity. He had many brilliant insights, but the structure of what he put together was very messy mathematically. There was no tidy way to put down in equations the essential meaning of his new ideas. Then he talked to an old classmate who had taken notes for him in Mathematics Class. Einstein explained his new hypothesis about gravity and asked the fellow if he had any ideas about how to structure gravity more clearly mathematically. His friend told him about a discipline of Mathematics that had been discovered while they had both been in School – tensor calculus and matrix mechanics in linear algebra. When he heard this, Einstein spent a lot of time slapping himself in the head. This Mathematics was not only elegant and beautiful, but it took the untidy equations Einstein had formulated and put them in a structure that was compact, showed relationships easily, and brought elegance and easy of understanding to what later became known as Einstein's General Theory of Relativity. Einstein's General Theory of Relativity boils down to this one equation in the language of tensor calculus.

$$G^{\mu\nu} = \kappa \, T^{\mu\nu}$$

Einstein later said that had he attended his math classes in school, he would have heard of these new mathematical disciplines, and instead of his theory taking eight years to develop, it would have taken him only three years at most.

*(**Source:** Retrieved from http://ww2.valdosta.edu/~cbarnbau/phys_math/ p1_grel.html on 28.09.2016)*

All the formulas/principles of Mathematics are, to a great extent, used in Physics. For example, the principles/formulas of Mathematics like Calculus (single and multivariable), Differential Equations, Methods of Approximation and Probability are used in Physics. Mathematics is not only interrelated with Physics, it is also related to other disciplines like Languages, Social Science and other branches of Science.

2.6.4   Inter-relationships between Biology and Chemistry

Like the inter-relationships between Physics and Mathematics, the disciplines of Biological Sciences (Zoology and Botany) are closely related with Chemistry. You might have been familiar with the new discipline i.e. 'Biochemistry'. The knowledge base of Biochemistry has been generated from the disciplines of Biology and Chemistry. The discipline of Biochemistry explains how chemical reactions are effectively used to understand the complexity of the content of Biology. Biochemistry also explores the chemical processes involved in living organisms. It is a laboratory based Science discipline which brings together the disciplines of Biology and Chemistry. The Biochemists understand and solve the biological problems using chemical knowledge and techniques.

From the above discussion, you might have understood that no discipline is independent, rather there is a very close relationship within and among the disciplines. Hence, it is important for the teacher to understand the basics of the disciplines and linkage of knowledge across the disciplines. The objectives of teaching can only be realized when we teach subjects from inter and multi-disciplinary perspectives.

Activity 4

Define the discipline of 'Mycology'? Explain, with an example, how the study of Mycology addresses the disciplines of Biology and Chemistry.

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Check Your Progress 4

Notes: a) Write your answer in the space given below.

b) Compare your answers with the ones that are given at the end of the unit.

10. Explain the inter-relationship of Social Sciences with Mathematics.

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11. How language works across the curriculum?

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12. Explain the relationship of Mathematics with Physics.

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2.7   LET US SUM UP

The Unit, 'Perspectives of Disciplinary Knowledge', is designed to acquaint you with the evolution of various disciplines taught at school level with different perspectives contributing to their formation and evolution. To acquaint you with the development of disciplines and its inter-relationship nature of disciplinary knowledge, a thorough discussion has been made with necessary illustrations. The nature and scope of various disciplines with their perspectives have also been discussed in this Unit with elaboration.

Teaching school subjects using multi and trans-disciplinary approaches is a big challenge for the teachers. It is, therefore, necessary on the part of the teachers to understand the disciplinary perspectives of education. To make the disciplines inter-linked and inter-related with other disciplines, a thorough discussion has been made in this Unit.

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2.9 ANSWERS TO CHECK YOUR PROGRESS

1. Discipline specific knowledge can be defined as a set of understandings that are more than broad knowledge of a field, rather, it is the sort of knowledge that is specific to the discipline or profession.

2. Discipline specific processes to acquire knowledge in the discipline of Science includes observation, inquiry, experimentation, empiricism and positivism knowledge.

3. The concept of Modern English started after William Caxton established printing press at Westminster Abbey in 1476. It was the time, when many literatures got printed including the Bible and some valuable manuscripts. It was during the English Renaissance that most words of Greek and Latin entered in to English.

4. The nature of contents included in 'Earth Science' are Geology, Astronomy, Meterology, Environmental Science and Oceanology.

5. Mathematics is considered as a human and cultural endeavour because Mathematical ideas develop everywhere because people may live in different cultures, but they do similar things. Put example of your own.

6. The ancient Greek thinkers (Plato and Aristotle) had laid the foundation to politics as one of the systematic science of study. The evolution of the discipline of Political Science is considered starting from that time.

7. Every discipline has a philosophy and that determine the frame of knowledge of that discipline. The philosophy of science discipline is based upon empiricism, scientific inquiry, and scientific observation whereas the philosophy of Social Science discipline is based upon social inquiry, survey, social observation etc.

8. The societal practices, cultural heritage, and tradition of a society reflect in the academic discipline and school curriculum. Discipline is not beyond the society. It is therefore, academic disciplines are certainly have a socio-cultural perspective.

9. All disciplines have a history and have also certain conditions for its development. That's why, historical perspective of academic discipline is always an inherent component of each and every discipline.

10. To understand the technical concept of Social Science we need to understand the concept of Mathematics. As example, to understand Geographical concepts, Economics, Population Studies, etc. we use the Mathematical concepts calculations, figures/graphs, statistics for data analysis etc.

11. Language helps us to understand the contents and its meaning of different disciplines. Language is not only limited to study languages but also the knowledge of language works to make us understand across the disciplines.

12. All the calculations, derivations, equations, and theorizations in Physics are done by Mathematics. It is rightly said that the language uses in Physics is the Mathematics. It is therefore Physics and Mathematics are inter-related with each other.

UNIT 3 DISCIPLINARY KNOWLEDGE AND SCHOOL EDUCATION

Structure

3.1 INTRODUCTION

Teaching is both a complex and an interesting activity. To become a teacher is, therefore, a challenging task. A good teacher needs to have both content and pedagogical knowledge of the subject as well as the discipline that he/she deals with. As you know from the previous units of this Block that knowledge pertaining to a particular academic area forms the basis of discipline. The academic knowledge deduced from that discipline constitutes the contents for the subject of a school curriculum. A true teacher needs to understand not only the subjects and contents what he/she supposed to teach but also the development and philosophy of those subjects.

Keeping in view the above, this Unit has been designed to understand the disciplinary knowledge of teaching subjects and their pedagogical concerns. A school curriculum does not only deal with the core disciplines and subjects, but also deals with many other special disciplinary knowledge areas such as Arts and Crafts, Work Education, Peace Education, Health and Physical Education, etc. The difficulty of our curriculum system arises from the fact that the specific disciplinary areas of knowledge are not given the same importance as that of the core school subjects. This Unit deals with these issues. Apart from these issues, the principles of framing or reframing school subjects are also discussed in this Unit.

3.2 OBJECTIVES

After going through this Unit, you will be able to:

- explain the pedagogical demands of disciplinary knowledge at different stages of school education;

- critically analyse the need and difficulties of classifying and accommodating specific disciplinary areas of knowledge as part of teaching-learning process at the school level;

- discuss the broad structure of curriculum of the school subjects;

- describe scholastic and pedagogical considerations of framing school subjects; and

- analyse the need for reframing of school subjects.

3.3 PEDAGOGICAL DEMANDS OF DISCIPLINARY KNOWLEDGE

Teacher education is one of the specialized areas of study in the discipline of education. The main concern of teacher education is to prepare quality teachers for the school education. Many factors are responsible for preparing quality teachers especially for the school education. Among these factors, understanding disciplinary knowledge and pedagogical practices to transact that disciplinary knowledge at different stages of school education are major factors. A teacher needs to understand both disciplinary knowledge and innovative pedagogical practices. Disciplinary knowledge need to be integrated systematically in curriculum at different stages of school education. Similarly, the connection between various strands of a discipline can be explained with good pedagogical tools. The pedagogical demands of disciplinary knowledge at different stages of school education need to be understood and worked on. Pedagogical content knowledge includes an understanding of what makes the learning of specific topics easy or difficult. The preconceptions of students of different ages and backgrounds needs to be linked with their new learning experiences. This requires learner centric (constructivist) pedagogy (Grayson, 2004).

The current pedagogical practices in school education are contextualized in the light of the specific needs of the learners. According to NCFTE, 2009, 'the key departure of pedagogical courses from conventional teacher education would involve shifting the focus from pure disciplinary knowledge and methodology to the learner and his/her context as well'. For example, a course on language pedagogy would promote an understanding of the socio-linguistic profiles of the learners, and of the classroom and the functional use of language(s) across the curriculum. In a multilingual milieu, we optimize learning by harping on 'A' medium of instruction (MoI) or we do better by bringing in multilingual rapporteur of children as well the teachers. We may need to move away from the conventional use of language as a subject, which emphasizes its grammatical structure rather than usage (NCFTE, 2009). In view of this, we discuss pedagogical concerns of different disciplines at different stages of school education.

3.3.1 Pedagogical Concerns of Disciplinary Knowledge

In Unit-1 and 2 of this Block, you have already learnt the concept of disciplinary knowledge and the evolution of an academic discipline. You have also learnt that a discipline has the following characteristics:

● It is a recognized area of study

● It has a substantial body of knowledge founded on core concepts and theories

● It uses of critical inquiry methods for studying problems

● It has a definite scope for research

● It has significant contributors of knowledge, research, and practices within a discipline

● It is associated with learned societies and academic organizations

● It has its own intellectual history

● Scholars continue their interest in studying the discipline

One of the most important characteristics of an academic discipline is that, it has a substantial body of knowledge and theories. Curriculum planning and development are made keeping in view the nature of knowledge of the discipline and the pedagogical treatment required for transacting the same knowledge. The curriculum transaction is guided by various schools of thought on teaching: behaviorism, cognitivism and constructivism. All the pedagogical approaches may not be suitable for transacting every content areas in a discipline. The pedagogical practices vary from content to content and for different stages of school education. To understand how disciplinary knowledge is mediated by pedagogical concerns and approaches, we need to understand what these pedagogic approaches are and what implications they have for teaching - learning practices.

Table 3.1 : Pedagogical approaches and their implications for teaching and learning

Pedagogic Approaches	Pioneers	Concept	Implications for Teaching Learning Processes
Behaviorist	I.P. Pavlov, E.L. Thorndike, J.B. Watson, and B.F. Skinner	Behaviorism is a school of thought in psychology which is based on the proposition that behavior can be researched scientifically without studying inner mental states. The changes or the modification of behavior occurs when the bonds of stimulus and response are established in the process of learning.	▪ An emphasis on producing observable and measurable outcomes in students. ▪ Pre-assessment of students to determine where instruction should begin. ▪ Emphasis on mastering early steps before progressing to more complex levels of performance. ▪ Use of reinforcement to impact performance. ▪ Use of cues, shaping and practice to ensure a strong stimulus-response association. *(Ertmer and Newby, 1993)*

Understanding Knowledge and Disciplines

Cognitivist and Early Constructivist	Alfred Adler, Gordon Allport, Albert Bandura, Raymond Cattell, Erik Erikson, Hans Eysenck, Sigmund Freud, William James, Karl Jungs, Kurt Lewin, Jean Piaget, Carl Rogers, and Wilhelm Wundt.	Cognitive theories focus on how information is received, organized, stored, and retrieved by the mind. It assumes that human brain is hardwired to perform complex cognitive tasks that make human learning possible. An understanding of how cognitive tasks are accomplished by brain and how mind mediates in performing those tasks. Such understanding helps the pedagogues develop unique teaching learning tools for children.	▪ Emphasis on the active involvement of the learner in the learning process. ▪ Use of hierarchical analyses to identify and illustrate prerequisite relationships. ▪ Emphasis on structuring, organizing, and sequencing information to facilitate optimal processing. ▪ Creation of learning environments that allow and encourage students to make connections with previously learned material. ▪ Discovery learning *(Ertmer and Newby, 1993)*
Social Constructivist	John Dewey, Jean Piaget, Jerome Bruner, and Lev Vygotsky	Social constructivism assumes that a child is an active constructor of his/her own knowledge. Teachers help the students to construct their knowledge by using their experience. The children cannot be coaxed to learn but to be motivated by meaningful participation in the classroom discourse (Panda, 2007). The classroom pedagogy needs to encourage students to ask questions, investigate and inquire individually and collectively the questions, and reflect on their own solutions. The teachers' role will be that of a collaborator of mutual construction of meaning and not a dictator of meaning. Textbooks play the role of a meditational tool for knowledge construction.	▪ Developing a classroom discourse around the concept using children's own experiences and knowledge at the beginning. ▪ Creating multiple contact points for the children with the classroom discourse. Taking help of textbook, children's own experience and innovative pedagogy to create these contact points ▪ An emphasis on learner's agency in the construction of his own ideas and knowledge ▪ The need for information to be presented in a variety of ways so that children find multiple scaffolds to their learning. ▪ Supporting the use of problem solving skills that allow learners to go beyond the information given and develop critical learning tools for themselves. ▪ Assessment focuses on multiple ways through which the knowledge can be constructed and contested. ▪ Use of critical pedagogy for development of reflexive engagement with oneself and knowledge. *(Ertmer and Newby, 1993)*

(Source:http://www.innovativelearning.com/teaching/behaviorism.html; http://northweststate.edu/wp-content/uploads/files/21143_ftp.pdf retrieved on 16.10.2015, Panda, 2006; 2007)

The above pedagogical approaches need to be taken into consideration while selecting the contents of the curriculum for different stages of school education. In India, one or more of the above three pedagogical approaches are used by the teachers for transacting curriculum at the school level. The NCF, 2005 and NCFTE, 2009 emphasize the use of constructive approach in school education. It emphasizes construction of knowledge on children's own experiences. It provides freedom and autonomy to children for constructing their own knowledge from various life experiences that they gather and the academic scientific discourse that the textbooks provide. Thus cognitivism and social constructivism provide a better pedagogic approach to teaching and learning in a particular discipline. Pedagogical approaches based on cognitivism and social constructivism provide enough freedom and scope to children to analyse and synthesize the observations that they gain from different social, personal and intellectual traditions.

For developing an understanding of the pedagogical approaches specific to disciplinary knowledge of different school subjects at school level, we present in Table 3.2 the disciplinary knowledge of the subjects taught at different school levels along with specific pedagogical approaches.

Table 3.2: Disciplinary knowledge and pedagogical approaches in school subjects

School Subjects	Disciplinary Knowledge	Pedagogical Approaches
Social Science	▪ Citizenship education ▪ Reflective socio-political enquiry ▪ Informed social criticism and ethical decision making to social issues ▪ Social dynamism, mobility and transformation ▪ Believe in constitutional values like democracy, justice, and equality ▪ Personal engagement and development ▪ Culture – Local, National, and Global ▪ People, place, and environment ▪ Individual development and identity ▪ Individuals, groups, and Institutions ▪ Power, authority, and governance ▪ Production, distribution, and society ▪ Science, technology, and society ▪ Global connections ▪ Civic ideas and practices ▪ Social research and innovations *(Ross, et.a. 2014)*	▪ Reflecting on one's own experience of various social and political situations ▪ Observing various social and political situations and engaging in critical political inquiry ▪ Case analysis of individuals and institutions ▪ Field visit to places of historical, social, and political importance ▪ Classroom debate and discussion on concepts and ideas ▪ Peer and group interaction ▪ Individual and group projects and assignments ▪ Use of portfolios and maintaining rubrics for assessment
Science	▪ Scientific literacy ▪ Science in everyday situations ▪ Understanding the world around the learners ▪ Socio-scientific issues ▪ Sources in and outside schooling ▪ Science as a way of knowing, thinking, and acting ▪ Matters in our surroundings. ▪ Atoms and Molecules ▪ Diversities in living organism	▪ Scientific inquiry to understand every day experiences ▪ Observation, discovery and experimentation ▪ Repeating classic experiments in Science and discussing how inventors encountered novel scientific ideas ▪ Engagement in the scientific discourse

	- Forces and laws of motion - Work and energy - Natural resources and its management - Improvement in food resources - Acid and chemical reactions - Metals and non-metals - Life processes - How do organisms produce? - Heredity and evolution - Electricity - Scientific research and innovations *(Corrigan, et. al. 2011)*	- Contestation, investigation, and evidence based conclusions - Peer and group works on scientific concepts, ideas and methods - Scientific quiz and workshop - Visiting science labs located in institutions of higher learning
Language	- Socio-cultural issues in language learning - Construction of language knowledge during the early years of life - Age wise language development. - Multilinguality and language learning. - Differences between school and home language - Usages of languages - Language development and cognitive skills - Language usages in diverse social households - Development of languages - Skills development in language learning – speaking, listening, writing, reading - Teaching various texts of languages – drama/fiction, grammar, poetry, prose, narratives, etc. - Creation and appreciation of language and literatures - Multi and cross cultural issues of languages - Language research and current practices	- Use of communicative approach - Use of narratives and story-telling - Peer and group discussions and debates of academic and language issues - Engaging learners in developing language acquisition skills - Sensitizing the learners to appreciate language creations and create their own literature - Finding out the gap between language usage at home and school - Using free response formats that allow for open ended and creative answers - Individual and group feedback and assessment *(Pinkley, 2009)*

Table 3.2, highlights the disciplinary knowledge under the subjects taught at the school level with the pedagogical approaches required to transact the same knowledge. The present practices of transacting school subjects are mostly learner centred. The pedagogical approaches reflected in third column of the table has emphasized child centered learning and teacher's place in the whole process is that of a facilitator. The pedagogical approaches need to address the disciplinary knowledge included in the subjects as a part of teaching-learning process at different stages of school education.

3.3.2 Pedagogical Concerns of Disciplinary Knowledge at Different Stages of School Education

In the section 3.3.1, we discussed about the general pedagogical approaches for transacting disciplinary knowledge at the school stage. Let us discuss the specific pedagogical approaches that need to be used for transacting disciplinary knowledge as a part of teaching learning process at different stages of school education.

Table 3.3: Pedagogical approaches for transacting disciplinary knowledge at different stages of school education

Stages of School Education	Subject Areas	Specific Pedagogical Approaches for Transacting Disciplinary Knowledge
Elementary	Language(s)	• Interactive, participatory, and collaborative methods • Use of narratives • Dealing with textual exercises • Listening and producing oral discourses • Interpreting tables, graphs, diagrams, pictures, etc. • Reviewing content of Book/article • Writing discourses and editing • Use of dictionary, encyclopedia, and internet • Theme based brainstorming • Use of concept mapping • Audio-lingual method, communicative approach, teaching diverse classroom – addressing socio-psychological factors of language learning • Conducting seminars, workshops for preparation of materials • Linking reading and writing • Using literature across the curriculum
	Social Science	• Issue based dialogue, debate and discussions • Discovery, project, problem solving, narration, comparisons, observation dramatization, and role play • Utilization of the resources like; audio-visual materials, photographs, charts, maps, replicas of archaeological and material culture • Practice of process skills – observations, classifications, questioning, framing hypothesis, data analysis, drawing inferences, interpretation of results, reporting, etc. • Map reading, cartoon analysis, writing slogans, etc. • Conducting inquiry - discussion, field work, peer and group activities, surveys, etc. • Interactive, participatory, and collaborative methods
	Science	• Conduct of activities and experiments, observation, classification, inferences, discussion, conducting inquiry, discovery, projects, etc. • Science-museum, field-trips, projects and exhibition • Probing, documenting and analyzing children's ideas • Science and society interface • Survey, organization and presentation of data • Use of concept map, peer and group learning, collaborative learning • Engaging in joyful learning
	Mathematics	• Inductive and deductive, problem solving, • Preparing mathematical models • Use of concept map to understand Mathematics • Interactive, collaborative, and participatory methods • Understanding two and three dimensional shapes • Analysis and synthesis, puzzles, play, mathematical games, analyzing time-table, time-line, data handling, etc. • Representation and interpretation of mathematical calculations • Development of spatial reasoning and visualization skills

Secondary	Language(s)	• Addressing multilingualism
		• Gaps between home and school languages
		• Classroom discourses – Questioning, discussion, debates, elocution, brain-storming, communication, dramatization, role pay, language games, etc.
		• Analyzing texts –expository vs. narrative, transactional vs. reflective
		• Note-making, summarizing, connecting reading-writing, process writing, writing to learn and understand
		• Analyzing texts across the curriculum
		• Flow of communication in schools and the society
	Social Science	• Enquiry-based and problem-based learning,
		• Methods of teaching – Source, field study, folk lore, oral history, balpanchyat, mock parliament. Project, story telling, exhibition, peer and group discussion, etc.
		• Visit to Historical, ecological, commercial, and political places
		• Organising awareness and other important activities- Environment, social, election, blood donation, etc.
	Science	• Use of science process skills
		• Understanding science and society
		• Enquiry and problem-based learning
		• Use of integrated, ecological, inductive, deductive, problem-solving, and constructivist approaches to learning
		• Use of lecture, discussion, debates, demonstration, field trips, individual-peer and group presentation, experimentation, scientific discovery, etc.
	Mathematics	• Mathematical modeling, data analysis and interpretation, content analysis in Mathematics
		• Exploring connections and patterns, visualization and generalization
		• Problem-solving, inductive-deduction, analysis-synthesis, project, demonstration, Mathematical activities, Use of Mathematical laboratories, etc.

(*Source*: *NCF, 2005; NCFTE, 2009; and NCTE New Curriculum Framework, 2014*)

The Table 3.3 depicts specific pedagogical approaches required for teaching at the elementary and the secondary stages of school education. From the Table-3.3, it is understood that most pedagogical approaches suggested for teaching subjects at different stages of school education are based upon the learner centered approaches to learning.

Activity 1

Select a topic from the text of any subject that you teach at the secondary level and identify the specific pedagogical approaches required to teach/learn that topic, also specify the justification of such pedagogical approaches.

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Check Your Progress 1

Notes: a) Write your answer in the space given below.

b) Compare your answers with the ones that are given at the end of the unit.

1. Discuss, with an example, how constructivist theory of learning can be applied in selecting topics for the curriculum of secondary school subjects.

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2. Critically analyze the specific pedagogical approaches that are required for the subject you teach at the elementary/secondary classes.

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3.4 CLASSIFYING AND ACCOMMODATING SPECIFIC AREAS OF KNOWLEDGE

Traditional approach to organize school curriculum is mostly based upon the subject contents which are drawn from the core disciplines. Hence, many areas of knowledge such as: Art and Craft Education, Work Education, Peace Education, Life Skills Education, Sports and Physical Education, Value Education etc. cannot be incorporated in school education as separate subjects since these areas of knowledge are not treated as disciplines like; Language, Social Science, Science, and Mathematics. 'Those important areas of knowledge become sidelined and are then described as 'extra' or 'co-curricular' areas of study instead of being an integral part of the curriculum' (NCF, 2005, p.29).This section will particularly address the issues and problems of incorporating these areas of knowledge in school curriculum.

3.4.1 Understanding Specific Areas of Knowledge

Gandhiji defines education as; "by education I mean an all-round drawing out of the best in child body, mind, and spirit". He therefore, stressed not only on the development of human intellect but also on holistic development of human beings. The existing school curriculum mostly comprise subjects pertaining to disciplines like Social Science, Mathematics, Science, etc. Specific areas of knowledge like work education, craft education, etc. have not been integrated in disciplinary knowledge of school curriculum. This is evident from the subject areas included in the school curriculum. Let us examine core disciplinary areas of knowledge in school curriculum.

Core Disciplinary Areas of Knowledge:

Mostly in our school system, the curriculum includes the core subjects of study that is; Languages, Social Science, Science, and Mathematics. If we analyze different stages of school education, we find that the subjects are presented in school curriculum with different nomenclatures. See Table 3.4.

Table 3.4 : Core Subjects in School Curriculum

Stages of School Education		Subject Areas	Presented in School Curriculum
Elementary (I-VIII)	Lower Primary (I-V)	Languages	Mother Tongue, Regional Languages, Hindi, English
		Social Science	Environmental Studies (EVS), that includes the themes/topics of both Science and Social Science
		Science	
		Mathematics	Mathematics as independent subject of study
	Upper Primary (VI-VIII)	Languages	Mother Tongue, Regional Languages, Hindi, English
		Social Science	Study of History, Political Science, and Geography under the subject area of Social Science.
		Science	Study of Physical and Natural sciences under the subject area of Science.
		Mathematics	Mathematics as an independent subject of study
Secondary (IX-X)		Languages	Mother Tongue, Regional Languages, Hindi, English
		Social Science	History, Political Science, Geography and Economics under the subject area of Social Science
		Science	Physical and Natural sciences under the subject area of Science
		Mathematics	Mathematics as an independent subject of study
Senior Secondary (XI-XII)	**Streams**	**Languages**	**Studies as compulsory subject**
	Arts and Humanities	History, Geography, Economics, Political Science, Sociology, Psychology, Languages etc.	Different branches of Arts and Humanities stream, treated as elective areas of study.
	Science	Physics, Chemistry, Mathematics, Botany, Zoology, etc.	Different branches of Science stream, treated as elective areas of study.
	Commerce	Accounting, Business Studies, Marketing, Finance, etc.	Different branches of Commerce stream, treated as elective areas of study.

Table 3.4 presents the core subject areas included in school curriculum. Besides the above subject areas, many other specific areas of knowledge are also included in the school time table without integrating them in the disciplinary

knowledge of school subjects. Let us understand those areas of knowledge and difficulties in including in school curriculum.

Art and Craft:

For decades, there have been debates on inclusion of Art and Craft education in school curriculum. However, no development has taken place till now. Sometimes, it is included in the school curriculum but is kept out of the core subject areas. The art and craft education needs to be an important component of learning in the school curriculum. Children need to develop skills and abilities in these areas. These areas should not be treated as mere entertaining fringe in the school curriculum. The sense of creativity, appreciation, skills, aesthetics, and value based learning opportunities are possible through art and craft education. Though there is an increasing scope for career and jobs in art and craft at the higher stages, but they are yet to be integrated in school curriculum.

Work Education:

Work is an integral part of every individual's life, be an adult or child. A child needs to be educated in the school for world of work. Work education needs to be included in the school curriculum as an opportunity for learning for the children and for preparation for their further life. Children learn through work at home, school, society, or work place. The inclusion of Socially Useful and Productive Work (SUPW) in school curriculum makes the children appreciate the worth of social life. It makes them disciplined, self-controlled, focused mentally, energized and emotionally balanced. But the inclusion of SUPW in the present school curriculum hardly helps the children to achieve its objectives. It needs to be effectively integrated in disciplinary knowledge of school curriculum.

Peace Education:

Unprecedented growth of violence, intolerance, fanaticism, conflicts, and discordance are the constant threats to our society. Hence, there is the need to train the children and the young adults to practice tolerance and peace at home, school, and society. In this regard, school is the important agent to include 'Education for Peace' in its curriculum. It essentially nurtures ethical development, inculcating the values, human rights, justice, tolerance, social responsibility, attitude and skills required for living in harmony with oneself and others. If we analyze our school curriculum, we find that very little contents are included which address the issue of peace education, that is also limited to a few topics and subjects. It is important to mainstream peace education in school curriculum, not limiting it to a few topics or subjects. It should be presented in the contents across the subjects of the curriculum in various forms like; stories, narrations, activities, interactions, etc. The inclusion of peace education in school curriculum may help the children understand the importance of peace in life.

Life Skills Education:

Life skills education has also been neglected in school curriculum. The aim of education is not to provide learners merely disciplinary knowledge and certify them, but also to acquaint them with life skills and values. "Nurturing Life Skills" includes developing an improved self-esteem, building empathy towards others and different cultures, etc. improving on their critical and creative thinking and making them better at problem solving with a balanced approach towards decision-making. The core life-skills must be integral to the whole process of education

(CBSE, 2015). As a teacher you might be knowing that the practice of life skills in school curriculum is limited to conducting a few activities and including them in students' report cards. This will not serve the basic purpose of practicing life skills in school curriculum. Sometimes, it is difficult to assess attainment of life skills as most of them require to be assessed in qualitative form. They can only be observed and qualitative description of student performance on these skills may be done. But the challenge is how to integrate them in the school curriculum. There is the need of including core life skills in the topics of various subjects of the school curriculum. They should be necessarily an integral part of core curriculum

Health and Physical Education:

Health and physical education has a significant contribution to the physical, social and emotional development of a child. It constitutes an important component of school education. The NCF (2005), therefore, recommends health and physical education at all levels of schooling with special attention to vulnerable social groups and girl children. Introducing Yoga is also another important addition to health and physical education. Yoga, health and physical education need to be part of core curriculum. Time for yoga, games and sports in school curriculum must not be reduced, rather enhanced.

Value Education:

Like life skills education, there is also a need to incorporate value education in the school curriculum. 'The aims of education are landscaped in the guiding principles of constitution which reflect a commitment to democracy and the values of equality, justice, freedom, concern for others' well-being, secularism, respect for human dignity, and human rights. Education should aim to inculcate these values, which are based on reason and understanding. The curriculum, therefore, should provide adequate experience and space for dialogue and discourse in the school to promote such a commitment in children' (CBSE, 2015-16).The concept of value education in school curriculum is not new. Almost all the education committees and commissions have recommended for inclusion of value education in curriculum, especially at the school level. The Central Board of Secondary Education as well as State Boards of School Education have tried to incorporate constitutional and other personal and social values in their curriculum, but still they seem to be inadequate in the curriculum. There is the need of integration of constitutional and other values across the subjects in the curriculum at all level of school education.

3.4.2 Implementation Strategies for Including Specific Areas of Knowledge in the Teaching Learning Process

The problem of classifying and including the specific areas of knowledge in the school curriculum has always been faced by the educationists and the curriculum designers. Time and again there has been the problem of including specific areas in the school text books, especially, the text books developed after NCF, 2005. The specific areas of knowledge which are not considered as core disciplines of study at the school level and often perceived as co-curricular or extra-curricular activities need to be included in the school curriculum. Making the specific areas of knowledge as an integral part of teaching and learning may help the learners develop their total personality. Let us discuss the strategies to include these areas of knowledge in school curriculum.

Table 3.5: Strategies for including specific areas of knowledge in school curriculum

Specific Areas of Knowledge	Strategies for Including in School Curriculum
Art and Craft Education	- May be taught as a compulsory subject in every school up to Class – X - Four basic streams such as: music, dance, visual arts and theatre should be included - Awareness campaign for the parents needs to be built - Craft could be integrated into the study of History, Social and Environmental Studies, Geography, and Economics - Craft should be taught as a lively experimental exercise - Craft should be taught as projects, and not as classroom exercises - More resource materials for art and craft heritage needs to be made available in the schools - Art and Craft teacher needs to be appointed in the schools - A culture of art and craft education should be developed in the schools
Work Education	- Integrating various forms of work activities in school curriculum - Unleashing the potential of work in knowledge acquisition - A culture of world of works in the schools needs to be developed - A set of work related generic competencies could be at all stages of education - In the name of work education, exploiting children needs to be avoided
Peace Education	- Setting up peace clubs and reading rooms in schools that focus on peace news and events. - Procuring document films relating to peace, values and justice and screening them from time to time - Arranging special interaction session of the journalists, editors, peace advocators with the children and publish views of children in newspapers - Organising various programmes for promoting peace and respect for women - Acquainting Senior Secondary students with peace laws

	• Topics in Languages, Social Science, and Science subjects need to address the peace issues
	• Teachers can take advantages of hidden components in a lesson by using appropriate strategies to awaken positive feelings, identifying experiences for reflecting, exploring, discovering, constructing and understanding peace related values
	• Teaching learning methods and techniques like; questioning, story telling, anecdotes, games, experiments, discussions, dialogues, clarification of values, giving examples, analogies, metaphors, role playing, and simulation on peace issues should be practiced in schools
Yoga, Health and Physical Education	• Multi and cross curricular integration of yoga, health and physical education in schools need to be encouraged
	• Yoga, Health and Physical Education may be included both as a subject of compulsory study or in forms of integrated activities in school curriculum
	• Health and physical education related activities such as: National Service Scheme, Bharat Scouts and Guides, and National Cadet Corps need to be organised in the schools
	• Adequate time needs to be allocated to Yoga, Health and Physical Education in the curriculum
	• Material and human resources should be made available to the schools for organizing daily activities and events
	• Specific need based approach should be adopted for teaching health and physical education
	(Source: NCF, 2005)

As per the Table 3.5, specific teaching learning strategies can be adopted for transacting Art and Craft education, Work education, Peace education and Yoga, Health and Physical education in school curriculum. It is important to note that our schools are currently integrating the above specific areas of knowledge in their school curriculum. In NCERT text books, these areas of knowledge have been already partly integrated, whereas the State Boards are in the process of integrating these areas of knowledge in their curriculum. It is again a good sign to note here that 'Yoga' is considered as an integral part of school and teacher education curriculum. In this regard, NCTE, in its Curriculum Framework, 2014, has made Yoga and Art Education compulsory in teacher education curriculum. But the real challenge lies in its proper implementation in the schools.

Activity 2

Analyze a topic that you teach your students at the secondary class in terms of the way the specific areas of knowledge have been integrated. What pedagogical strategies would you prefer to teach your students on those areas of knowledge and why?

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3.5 FRAMING SCHOOL SUBJECTS

The understanding of academic disciplines and school subjects is important for teachers and teacher educators. The present education system does not provide teachers with a complete understanding to critically analyze an academic discipline and how disciplines help to frame different broad subject areas for teaching in school curriculum. Quite often, certain questions bother us like;

How does the knowledge take the frame of academic discipline?

What are the basic characteristics of an academic discipline?

How are school subjects framed?

How are school subjects related with the academic disciplines?

How are the contents of the subject selected for school curriculum at a particular stage of education?

Getting answer to these questions is very much important for the teacher. In the coming section, we discuss how the Academic Disciplines are related with the school subjects, and then we will proceed to understand how school subjects are framed.

3.5.1 Academic Disciplines and School Subjects

Stengel (2010), analyses relationships between academic disciplines and school subjects in two steps:

- Examining a range of possibilities regarding the relationship between academic disciplines and its related school subjects; and

- Attempting to interpret the meaning of each, using the various possible relationships as the content for meaning.

Further clarifying the steps, Stengel made it clear that, both academic disciplines and school subjects are not independent. In order to understand content incorporated in a subject area, we need to understand the philosophy and aims of that subject. To understand the subject areas in school curriculum, accordingly, we need to understand the disciplines from where the subjects are conceptualized. Therefore, there is the need to understand both academic discipline and school subjects together.

Further establishing relationship between the two, Scheffler (1991) suggested that:

- Subjects are not, in fact, drawn directly or readily from their parent studies, and parent studies are not all disciplines.

- The academic disciplines and the school subjects are not written without a base, the authentic knowledge and the research constitute their base.

- The former is arranged for the expedient advancement of investigations and researches, and the latter for the facilitation of learning and teaching in particular contexts and purposes.

- The academic disciplines and the school subjects are continuous, interdependent, and linked to the same goals.

Critically analyzing the above points, the possible logical relationship between academic disciplines and school subjects may be stated as follows:

1. Academic disciplines and school subjects are essentially continuous.

2. Academic disciplines and school subjects are different but interdependent.

3. Academic discipline precedes school subjects.

4. School subject proceeds academic discipline.

Disciplines and subjects continue to evolve as knowledge grows due to new thinking, intellectual discourse and research in those disciplines and subjects. Accordingly, our school and higher education curricula undergo changes with inclusion of new academic disciplines and subjects. Therefore, disciplines and subjects are dynamic in their nature.

Academic disciplines are the primary source of school subjects because they provide 'the knowledge, understanding, skill, and disposition that are to be learned

by school children' (Shulman, 1987). The academic discipline precedes the school subject and the latter is derived from the former. The academic discipline differs from the school subject because the latter is a 'transformed' version of the former. The process of transformation, of course, is influenced by the teacher's conception of the purposes of teaching, pedagogical content knowledge, and knowledge of learners, of learning, of relevant curriculum materials, and of contexts (Shulman, 1987, Wilson et al. 1987). Nevertheless, the teacher's orientation to and understanding of the intellectual discipline, is the foundation for the transformation (Shulman, 1986).

Although academic discipline precedes school subjects, there exists a continuum between them. Whereas teachers deal with relatively simple facts, concepts, and principles in classroom situations, they nonetheless teach the same facts, concepts, and principles taught by the discipline expert. The academic discipline constitutes an essential criterion for the school subject. The subject-matter knowledge 'that is central to teaching is also knowledge that is central to "knowing" a discipline' (Grossman et al. 1989). Accordingly, teachers need to know not only the information and facts, but also the substantive and syntactic aspects of the academic discipline (Grossman et al. 1989; Shulman, 1986).

3.5.2 Framing School Subjects – Scholastic and Pedagogical Considerations

We have discussed that academic disciplines are framed by classifying and categorizing specific knowledge. School subjects are the transformation of academic disciplinary knowledge through the school curriculum by using suitable pedagogic approaches.

There are three levels of curriculum making such as: **'Institutional, Programmatic, and Classroom'** (Doyle, 1992), to frame school subjects and include them in curriculum.

The **'institutional'** level curriculum emphasizes interfaces between the school, culture and society. It embodies what schooling should be in respect to the society and culture. The desirable social and cultural orders become the main base in this level of framing school subjects.

The **'programmatic'** curriculum is the transformation of institutional curriculum into school subjects, programmes, or courses. It is the official curriculum document in the form of syllabus wherein content is organized in a logical sequence in the form of school subjects.

The **'classroom curriculum'** is characterized by a cluster of events jointly developed by teachers and students for the purpose of a particular classroom (Doyle, 1992). Classroom curriculum-making involves transforming the programmatic curriculum embodied in curriculum documents and materials into teaching learning processes. It involves further elaboration of the programmatic curriculum, making it connect with the experience, interests, and the capacities of students (Westbury 2000).

Further as per CDC/HKEAA (2007) and Deng (2007), the following curriculum goals are also necessary to be undertaken to frame school subjects.

- To enhance students' understanding of themselves, their society, their nation, the human world, and the physical environment;

- To enable students to develop multiple perspectives on perennial and contemporary issues in different contexts (e.g. cultural, social, economic, political, and technological contexts);

- To help students become independent thinkers so that they can construct knowledge appropriate to changing personal and social circumstances;
- To develop in students a range of skills for life-long learning, including critical thinking, creative problem-solving, communication, and information technology skills;
- To help students appreciate and respect diversity in cultures and views in a pluralistic society and handle conflicting values;
- To help students develop positive values and attitude towards life, so that they can become informed and responsible citizens of society, the country and the world;

Apart from the above, Dewey (1966) opined that a school subject involves distinct psychological, epistemological, logical, and social issues. Academic disciplines provide necessary guidance and directions for the implementation of school subjects and use of pedagogical principles to transform them. To certain extent, the school subject can be viewed as reformulation of the academic discipline which is called 'psychologizing the subject matter'. Therefore, the following considerations need to be taken into account while framing subjects for the school curriculum:

- Specific pedagogical consideration to transact the subject – all subject demands specific pedagogy
- Knowledge inputs and scholastic consideration
- Concerns of contemporary socio, political and pluralist cultures
- Adherence to the aims of local, national, and global societies
- Changing scenario of social norms, standards, development in technologies, and global demands

3.5.3 Need of Reframing School Subjects

Earlier, we have discussed that both academic disciplines and school subjects continue to evolve giving rise to new disciplines and school subjects. Therefore, you might have come across new disciplines and subjects both at school and higher education level.

What is the need of reframing school subjects?

What parameters should be taken into consideration while reframing the school subjects?

Let us try to answer to the questions with the help of two questions. Since the mid-1970s the Government of Hong Kong has 'initiated a series of reforms to broaden the curriculum to meet the political, social, and educational needs of Hong Kong. New school subjects of cross-curricular nature were introduced, such as social studies (1975) and integrated science (1976)' (Deng, 2007). Again another initiative had also been taken for 'infusion of cross-curricular themes across the school subjects in China with an intention to promote civic, moral, sex and environmental education' (Morris and Chan, 1997). The above two examples depict that as and when the Government requires its citizens to acquire certain type of knowledge, it ensures that the same knowledge is taught at the school, and included in the school curriculum. In India, you might have observed that time and again the contents of school subjects have changed, and even new subjects have been included in school curriculum. Of late, you might have observed that 'Yoga and Health Education' have been made a compulsory subject/component of study at the school and teacher education institutions in India. The socio-political system of the country also influences reframing subjects in school.

Apart from the above reasons, new knowledge, new concepts, new areas of study, need for micro study, etc. necessitate reframing of new subjects. For example, the new areas of study, i.e., 'Bio-Informatics', 'Microbiology', 'Biochemistry', or 'Biotechnology' Bio-Engineering', etc. emerge from the parent discipline of 'Biology'; 'Astro-Physics', 'Nano-Technology', 'Electronics' etc. from 'Physics'; and 'Computer Science', Information and Communication Technology', etc. from 'Mathematics'. Moreover, many 'new subjects' have also emerged from the cross and multi disciplinary areas of studies.

Reframing school subjects and introducing new subjects in the school curriculum is a continuous process. Let us summarize them in the following lines:

- Socio political system, culture and economy of the country, the form of government in the country determine reframing of school subjects.

- Emergence of new areas of knowledge, concepts, theories, and practices from the parent disciplines determine reframing of subjects.

- Scope for further higher education, career, job opportunities, demands in global market influence reframing and introduction of new subjects in schools.

- Change in pedagogical practices and approaches necessitate reframing of the subjects in curriculum.

- Skills development, inculcation of values, community living, etc. are other factors for reframing school subjects.

- Academic disciplines with vast knowledge base may give rise to new areas of study or subject.

Activity 3

Select a text book of NCERT in any subject for the secondary classes published after implementation of NCF, 2005. Compare the texts with the NCERT books for the same class and subject published before NCF, 2005. What new things, do you find, which have been included while reframing the subject?

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Check Your Progress 3

Notes: a) Write your answer in the space given below.

b) Compare your answers with the ones that are given at the end of the unit.

5. How are the school subjects and academic disciplines related with each other?

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6. Write at least two new disciplines been emerged from Science and Arts, which have recently introduced as subjects study in school/higher education.

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3.6 LET US SUM UP

The current practices in school and teacher education have changed a lot. Preparing future teacher is a challenging task. A school teacher is not only expected to perform the task of teaching and learning, but also he/she is required to transform the school curriculum in a way to integrate disciplines and subject knowledge, pedagogy, and process of teaching and learning across the curriculum. It is, therefore, a thorough Knowledge on Content and Pedagogy (KCP) is required for the teacher. For understanding content of a subject, there is the need to understand the disciplinary knowledge; pedagogical approaches to select disciplinary knowledge for school subjects; difficulties in accommodating specific areas of knowledge; and understanding the framing of school subjects. All these aspects have been addressed in this Unit.

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3.8   ANSWERS TO CHECK YOUR PROGRESS

1. Self exercise

2. Self exercise

3. Specific areas of knowledge are rarely integrated in the curriculum. Time allowed in the curriculum for dealing these areas through various activities are also comparatively less. These are wrongly called either extra or co-curricular activities. Still these are not treated as subjects in school curriculum and mainstream learning.

4. Self exercise

5. Academic disciplines and school subjects are:

   - essentially continuous;

   - different but interdependent;

   - academic disciplines precedes school subjects; and

   - both are dialectical related.

6. Self exercise