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Mangalagangothri - 574 199

COURSE 5

Understanding Disciplines and School Subjects (Curriculum and Pedagogic Studies) BLOCKS 1 & 2

B.Ed. DEGREE PROGRAMME

(OPEN AND DISTANCE LEARNING)

FIRST YEAR B.Ed.

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COURSE 5

Understanding Disciplines and School Subjects
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Manalagangothri-574 199

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Contents

Overview of the Course

This course will enable you to reflect on the nature and role of disciplinary knowledge in the school curriculum, and the paradigm shifts in the nature of disciplines. This course will help you to understand that disciplines and school subjects are not 'given' but are products of history and geography and they emerged in particular social, political and intellectual contexts, especially over the last two centuries, and have been constantly redefined and reformulated . There have been attempts towards redefinitions of the school subject, also with concern for social justice.

This course will introduce you to the content, processes, organizational approaches of different school subjects. It is increasingly recognised that for teachers to know a school subject they must know the 'theory of content' – how the content was selected, framed in the syllabus, and how it can be transformed so that learners construct their own knowledge through it.

Apart from the content, it is important to know the history of a subject because it helps to deepen the understanding of the content. It tells us why something was included or not included in a particular subject at a point of time. Understanding the processes of different disciplines through which the school subjects have been deducted, will help teachers to decide the pedagogic approaches. This also helps teachers to understand that there is a close relationship between the nature of knowledge and the pedagogical processes. This course also helps you to understand why some subjects existed and some did not, at one time in school curriculum. Through this course, you will realise that, in the present context, there is a need to incorporate some new approaches while teaching different school subjects.

The above issues have been discussed in two blocks. The concept of discipline, school subject, academic discipline, their inter relationships and differences, aims of schooling, history of emergence of disciplines, formation of school subjects and their importance, nature and content of school subjects have been discussed under block 1. The different classification of disciplines, inter disciplinary and multidisciplinary concepts, nature and curricular aspects of different subjects like Science, Social Science, Math, as well as the issue of social justice in relation to school subjects have been discussed under block 2.

Understand the concepts presented and discussed in this course thoroughly well and develop the competencies required of a classroom teacher to the maximum level and prove to be a good teacher.

Block - 1 : Introduction to Disciplines and School Subjects

Unit - 1 : Concept and Meaning of School Subject, Discipline and Academic Disciplines

Unit Structure

1.1.1. Learning Objectives

After learning through this Unit, the student teachers will be able to

- Explain the concept and meaning of School Subjects
- Explain the concept and meaning of Discipline
- Explain the concept and meaning of Academic Disciplines

1.1.2. Introduction

You are familiar about different school subjects like Science, Social Science and Mathematics etc. You also know that these subjects belong to different disciplines. If you

have noticed the way we teach these subjects, you will realise that we teach each of these subject in a different fashion. You might have already noticed it. Science is not taught as we teach social science. Why is this? This is because the nature of each discipline is different and this demands different type of methodology or approach for each subject. Hence it is very important for each teacher to understand the nature of each discipline so that the methodology can be properly adopted. Before understanding the nature of each discipline, it is important to know the meaning of 'Discipline' and its related concept 'Academic Discipline' and the concept of school subjects. Let us understand the meaning of these concepts and relationship among them in this unit.

1.1.3. Learning Points and Learning Activities

1.1.3.1. Concept and Meaning of School Subject

Meaning of School Subjects

Exercise I: You have been teaching different subjects in your schools. Try to define them .

A school subject is a subject or a field of study as well as a branch of knowledge that is taught and researched at the school, college or university level.

School subject refers to an area of knowledge that is studied in school. It can be called a learning tool or the criteria by which we learn. More precisely, subjects are the parts into which learning can be divided. It is a field or sphere of knowledge in which the learner has chosen to specialize.

It can sometimes be used synonymously with the term 'discipline' and can be referred to as a systematic instruction given to the students in a particular area of learning that follows specific code of conduct.

Humanist educators argue that school subjects are created to provide students with intrinsically rewarding experiences that contribute to the pursuit of self-actualization, personal growth, and individual freedom. School subjects, therefore, need to be formulated according to the interest, attitudes, and developmental stages of individual student & they need to derive content from a wide range of sources such as personal experiences,

human activities, and community cultures and wisdoms. Disciplinary knowledge might or might not be useful for the formation of school subjects. From the perspective of social efficiency, school subjects are constructed for the primary purpose of maintaining and enhancing economic and social productivity by equipping future citizens with the requisite knowledge, skills, and capital & the formation of school subjects, therefore, is justified with close reference to the needs of occupation, profession, and vocation. Specialized and applied -fields (e.g., engineering, accounting, and marketing,) among others, therefore, are the primary sources from which the contents of school subjects are derived School subjects are created to provide students with meaningful learning experiences that might lead to emancipation and engender social agency. The formation of school subjects is based upon an examination of social contents, social issues, and futures, with the intention of helping individuals reconstruct their own analyses, standpoints, and actions. Like humanistic educators, social reconstructionist believes that schools subjects derive contents from a wide range of sources.

Definition for School Subject

A school subject can be defined as a branch of knowledge or a body of knowledge that is being provided to its learner. According to Zongyi Deng, a school subject refers to an area of learning within the school curriculum that constitutes an institutionally defined field of knowledge and practice for teaching and learning.

A school subject constitutes an organizing framework that gives meaning and shape to curriculum content, teaching, and learning activities (Karmon, 2007).

School Subjects is defined as an "area of knowledge that is studied in school". - Britannica Encyclopedia.

"A school subject is an area of learning within the school curriculum that constitutes an institutionally defined field of knowledge and practice for teaching and learning."- Deng, Z (2013).

School subjects are human constructions in response to social, economic, cultural, political, and educational realities and needs. They are "uniquely purpose-built educational enterprises, designed with and through educational imagination towards educative ends" (Deng & Luke, 2008, p. 83).

A school subject is an area of learning within the school curriculum that constitutes an institutionally defined field of knowledge and practice for teaching and learning.

School subjects can be traditional academic subjects, such as mathematics, history, geography, physics, chemistry and economics. Academic school subjects, such as

mathematics, chemistry, geography, history, and economics, are to be compulsorily taught to the students. The content of these academic subjects needs to be worked with and transformed by the teachers in such a way that it is appropriate for classroom teaching. Constructing a school subject involves the selection and arrangement of content of knowledge, skills and the transformation of that content for school and classroom use. This is in accordance with respect to both societal expectations and activities of teaching.

Nature of School Subjects

Grossman and Stodosky (1995) defined three features of school subjects. They are

1. School subjects differ in their status they have in school and larger community. Craft, physical education are considered less important than science and mathematics.
2. Sequentiality is perceived as important in school subjects where certain knowledge and skills have to be learnt before proceeding to new learning. For example, the basic calculations of addition, subtraction, multiplication and division are to be taught before teaching 'fractions'.
3. The scope of the subject refers to the different disciplinary areas included in the subjects which can be broad or restricted. An example of broad-based subject is physical science which includes physics and chemistry. Social science includes history, geography, economics, and civics.

Let us analyse the above definitions and understand the nature of school subjects.

A School subject

- is also called as a learning tool
- serves as criteria by which we learn
- is used synonymously with the term 'discipline'
- refers to a particular area of leaning
- has a specific code of conduct
- aims to give intrinsically rewarding experience to students
- contributes for self-actualization, personal growth and individual freedom
- needs to be formulated according to the needs of students
- derives content from a wide range of sources
- is constructed from the perspective of social efficiency
- aims to maintain and enhance social productivity.

- has close reference to the needs of occupation, profession, and vocation
- is an area of learning within the school curriculum
- involves the selection and arrangement of content of knowledge, skills and the transformation of that content

Thus, a school subject is the result of institutional selection, organization, and framing content for social, economic, cultural, curricular and pedagogic purposes. A school subject constitutes an organizing framework that gives meaning and shape to curriculum content, teaching, and learning activities. School subjects are distinctive, purpose-built enterprises, constructed in response to different social, cultural, and political demands and challenges, and towards educational aims. Thus a school subject contains content, and translating content for educational purposes.

Check Your Progress – 1

1. Define 'Subject'
2. Explain the Concept & Meaning of School Subject

1.1.3.2. Concept and Meaning of Discipline

Meaning of the term 'Discipline'

The word discipline which we are referring to is in the context of academics. This should not be confused with school discipline. School discipline relates to the actions taken by a teacher of the school organization towards a student or a group of students, when their behviour disrupts the ongoing educational activity or breaks a rule created by the teacher or school system. But we are not dealing with that concept in the present context. This is related to a field of study. The origin of this word is not clearly known. The term discipline may be used for many things at the same time and it is necessary to examine the various meanings of the word.

Let us start with an exploration of the etymology of the word discipline. Dictionaries suggest words like 'discipulus' which means pupil, and discipline, and also means teaching. Whether this has any connotation of the word, we are discussing, we do not know. The term discipline is defined by the Oxford English Dictionary as "a branch of learning or knowledge". It is technical term for organization of learning and systematic production of new knowledge. The Latin term 'disciplina' meant 'teaching, learning', and instruction. The Old English Version dictionary referred to a branch of knowledge or field of study.

Arthur Dirks points out that, discipline in an academic sense, pertains to the practice of study of a certain category of experience, its methodologies, how it goes about its pursuit

of truth. There is fundamental theory and fact (one might call it doctrine) that informs the practice of that pursuit, but it is the pursuit that counts.'

According to Moti Nissani (1997), a discipline can be conveniently defined as the study of "any comparatively self contained isolated domain of human experience which possesses its own community of experts".

In the words of P. Bourdieu, a discipline has an academic and socially acknowledged name (that for example can be found in a library classification system). A discipline is inscribed in, and upheld by, the national and international networks of research, university departments, research institutes and scientific journals that produces, certifies, rewards, and upholds that which he calls the 'discipline capital'. And a discipline is characterized by a particular, unique academic and social style.

Disciplines are broken into sub disciplines and sub sub disciplines. This is a convenient way to organize a library, a school program, or a higher education institution.

John Walton states, "by discipline I mean a body of subject matter made up of concepts, facts, and theories, so ordered that it can be deliberately and systematically taught." According to him, a discipline is a body of subject matter that is teachable. However, Walton's definition does not define a discipline comprehensively as it considers any body of knowledge as a discipline which has quality of teachability. However, there are many subjects which are taught at different levels but are not considered as disciplines.

Janice Beyer and Thomas Lodahl (1976) describe disciplinary fields as providing the structure of knowledge in which faculty members are trained and socialized; carry out tasks of teaching, research, and administration; and produce research and educational output. Disciplinary worlds are considered separate and distinct cultures that exert varying influence on scholarly behaviors as well as on the structure of higher education. Disciplinary communities establish incentives and forms of cooperation around a subject matter and its problems. Disciplines have conscious goals, which are often synonymous with the goals of the departments and schools that comprise an institutional operating unit.

According to M. S. Yadav and T.K.S Lakshmi (1995), discipline refers to a specific area of study, a branch of knowledge recognized by a certain distinctness it reveals in its substance and methodology. A discipline is a deliberate differentiation of the knowledge base with a specific perspective in order to gain better understanding of the phenomenon under focus. According to them, the knowledge base represents the sum total of the human understanding of environment. Disciplines are derived from the knowledge base but get formulated in recognizable differentiated forms of both substance and methodology due to further specialization, diversification and differentiation.

Bryan Turner (2001) has pointed at the ecclesiastical meaning, which refers to the order maintained in the church, and at the medical meaning of discipline, as a medical regimen imposed by a doctor on a patient to the patient‘s benefit. It follows that the academic discipline can be seen as a form of specific and rigorous scientific training that will turn out practitioners who have been disciplined by their discipline for their own good.

The term ‘discipline‘ is inherited from the vocabulary of nineteenth century and is understood as a branch of instruction for the transmission of knowledge and as a convenient mapping of academic administration.

Let us derive the nature of discipline from what we have presented so far and our experience with dealing with different disciplines:

- Discipline implies an order
- Discipline is related to learning
- Discipline is related to putting some order to learn
- Discipline is making some organization with the purpose of learning
- It involves some efforts made to organize teaching
- It involves some efforts made to organize learning
- It is related to teaching learning process
- It is related to knowledge organization process
- It is related to processing of knowledge
- It involves deduction of more knowledge through organization of the existing knowledge
- It is basically related to learning process and hence education
- It is related to the learner teacher, experts and specialists
- It is related to construction of new knowledge
- It implies that knowledge grows and expands
- It implies that knowledge is not final.
- It involves a process of classification.
- It is a body of specialised knowledge
- It has theories and concepts
- It has specific terminology
- Its specific object is research
- It has got definite methodology of research

Check Your Progress – 2

Identify the correct statements using '✓' mark.

1. Order is not an inevitable part of Discipline
2. Discipline is related to learning
3. Discipline is related to putting some order to learn
4. Discipline is making some organization with the purpose of knowing
5. It involves some efforts made to organize school activities
6. It involves some efforts made to organize learning
7. It is related to teaching learning process

1.1.3.3. Academic disciplines-Meaning and Nature

Let us understand the meaning of the word 'Academic discipline'

You have heard of different academic disciplines like science, humanities, arts etc. Recall your experiences with these disciplines and try to identify the meaning of academic disciplines.

The term 'academic discipline' certainly incorporates many elements of the meaning of 'discipline' discussed above, as school discipline. 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 taught subjects, but clearly not every subject taught at university can be called a discipline. Discipline has many more attributes than the fact that something that is taught in an academic setting.

Characteristics of Academic Discipline

There is a list of criteria and characteristics, which indicate whether a subject is indeed a distinct discipline. They are as follows:

- disciplines have a particular object of research (e.g. law, society, politics), though the object of research may be shared with another discipline;
- disciplines have a body of accumulated specialist knowledge referring to their object of research, which is specific to them and not generally shared with another discipline;
- disciplines have theories and concepts that can organise the accumulated specialist knowledge effectively;
- disciplines use specific terminologies or a specific technical language adjusted to their research object;

- disciplines have developed specific research methods according to their specific research requirements; and may be most crucially
- disciplines must have some institutional manifestation in the form of subjects taught at universities or colleges, respective academic departments and professional associations connected to it.

Generally, it can be said that the more of these criteria discipline can tick, the more likely it becomes that a certain field of academic enquiry is a recognised discipline capable of reproducing itself and building upon a growing body of own scholarship. If a discipline is called 'studies', then it usually indicates that it is of newer origin (women studies) and that it may fall short of one or more of the above mentioned characteristics. This would be typically lack of theorisation or lack of specific methodologies, which usually diminishes the status of a field of research. These 'studies' can either aim at remaining 'undisciplined', as women's studies did in the 1970s, or they can engage in the process of their disciplinarisation and institutionalisation. Thus, we can conclude that

- Academic discipline is a branch of learning or scholarly investigation that provides a structure for the students' (program of study,) especially in the graduate and post-graduate levels.
- Academic discipline is a field or branch of learning affiliated with an academic department of a university, formulated for the advancement of research and scholarship.
- Academic discipline is formulated for the professional training of researchers, academics and specialists.
- It is a branch of knowledge that is taught and researched as part of higher education. Examples for Academic Disciplines are Anthropology, Space Science, psychology, sociology, archaeology, Education etc.
- An academic discipline is a subdivision of knowledge that is taught and researched at the college or university level.
- It incorporates expertise, people, projects, communities, challenges, studies, inquiry, research areas, and facilities that are strongly associated with a given scholastic subject area or college department. For example, the branches of science are commonly referred to as scientific disciplines, e.g. physics, chemistry and biology.
- Individuals associated with academic disciplines are commonly referred to as experts or specialists. Others, who may have studied other subjects rather than concentrating in a specific academic discipline, are classified as generalists.

- While academic disciplines in and of themselves are more or less focused practices, scholarly approaches - multidisciplinary / interdisciplinary, transdisciplinary, and cross-disciplinary- integrate aspects from multiple academic disciplines. They address any problems that may arise from narrow concentration within specialized fields of study.
- Academic discipline is also known as field of study. Field of inquiry, research field and branch of knowledge are the different terms used in different countries and fields to denote a 'discipline'.

Check Your Progress – 3

Identify the correct statements using '✓' mark.

1. The object of research of a discipline cannot be shared with other disciplines
2. Disciplines have a body of accumulated specialist knowledge referring to their object of research, which is specific to them and not generally shared with another discipline
3. Discipline are free from theories and concepts.
4. Disciplines use specific terminologies or a specific technical language adjusted to their research object;
5. Methodology of research is not discipline specific
6. Disciplines must have some institutional manifestation in the form of subjects taught at universities or colleges, respective academic departments and professional associations connected to it.

1.1.4. Let us Summarise

- School subject refers to an area of knowledge that is studied in school. It can be called learning tool or the criteria by which we learn.
- There is no single and comprehensive definition of the term discipline.
- A school subject constitutes an organizing framework that gives meaning and shape to curriculum content, teaching, and learning activities .
- There is no single and comprehensive definition of the term discipline. It is technical term for organization of learning and systematic production of new knowledge.
- The term 'academic discipline' certainly incorporates many elements of the meaning of 'discipline' . it has also become a technical term for the organisation of learning and the systematic production of new knowledge.

1.1.5. Answers to Check Your Progress 1, 2 and 3

Check Your Progress – 1

Refer Section 1.1.3.1

Check Your Progress – 2

2, 3, 6 and 7 - '✓'

Check Your Progress – 3

2, 4 and 6 - '✓'

1.1.7. References

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Block - 1 : Introduction to Disciplines and School Subjects

Unit - 2 : School Subjects and Academic Disciplines - Differences and Relationship

Unit Structure

1.2.1. Learning Objectives

After completing this Unit, the student teachers will be able to

- Identify the differences between school subjects and academic disciplines;
- Clarify the relationship between school subjects and academic disciplines; and
- Identify the school subjects and academic disciplines.

1.2.2. Introduction

You are familiar about the concepts of subject, school subject, discipline and academic discipline. These concepts are related and at the same time they differ in some aspects. It is important to be aware of these differences and similarities because they have implications for learning and teaching. Teaching depends on the understanding of the nature of the content you are teaching and hence a teacher needs to know whether they are teaching a school subject or academic discipline. Academic disciplines demand a different set of behavior than those employed for teaching a subject. The teaching plan for an academic subject is less rigid than the plan employed for teaching academic discipline. Let us take an

example. Suppose a teacher is teaching the 'properties of magnet' in a discipline-based physics class, the primary and most important method is observation. A teacher cannot teach this topic without making the students observe the magnetic properties. On the other hand, when a teacher is teaching 'women studies' (subject of study), she can start with a discussion on the current status of women in the society, or show a video, or discuss a paper clipping etc. Hence, in the present unit, let us understand the relationship and differences between school subjects and academic disciplines.

1.2.3. Learning Points and Learning Activities

1.2.3.1. School Subjects and Academic Disciplines- Relationship

Let us begin with the word discipline. As mentioned above, discipline refers to a branch of academic study. For example, psychology, sociology, anthropology, mathematics and philosophy are all disciplines. These can mostly be seen in higher educational institutions such as universities. This, however, does not denote that disciplines cannot be seen in other educational settings such as schools. For example, mathematics is a school subject that is also a discipline that is found in higher educational institutions.

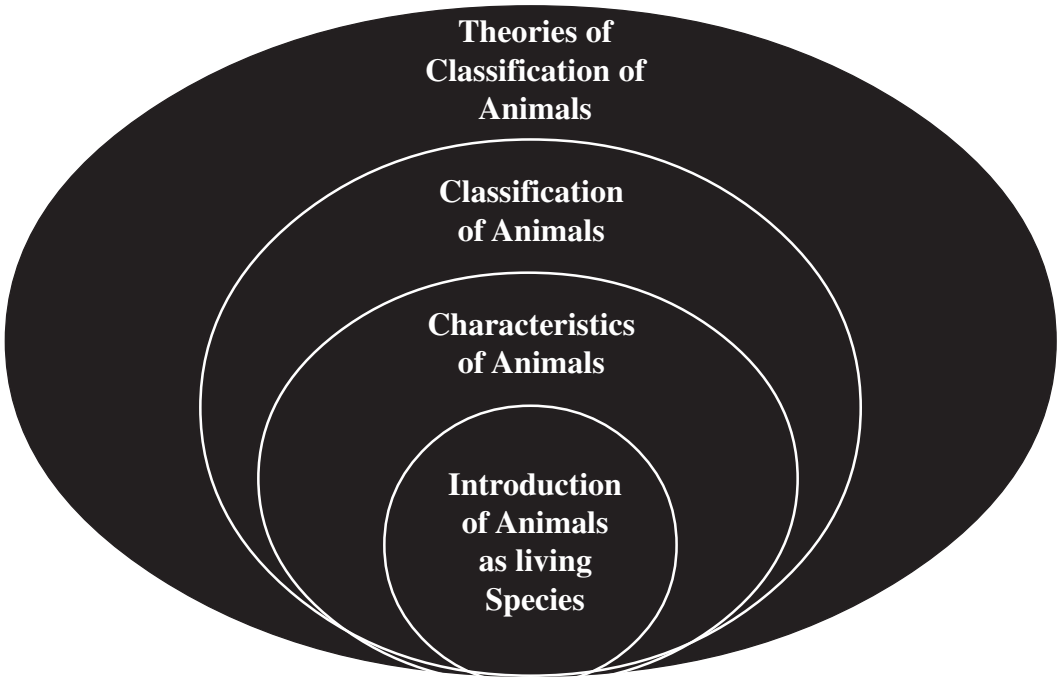
Disciplines usually consist of theoretical backgrounds, research and experiments, groups of experts in the discipline, etc. For example, a person who is pursuing his studies in a particular discipline not only gains an in-depth understanding of it but also conducts experiments or research as well. Such a person is considered as specializing in the chosen discipline.

School subjects are the basis for the development of basic information that will turn the learners into specialists in academic disciplines. A school subject results from the transformation of an academic discipline. School subjects come first and academic disciplines later in one's journey of learning from school to the university. An academic discipline provides an end point for the formation of a school subject and school subject furnishes the avenue for getting to know the academic discipline.

School subjects can have different and variable relationships to academic disciplines, depending on their aims, contents, and developmental phases. School subjects are derived from academic disciplines. They are also organized according to the 'structure' of academic disciplines. For example, History as a school subject is derived from 'humanities' and both history (a school subject) and humanities(a discipline) are narrative structurally. That is the nature in both the contexts. Science as a discipline deducts truth through inductive approach and this holds good for physics also, which is a school subject.

School subjects constitute a faithful and valid introduction to the academic disciplines. While students are dealing with relatively simple ideas and methods in school subjects,

they study the same ideas and method known by experts in the academic discipline. Remember, we use concentric approach in the organization of curriculum. There, one can see how a school subject gets enhanced as a discipline.



Observe how the status of school subject develops as academic discipline as students go to higher classes.

The relationship between school subjects and academic disciplines can be understood from three key positions.

It is important to transmit disciplinary knowledge for the development of the intellectual capacity of students and for the maintenance or reproduction of academic culture/ knowledge. This is called the doctrine of disciplinarity, according to which school subjects are derived from and organised according to the structure of academic disciplines.

- The central purpose of a school subject, like that of a discipline, is to initiate the young into the academic community of scholars. School subjects, therefore, are supposed to derive their life, from their related intellectual disciplines.
- School subjects constitute a faithful and valid introduction to the academic disciplines whose names they bear.
- Students are dealing with relatively simple ideas and methods; they study the same ideas and methods known by experts in the academic disciplines.

Check Your Progress – 1

1. Explain the relationship between School Subjects and Academic Disciplines

1.2.3.2. School Subjects and Academic Disciplines- Differences

Discipline and Subject are two words that relate to fields of knowledge between which a key difference can be seen. Discipline refers to a branch of academic study. On the other hand, subject refers to a branch of knowledge studied or taught.

School subjects and academic disciplines are essentially different in purpose and substance. Hence, school subjects are allowed for construction, which could get beyond the narrow academic or disciplinary concern. The discontinuous position finds support in humanism, social efficiency, and social reconstructions.

Humanist educators argue that school subjects are created to provide students with rewarding experiences that contribute to personal growth and individual freedom. School subjects, therefore, need to be formulated according to the interest, attitudes, and developmental stages of individual students. They need to derive content from a wide range of sources – such as personal experiences, human activities and community cultures and wisdoms. Disciplinary knowledge may or may not be useful for the formation of school subjects.

From the perspective of social efficiency, school subjects are constructed for the primary purpose of maintaining and enhancing economic and social productivity by equipping future citizens with the requisite knowledge, skills, and capital. The formation of school subjects, therefore, is justified with close reference to the needs of occupation, profession, and vocation. Academic disciplines are drawn upon only when they demonstrate their efficacy in promoting those skills and knowledge actually needed in occupations.

School subjects are created to provide students with meaningful learning experiences that might lead to liberation and cause social activity.

The formation of school subjects is based upon an examination of social contexts, social issues, and futures, with the intention of helping individuals reconstruct their own, standpoints, and actions.

The curricular discourses call for a learner-oriented approach to the construction of a school subject that allows learners to construct their own knowledge according to their individual needs and interests.

The curricular discourses require the school subject to be formulated in ways that help students cultivate certain kinds of sensitivity, disposition and awareness needed for responsible participation in society.

The school subjects equip students with general skills and lifelong learning abilities, essential for facing the challenges of globalisation and the knowledge-based economy.

Discipline refers to a branch of academic study. On the other hand, the subject refers to a branch of knowledge studied or taught.

Try to understand the difference between school subjects and academic disciplines from the following table

Areas	School Subjects	Academic Disciplines
Aim	Aims at social reform and reconstruction	development of the intellectual capacity of students and for the maintenance or reproduction of academic culture/knowledge.
Content	Formed by simple ideas and information.Includes practical knowledge, local community knowledge and technical knowledge	Complex theories and their implication, content related to the discipline and inter disciplines.
Focus	More concerned about meeting social, economic and political needs,takes care of the demands of the society and the individual.	More concerned about learning the content of the discipline, compared to school subjects focus is narrow, but focused on in-depth knowledge of the discipline. Works within the discipline.
Competencies, skills	Skills required by the individual to live in the society like communication, comprehension etc	Competencies related to understanding and application of the discipline like experimentation, observation etc.
Outcome	The result will be the formation of a better citizen involves basic skills such as reading, writing and arithmetic. Scope is vast since the aims is broad based	Gives importance for the development of special skills, many professional and vocational skills. Related to enhancing the disciplinary knowledge through one's own thinking.
Scope	Flexible: changes as the aims of society change	Scope within the subject, narrowed point of view compared to school subjects

Nature	constructed based on the interests, attitudes and feelings of learners	Less scope for flexibility, working within the discipline, less scope for change of knowledge.
Curriculum construction	Learner centred constructivist approach	Constructed according to the nature of discipline and advances according to the nature of disciplines only when new innovations take place.
Curricular discourses Area of operation	Limited to schools	Not learner centred For universities and other higher educational institutions.

Check Your Progress – 2

1. Explain the difference between school subject and academic Discipline

1.2.4. Let Us Summarise

- A subject or a field of study is a branch of knowledge that is taught and researched at the school, college or university level.
- School subject refers to an area of knowledge that is studied in school. It can be called learning tool or the criteria by which we learn. More precisely, subjects are the parts into which learning can be divided. It is a field or sphere of knowledge in which the learner has chosen to specialize.
- The term discipline 'originates from the Latin words discipulus, which means pupil, and discipline, which means teaching. The term discipline is defined by the Oxford English Dictionary as "a branch of learning or knowledge".
- "Academic discipline is a field or branch of learning affiliated with an academic department of a university, formulated for the advancement of research and scholarship. It is formulated for the professional training of researchers, academics and specialists."- Deng, Z (2013).
- School subjects can be traditional academic subjects, such as mathematics, history, geography, chemistry and economics that have direct relation with their parent academic disciplines. School subjects constitute a faithful and valid introduction to the academic disciplines whose names they bear. Students are dealing with relatively simple ideas and methods, they study the same ideas and methods known by experts in the academic disciplines.
- The exclusive reliance of the curricular position on academic disciplines in defining school subjects leaves out other kinds of knowledge (e.g., practical knowledge, technical knowledge, local community knowledge, etc.) that could be potential curriculum content.

1.2.5.Answers to 'Check YourProgress' 1and 2

Check Your Progress – 1

1. Refer Section 1.3.3.1.

Check Your Progress – 2

1. Refer Section 1.3.3.2.

1.2.6. Unit-end Exercises

1. Discuss the relationship and difference between academic discipline and school subjects.

1.2.7. References

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Block - 1 : Introduction to Disciplines and School Subjects

Unit - 3 : Aims of Schooling

Unit Structure

1.3.1. Learning Objectives

After learning through this Unit, the student teacher will be able to;

- Explain the meaning and nature of aims of Education and Schooling;
- Explain the Aims of Education and Schooling in Global Context; and
- Explain the Aims of Education and Schooling in Indian Context.

1.3.2. Introduction

We all work in schools. We go to school every day, do the assigned work like teaching, monitoring students, helping in curricular and co-curricular activities etc. But have we ever contemplated on why are we involving ourselves in all these activities? What are our goals? Where do we want to reach? Or in other words, what are our aims in guiding our students? Where do we want to take them etc. In the same way students also come to school. They learn what we teach, or guide, pass the examinations and go to the next class.

After completing school education, they join the next class in colleges. Have they ever asked you, why they should do schooling? Neither they nor we are serious about knowing the purposes of schooling. We have started our journey without knowing our destination. Don't you think this may lead to a great amount of waste and failure? Therefore, in the present Unit, let us understand what are the aims of schooling, what goals we, as teachers need to keep in mind while working along with students in school.

1.3.3. Learning Points and Learning Activities

1.3.3.3. Meaning, Nature and Aims of Education and Schooling in Global Context:

School is a social institution established with a social purpose of imparting education to people. It is an important means to achieve the aims of education of a country. Therefore, anyone interested in identifying the aims of schooling must first understand the philosophy of education of the place(nation) to which the school belongs. This naturally will lead to an understanding of the aims of schooling.

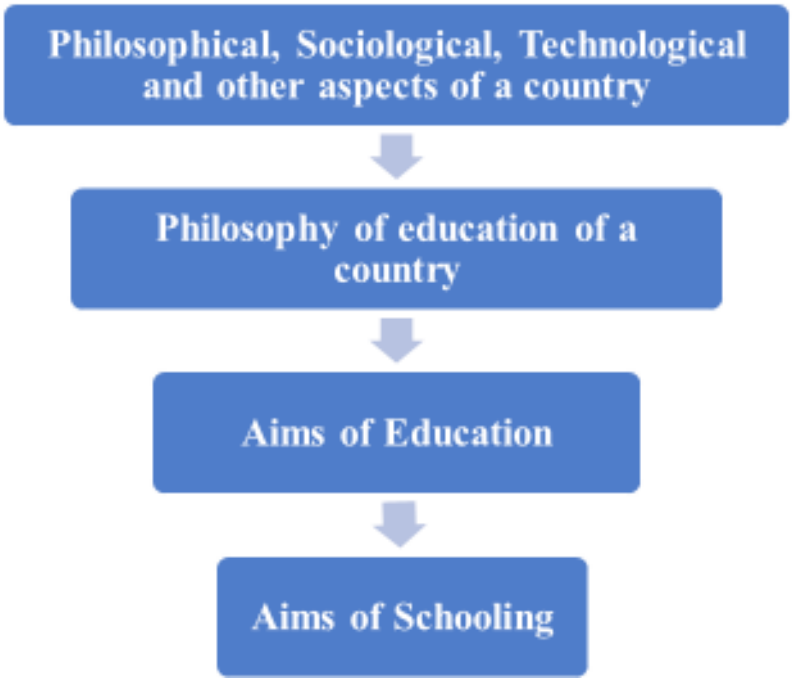
Aims of education are not fixed and universal. These are changeable and relative in nature. We can point out some specific nature of educational aims as follows. These are true in terms of the aims of schools also, because, schools aim to achieve the aims of education.

- As education is not a single aimed activity, plurality is an important feature of educational aims. Different aims represent different ways of looking into the same thing.
- Educational aims differ in nature and orientation. Some are permanent, definite and unchangeable whereas others are flexible, adjustable and changeable.
- Educational aims are related to the multiple needs of the individual, as well as, of the society.
- Educational aims are correlated with the ideals of life. Thus, educational aims change in keeping with the different schools of philosophy, religious, political and economic ideals held by an individual or by a country. Therefore, the formulation of aims of education is formulation of aims of 'life', itself.
- In reality, education is a reflection of the society and a process of social control. So educational aims are the means to shape and form a society.
- Educational aims change from age to age and place to place. Thus, these aims are not fixed.
- Lastly, different types of education have separate aims of education.

Thus, educational aims are changing according to the specific needs and ideals of the individual as well as the society. Quest of educational aims has been made since time immemorial. This quest gains momentum with the birth of great thinkers and philosophers and with their educational experiments. Social and economic issues also serve as determinants of educational aims and objectives. Education must prepare the future generation for the economic and social system of the country. In determining its educational objectives, every country has to take into consideration its economic conditions. Thus, we find variability is the nature of educational aims. The Secondary Education Commission (1952) puts it: "As the political, social and economic conditions change and new problems arise, it becomes necessary to re-examine carefully and re-state clearly the objectives which education at definite stage should keep in view."

The aims of education all over the world in general are the same. It is to help the citizens as well as the country to grow in a positive direction. But the specific aims of education of each country will emerge based on its philosophical, sociological, technological and many other situations. These aspects determine the aims of education of a nation, and hence the aims of schooling of that place also.

The following diagram clarifies the relationship between the aims of education as well as the aims of schooling.



Thus, it is clear that the aims of schooling are derived from the aims of education. There are some general aims of education, as well as schooling, which applies to all the nations, but specific aims are nation specific. Therefore, let us understand the aims of education as well as schooling in general and then get clarified about the aims of schooling in Indian situation. Hence our discussion starts with the global aims of education, followed by the deducted aims of schooling in global context. Next, let us proceed with the aims of education suggested by different documents at different times in India, followed by their respective implications for aims of schools.

The historic Universal Declaration of Human Rights, adopted at the UN General Assembly in 1948, declared that "everyone has the right to education". Article 26 in the Declaration stated that "education shall be free, at least in the elementary and fundamental stages" and "elementary education shall be compulsory", and that 'education shall be directed to the full development of the human personality and to the strengthening of respect for human rights and fundamental freedom. The idea that education must result in the 'full development of the human personality' continued to be reflected in influential reports such as that entitled 'Learning: The Treasure Within', the International Commission on Education for the Twenty-first Century chaired by Jacques Delors, submitted to UNESCO in 1996. According to Delors, the twenty first century will witness the following main tensions; and all of us have to confront and overcome them. These tensions are:

- The tension between the global and the local.
- The tension between the universal and the individual.
- The tension between tradition and modernity.
- The tension between long-term and short-term considerations.
- The tension between the need for competition and the concern for equality of opportunity.
- The tension between the extraordinary expansion of knowledge and human beings' capacity to assimilate it.
- The tension between the spiritual and the material.

Looking at the major tensions that a twenty-first century human being is poised to encounter, "it is not enough to supply each child early in life with a store of knowledge to be drawn on from the on. Each individual must be equipped to seize learning opportunity throughout life, both to broaden her or his knowledge, skills and attitude, and to adapt to a changing, complex and interdependent world".

The Commission advocated four types of learning, which are important in a person's life and these four types are popularly called the four pillars of education. These are:

1. Learning to know: To acquire the instruments of understanding
2. Learning to do: To act creatively on one's environment
3. Learning to live together: To participate and cooperate with other people in all human activities.
4. Learning to be: An essential progression which proceeds from the previous three.

In the traditional system of education, the first two aims of education have been the major focus. However, there is a need to make all the four aims of education an integral part of the organized learning system. Let us briefly discuss each of these aims.

Learning to know:

Learning to know has mainly two dimensions. These are as a means and as an end in life. As a means, it helps an individual to understand his/her environment so that he/she can live in dignity, develop occupational skills and communication. As an end, it strives to foster understanding, knowing and discovering the abilities of an individual. In this context, it is essential that children acquire the knowledge of scientific method and becomes 'friends of science'.

The second major aspect of this learning is that learners should be exposed to both general education as well as specialised education so that they can cope up with the constantly changing and proliferated knowledge of the 21st century.

According to the Commission, 'learning to know pre-supposes learning to learn, calling upon the power of concentration, memory and thought. In today's world, when the information grows rapidly, one need to learn to concentrate on things and people, otherwise he will be completely lost. Inculcation of memory right from childhood should be encouraged in the schools so that a child is able to store and circulate vast amounts of information which is available for him/her. It is also necessary that schools attempt to develop thought processes in children by encouraging two-way traffic between the concrete and the abstract, between deductive and inductive approaches to learning. Hence, the Commission emphasises that acquiring knowledge is a never-ending process and can be enriched by all forms of experience.

Learning to Do

Learning to know and learning to do are quite inseparable. After acquiring knowledge, it is important that knowledge should be put into practice. Although this concept is not new to the field of education, the Commission has hinted at how education can be adapted to future work plan when it is not possible to foresee how exactly that work will evolve. The commission advocates a shift from skill of a worker to his/her personal competence, which has become inevitable due to the changed nature of production processes. "Purely physical tasks are being replaced by more intellectual, more mental work, such as controlling, maintaining and monitoring machines, and by the work of design, study and organisation, as machines themselves became more 'intelligent' and the physical labour required for work diminishes". Hence, the abilities to communicate, work with others, manage and resolve conflicts must be developed among the learners.

Secondly, the 'dematerialization' of the advanced economies has resulted in quantitative and qualitative expansions in both market oriented (finance accounting, management) and on-market oriented service sectors (education, health, social services). This has, no doubt, called for tremendous training in interpersonal relationships among the workers. Therefore, the education system is called upon to develop in the learners, the qualities of teamwork and development of interpersonal relationships.

Learning to Live Together

Never has the human society faced such a threat of self-destruction, as it would encounter in the twenty first century. Human beings are becoming mute spectators of conflicts, destruction and mass killings. Hence, there is a need "to devise a form of education which might make it possible to avoid conflicts or resolve them peacefully by developing respect for other people, their cultures and their spiritual values". Among the various means to combat prejudices and conflicts, non-violence has been recommended by the Commission. Moreover, countries must have common objectives and a shared purpose to reduce prejudices and hostilities and to pave the way to cooperation and friendship. The Commission therefore suggested that "formal education must therefore provide enough time and opportunity in its programmes to introduce the young, from childhood, to cooperative undertakings through participation in sport or in cultural activities, and also through participation in social activities such as neighbourhood renovation, helping the underprivileged, humanitarian work, intergenerational assistance, etc. "Both teacher and students should come together to resolve conflicts and this will also help enhance the teacher-pupil relationship.

Learning to be

All the three types of learning presented earlier form the basis for the fourth type of learning. This type of learning envisages all round development of human personality body,

mind and spirit. All human beings should develop independent and critical thinking, and form their own judgement. It restates the fear 'Learning to be', the report of the International Commission on Education, 1972 that "the world would be dehumanized as a result of technical change". Therefore, education should help an individual to solve his own problems, make his own decisions and shoulders his responsibilities. Education should strive to 'give people the freedom of thought, judgement, feeling and imagination that they need in order to develop their talents and remain as much as possible InControl of their lives'.

In the twenty first century, it is required that standardization of individual behaviour must pave the way for the qualities of imagination and creativity, the clearest manifestations of human freedom. The commission emphasizes "it is therefore important to provide children and young people with every possible opportunity for discovery and experiment-aesthetic, artistic, sporting, scientific, cultural and social swell as appealing introductions to the creation of their contemporaries or earlier generations". To sum up, education must try to foster a fully developed and balanced personality in human beings.

In the 21st century three curricular discourses, autonomous learners, participatory citizenship, and globalization, have become rather influential in the debates. These discourses argue that contemporary schooling should allow individual learners to construct their own knowledge base and competences. It should prepare young people for their future role as active, responsible, and productive citizens in a democratic society. Furthermore, schools are expected to be instrumental in equipping individuals for the challenges created by economic and cultural globalization.

Aims of Schooling –Based on Curriculum Ideologies

Over the last century schooling has been asked to serve four different aims that are reflected in four curricular ideologies. They are;

- **Academic Rationalism:** Primary function of schooling is intellectual development through initiating students into specific bodies of knowledge, techniques, and ways of knowing embedded in academic disciplines.
- **Humanism:** The central goal of schooling in terms of fostering students' potential, personal freedom, self-actualization, and all-round development.
- **Social Efficiency:** The central purpose of schooling is to meet the current and future manpower needs of a society by training youth to become contributing members of society.
- **Social Reconstructionism:** Schooling is primarily an instrument for solving social problems (inequalities, injustice, poverty, etc.) and cause social reform and reconstruction.

Check Your Progress 1

Below are given the ideas suggested under different objectives of 'Learning: The Treasure Within' document. Classify them under each of the objectives appropriately.

I. Learning to know:

II. Learning to Do:

III. Learning to Live Together:

IV. Learning to Be:

1. Resolve conflicts peacefully
2. the qualities of teamwork
3. helps an individual to understand his/her environment
4. strive to 'give people the freedom of thought
5. skill of a worker to his/her personal competence
6. countries must have common objectives
7. strives to foster understanding
8. help to solve one's own problems
9. pre-supposes learning to learn
10. the abilities to communicate, work with others
11. introduce the young, from childhood, to cooperative undertakings
12. help to make one's own decisions

1.3.3.3. Aims of Education/ Aims of Schooling – Indian Context

I. Aims (Aims of Schooling) as derived from the Constitution of India

1. **Development of Democratic Citizenship and Values in the People:** The success of democracy depends largely upon people's awareness of their rights and duties and the extent to which they fulfill their responsibilities. Education should assume the responsibility of providing the kind of education that would enable the students to develop qualities which are of great importance for them towards bear responsibility of a democratic citizen. Education aims at developing the ability to think and distinguish between right and wrong in people, to understand social, economic and political issues, and to reflect on the possibility of solving such problems. Thus, education has a challenging responsibility with regard to moulding and directing

every citizen towards democratic citizenship. The schools are responsible to develop this democratic citizenship.

2. **Training in Skillful Living:** Democracy can be said to succeed only if it translates the democratic ideals to its society. And, for this, socialisation of the individual through education is essential. The educational system should be designed to inculcate some democratic values, such as scientific temperament of mind, a spirit of large-hearted tolerance, of mutual 'give and take', respect for the culture of other nations, etc. It is also desirable to develop such social qualities as collective feeling, cooperation, discipline, sympathy, brotherhood, etc., in the individual. Education must also aim to create faith in social justice and the willingness to rebel against injustice. Education helps people in adjusting to each other. Therefore, schools should aim at developing these values among children.

3. **Development Vocational Skill**: No nation can progress in the absence of economic progress. The first duty of the state is to provide a system and means of education which imparts some vocational and professional skills to the learners so that they are able to earn their livelihood at the same time as they contribute to the nation's economic growth. Education must aim at increasing the productive or vocational efficiency of young students for increasing national wealth of the country. Therefore, schools should aim at development of an attitude towards appreciating the dignity of work and productive efficiency of the individual.

4. **Development of Social, Moral and Spiritual Values:** The success of democracy, its strength and stability are contingent upon people's developed sense of social responsibility and a deeper appreciation of moral and spiritual values hence, the schools should at strengthening and deepening of the sense of social responsibility and a keener appreciation of moral and spiritual values.

5. **Promoting National Consciousness:** India is a land of different castes, peoples, communities, languages, religions and cultures. The achievement of social and national integration is an important aim of our educational system. The main role of education should, therefore, be to enable our students to discover 'unity in diversity' and in this way. The schools should aim at promoting this national consciousness through planned activities.

6. **Development of Physical Resources:** The modernisation of agriculture and rapid industrialisation should also be an important aim of education in a democracy like India. To achieve this purpose education should be linked with productivity, science should be considered a basic component of education, work- experience should be considered important, vocational education should be expanded, scientific and

technical education should be improved. In this regard, schools should develop productive skills among students which help them to develop required competencies.

7. **Development of Human Resources:** This aim implies changes in the knowledge, skills, interests, and values of the people as a whole. In a democracy the individual is an end in himself and the primary purpose of education should be to provide him with the widest opportunity of developing his potentialities to the fullest, through social reorganization and emphasis on social perspectives. Cultivation of essential values in the people, development of dedicated and competent leadership and educated electorate are essential towards strengthening democracy. Schools, therefore, must aim at developing such human resources required for the defense of Indian democracy. Democracy can succeed only if most of its members have developed mature personalities through physical, mental, social, ethical and spiritual development. These aims are social or national objectives which are to be achieved through education. These are imperative towards strengthening the society.

Aims of Schooling-Deductions:

The schools should aim at developing

- Democratic Citizenship
- living skills
- Vocational Skills
- Social, Moral and Spiritual Values
- National Consciousness
- Physical Resources, and Human Resources.

More or less the same aims have been emphasized further by different committees and commissions as well as curricular frame works. Let us see the implications of the recommendations of these committees in relation to the aims of schooling.

II. Aims of Schooling as deducted from National Policy on Education (1986).

The Government of India declared its new education policy under the title "National Policy on Education, 1986" which was intended to prepare India for the 21st century. As per the National Policy on Education (NPE1986), the aims of education should be

1. To foster all round development of the individual, as well as, the society as a whole.

2. To promote values such as India's common cultural heritage, egalitarianism, democracy, socialism and secularism, equality of the sexes, national cohesion, removal of social barriers etc.

3. To provide education of comparable quality to all students, irrespective of caste, creed, location or gender. d) To develop manpower for different levels of the economy which would further guarantee national self-reliance.

4. To develop a scientific temper and independence of mind and spirit.

5. To reconstruct the educational system to improve its quality at all stages, and give much greater attention to science and technology, the cultivation of moral values and a closer relationship between education and the life of the people.

6. To inculcate in the mind of the students the importance of national integration and certain national values like secular, scientific and moral values.

7. To strengthen the world view and motivate the younger generations towards international cooperation and peaceful coexistence.

8. To promote equality, it is necessary to provide equal opportunity or access, but also provide conditions for success.

9. To develop awareness of the importance of protection of environment and observance of the norms of small family.

10. To encourage students towards cherished goal of life long education through open and distance education.

Aim of Schooling: Deductions

- The school should aim to achieve all round development of the individual and the society,
- Promote Indian cultural values, along with nationalistic, scientific, moral, environmental values, provide quality education irrespective of any differences and develop manpower.

III. Aims of Schooling as deducted from National Curriculum Framework (2005)

The aims of education according to the National Curriculum Framework 2005 are the following:

According to this, education should develop a commitment to democratic values of equality, justice, freedom, concern for others' wellbeing, secularism, respect for human dignity and rights, build a commitment to these values which are based on reason and understanding, promote independence of thought and action, encourage value-based decision

making, independently and collectively, teach the skills of learning to learn and the willingness to unlearn and relearn as means of responding to new situations in a flexible and creative manner. It also suggested that the curriculum needs to emphasise the processes of constructing knowledge. It emphasized that choices in life and ability to participate in democratic processes depend on the ability to contribute to society in various ways. This is why education must develop the ability to work, participate in economic processes and social change. Appreciation of beauty and art forms is an integral part of human life. Creativity in arts, literature and other domains of knowledge is closely linked. Education must provide the means and opportunity to enhance the child's creative expression and the capacity of aesthetic appreciation.

Aims of Schooling: Deductions

- Schools should aim at developing democratic values
- Develop a commitment to these values
- Develop independence of thought and action, the skill of learning to learn
- Promote value-based decision-making skills
- Promote the attitude to unlearn and relearn
- Develop the ability to participate in democratic processes
- Promote an attitude to appreciate art forms.

IV. Aims of Schooling as deducted from the context of Globalization:

The aims and importance of global education can be stated as follows:

1. Education should aim to enhance the ability of learners to access, assess, adopt, and apply knowledge.
2. Education should allow every individual to develop freely. The individual will have to find his/her own point of reference in a society of constant change that generates short lived values.
3. Education should help students to gain skills of new cultures. Education should help learners to develop their critical thinking skills, gain democratic values and apply their knowledge independently in an effectively designed teaching-learning environment.
4. Education must give the people the capacity to acquire the relevant knowledge and interpret values that will help them to adjust with the changing environment such as tolerance in human rights, the diversity of culture, respect for others and for the environment. It should create the right balance among the concern of societies and the integrity.

5. Education should produce an increased quantity of scientifically and technically trained persons, as the emerging economy is based on knowledge as a key factor which demands highly trained person in science and technology.

6. In a global society education should aim at providing students the ability of working together. Education should be the catalyst for the desire to live together. At the heart of the same society and in the same 'global village' through universal values such as tolerance and human rights, the diversity of culture, respect for others and for the environment etc. maintaining balance between the concerns of society and integrity of individuals.

7. Education should enable students to think independently to exercise appropriate judgment and to collaborate with others in order to make sense of new situations. Education should assist people in criticising events from global perspectives.

8. Education should help to develop the skill of multi-sided thinking by enabling individuals to gain the cultural sensitivity and experience, to develop the language and skills of harmony at work in different cultures.

9. Education should aim at playing an increasingly vital role in resolving and treating the social contradictions and strains carried by globalisation.

10. Education should aim at equipping people with the new knowledge and skills required for the global economy. In such a global context, education should aim at preparing children to compete in the global labour force.

11. Education should develop feelings of world citizenship to acquaint the student with new and current or latest areas of knowledge and to develop international understanding.

12. In a global world, education should aim at producing better educated citizens.

Aims of Schooling: Deductions:

- Enhance the ability of learners to access, assess, adopt, and apply knowledge
- Allow every individual to develop freely
- Help students to gain skills of new cultures
- Give the people the capacity to acquire the relevant knowledge and interpret values
- Produce an increased quantity of scientifically and technically trained persons

- Aim at providing students the ability of working together, enable students to think independently to exercise appropriate judgment
- Aim at equipping people with the new knowledge and skills required for the global economy
- Develop feelings of world citizenship

V. Aims of Schooling as deducted from Draft National Education Policy 2019:

The draft National Education Policy 2019 has clearly presented the vison of education in India in its preamble. Accordingly, it is to ensure that it touches the live of each and every citizen, consistent with their ability to contribute to many growing developmental imperatives of this country on the one hand, and towards creating a just and equitable society on the other.

It also mandates to have broad view of education encompassing the holistic development of students with special emphasis on the development of the creative potential of each individual, in all its richness and complexity, as suggested in many reports from UNESCO, the OECD, the World Bank, the World Economic Forum. The draft documents also highlights the aims of schooling as the development of not only cognitive skills - both 'foundational skills' of literacy and numeracy and 'higher-order' cognitive skills such as critical thinking and problem solving skills - but also social and emotional skills, also referred to as 'soft skills', including cultural awareness and empathy, perseverance and grit, teamwork and leadership, among others. The Policy recognises that it is important to conceive education in a more encompassing fashion, and this principle should inform and guide reforms in relation to the reorientation of the contents and processes of education.

According to the policy, culturally, India has been, and continues to be, a cradle of great diversity in all walks of life, with its myriad languages and dialects, with as many as seven classical dance forms and two classical music forms, many well-developed traditions of folk arts and music, pottery, sculptures and bronzes, exquisite architecture, incredible cuisines, fabulous textiles of all kinds, and so much more. These rich legacies to world heritage must not only be nurtured and preserved for posterity, but also enhanced and put to new uses through our education system.

Aims of Schooling: Deductions:

The schools should aim at developing

- creative potential of each individual
- cognitive skills

- foundational skills
- higher order skills
- social and emotional skills
- culturally diverse arts and skills

There are some more specific aims of schooling, that aresuggested by the experts in the field. They are highly significant. You will find those aims below:

- Develop a love for learning and opportunity for each individual to achieve their full potential and to develop and explore their own interests in a secure and challenging environment.
- Enable children to become confident, resourceful, enquiring and independent learners, able to apply their skills;
- Create an atmosphere of mutual respect, understanding and consideration for the ideas, attitudes, values and feelings of others;
- Develop children's self-esteem, resilience, personal development and well-being;
- Promote individual and collective responsibility
- Enable children to value and be valued as part of their community.
- Provide a rich, diverse and challenging education through excellent and innovative teaching and learning.
- Celebrate success, promote a "can do" attitude and inspire each to achieve their best.
- Support personal development, social responsibility and a sense of self-worth.
- Develop the attitudes and skills that support a healthy and fulfilled life together with the confidence for a lifetime of learning.
- Work as partners in learning with students, parents/carers and the community.
- Provide a safe, supportive and well-ordered environment where students and staff are happy and confident as they aspire to achieve.

Check Your Progress -2

Below are given the aims of schooling (two each) as deducted by different documents and contexts. Classify them under appropriate documents and context.

1. Constitution of India
2. National Policy on Education 1986

3. National Curriculum Framework
4. Context of Globalization

1. Develop manpower.
2. Democratic Citizenship
3. Allow every individual to develop freely
4. Promote the attitude to unlearn and relearn
5. Living skills
6. Achieve all round development of the individual and the society
7. Promote value-based decision-making skills
8. Help students to gain skills of new cultures

1.3.4. Let us Summarise

- School is a social institution established with a social purpose of imparting education to people. It is an important means to achieve the aims of education of a country.
- Aims of education are not fixed and universal.
- As the political, social and economic conditions change and new problems arise, it becomes necessary to re-examine carefully and re-state clearly the objectives which education at definite stage should keep in view.
- The aims of education all over the world in general are the same. It is to help the citizens as well as the country to grow in a positive direction. But the specific aims of education of each country will emerge based on its philosophical, sociological, technological and many other situations. These aspects determine the aims of education of a nation, and hence the aims of schooling of that place also.
- 'Learning: The Treasure Within', the International Commission on Education for the Twenty-first Century chaired by Jacques Delores, suggested four types of learning: Learning to know, Learning to do, Learning to live together and Learning to be. schools are expected to be instrumental in achieving these and hence form the aims of schooling.
- The aims of schooling in India can be derived by different documents of different times and also in different contexts.

- They are the constitution of India document, NPE 1986, NCF 2005 and the context of Globalization and the draft of National Education Policy 2019. Each suggests some common and some context specific aims for schooling.

1.3.5. Answers to 'Check Your Progress' -1 and 2

Check Your Progress-1

Check Your Progress -1

Learning to know- 3,7,9

Learning to Do - 2,5,10

Learning to Live Together - 1,6,11

Learning to Be - 4,8,12

Check Your Progress -2

Constitution of India- 2,5

National Policy on Education 1986-1,6

National Curriculum Framework-4,7

Context of Globalization-3,8

1.3.6. Unit end Exercises

1. Explain the aims of Schooling.

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Block - 1 : Introduction to Disciplines and School Subjects

Unit - 4 : Emergence of Academic Disciplines and Formation of School Subjects

Unit Structure

1.4.1. Learning Objectives

- After completing this Unit, the student teachers will be able to
- Describe the historical perspectives of academic discipline;
- Explain how the academic disciplines emerged; and
- Describe how the school subjects were formed.

1.4.2. Introduction

We know that, what we speak of disciplines today like science, mathematics, history etc. were not in existence in the past. The knowledge was considered as a single unit. The knowledge was classified into different discipline for number of reasons. We are also aware that the subjects taught in our schools today emerged during the course of time. We are naturally curious to know how these disciplines and school subjects emerged. Let us understand the history behind this process in the present unit.

1.4.3. Learning Points and Learning Activities

1.4.3.1. Emergence of Academic Disciplines

knowledge is the starting point in the process of the evolution of discipline. Let us understand how knowledge is created. Knowledge emerge in the following situations:

- social experience of human beings
- interaction between human beings and the environment

When these personal experiences are felt by many people in a cultural environment, it gets validated and get the status of knowledge. Take for example, many people experience the possibility of training dogs and as a result of it, they deduct the knowledge that 'dogs are trainable'. This will be further validated by many people and gets established as knowledge.

When knowledge gets into the realm of academic discipline, its focus and scope get narrowed. Bringing knowledge under a discipline means, defining the boundaries of knowledge of different nature. Therefore, a discipline defines boundaries, and decides whether a particular knowledge can be brought within or outside that particular discipline. Today we are so familiar about these boundaries, that the moment one describes the structure of a plant, we say he is talking about botany, the moment one speaks about the form of government of a country, we say he is dealing with political science.

Why did people categorize knowledge under different disciplines? This may be because people thought that this helps people to get specialized in that discipline. This specialisation helps to identify principles, laws and also to form theories. The network of laws and principles help to deduct new knowledge within disciplines. More exploration into the discipline again leads to the growth or expansion of the discipline.

The need for segregation of knowledge can be identified as follows:

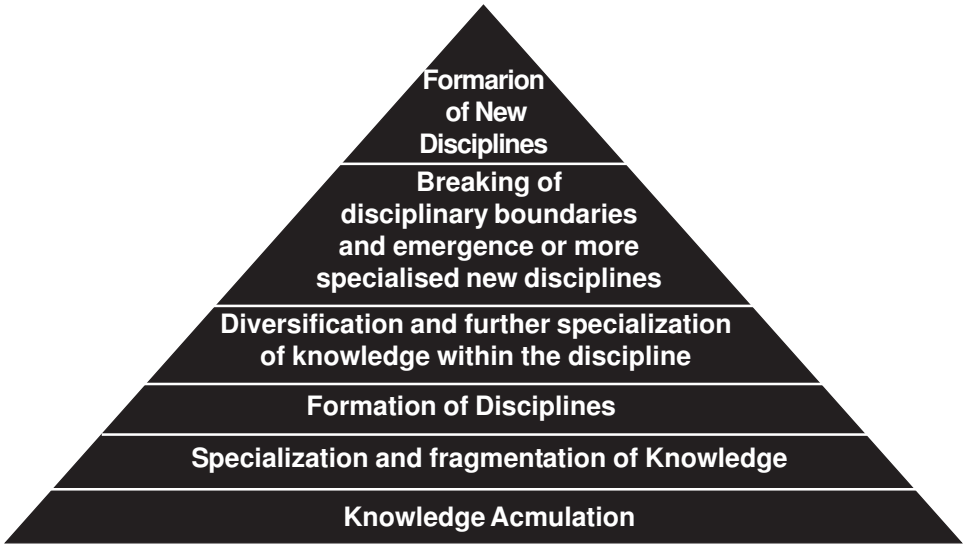
- Due to continuous production of new knowledge in different fields the need of its preservation and transfer was also inevitable.
- The customs and knowledge of ancient civilizations also became more complex. These different kinds of skills and activities were the earlier forms of human knowledge. Each generation, since the beginning of human existence, has sought to pass on cultural and social values, traditions, morality, religion and skills to the next generation.
- In pre-literate societies, education was achieved orally and through observation and imitation. But with the passage of time, different skills and activities became

more specialized due to generation of new knowledge and new discoveries. Each such discovery and invention enriched human understanding in different fields of knowledge.

This organized body of knowledge of a particular field was termed as 'discipline'. Disciplined study of different fields of human knowledge started with the beginning of institutionalized study and research of these areas at different times. The knowledge that a society possessed has been developed into the status of disciplines and its diversification and specialisation results in further fragmentation of knowledge in to new disciplines. The evolutionary process of disciplines might have gone through the following phases:

- Knowledge accumulation
- Specialization and fragmentation of Knowledge
- Formation of Disciplines
- Diversification and further specialization of knowledge within the discipline
- Breaking of disciplinary boundaries and emergence of more specialised new disciplines
- Formation of New Disciplines, breaking of disciplinary boundaries and emergence of more specialized new disciplines.

The same has been represented in the following diagram.



This may be occurred in one of the following ways:

(i) Two or more branches of knowledge merge and develop own distinct characteristics and form a new discipline. In interdisciplinary learning learners draw on two or more disciplines in order to advance their understanding of a subject or problem that extends beyond the scope any single discipline. Learners integrate and develop information, concepts, methodologies and procedures from two or more disciplines to gain new

knowledge, understanding and skills, and commonly also to explain or solve problems. Frequently cited examples of inter disciplines are neuroscience, biochemistry, geobiology, Knowledge Specialization and Fragmentation of knowledge Discipline Diversification and further specialization of knowledge within the discipline Breaking of disciplinary boundaries and emergence of more specialized new disciplines. sustainability science and engineering, psycholinguistics, ethnomusicology, cultural studies, etc.

(ii) A social and professional activity becomes an area of application for several disciplines and recognized as an independent field of study. For example, education, social work, management, medical Sciences, agriculture, technology and engineering etc. In these cases, the practice of practitioners in the field became an organised discipline by incorporating the specialised knowledge emerged out of the practices.

(iii) When number of disciplines converge into an important field of activity resulting in two-way flow of ideas for the enrichment of both, it results in the emergence of interdisciplinary knowledge and areas.

(iv) The changes in the socio-political scenario may result in the formation of new disciplines. Based on the changes taking place in the living pattern of people, some form of enquiry may be essential and later they may result in the formation of new disciplines. For example, 'urban studies' has been evolved as result of formation of urban society.

(v) New researches and consequent developments and inventions will also result in the formation of new discipline. For example, nanotechnology, information technology, Space Science etc. The invention of computer and related technology add to the development of information technology.

The Chronology of Formation of Disciplines

Disciplines inadvertently have been around as long as humans have been learning from each other. Of course, this knowledge exchange was not labelled. The earliest recording of an academic discipline, similar to the ones we know today, was with the Greeks in Socrates' time. During this time and extending closer to the present, education was strictly for the upper class. Also, during this time, education was religion-and military-centered versus the disciplinary-focused curriculum we know today.

The 1800's started to see the development of the modern disciplinary systems we know. The disciplines that we know today started as scholars specializing in that field of interest then continuing to share their knowledge with others. The scholars who have specialized in particular topics would collaborate together to determine definitions for the

field of study in order to create the disciplines. As knowledge along with communities grew, the need for professions grew as well, and these communities and professions carved out the academic disciplines.

Kenneth (1974) observes that like any other social phenomena academic disciplines do have a history. Every discipline can be analysed by looking at its historical development. Historians of science can look at the specific historical conditions that led to the foundation of an academic discipline and at how it changed over time, or in other words, its evolution. The historical perspective helps to understand the great continuity of disciplines, but also the points of discontinuity or departure from obsolete practices and ways of thinking. Sometimes this leads to the disappearance of an older discipline and the creation of a new one that can replace it. In other words, the historical perspective captures the great dynamics of the development of science and the academic disciplines.

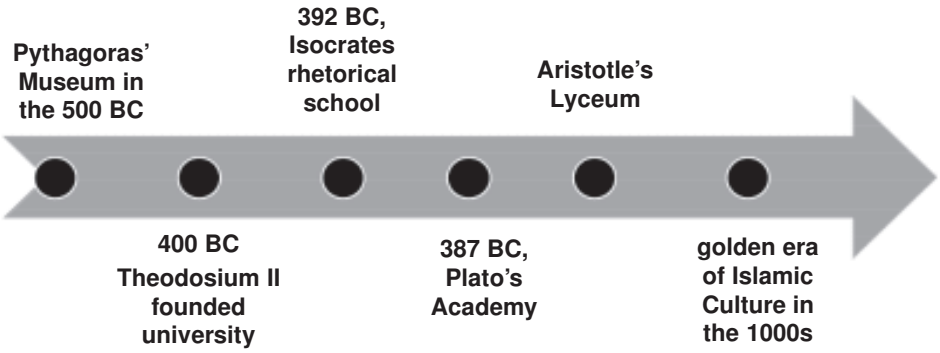
Historians will generally look for the wider societal context and the overall conditions that influenced the development of a specific discipline, for example the political climate or any particular needs society had at a particular time, as well as internal factors that shaped its development. For example, Julie (1990) has pointed out that the academic discipline was an invention of the late Middle Ages. The term was first applied to three academic areas for which universities had the responsibility of producing trained professionals: theology, law and medicine. Julie argues that this early disciplining of knowledge was a response to external demands, while the specialization into disciplines that emerged in the 19th century was due to internal reasons.

How does a new discipline emerge?

The formation of a new discipline requires talented scientists who can take over the burden of intellectual leadership by defining what the new discipline is about and by giving it a clear agenda for research, which can inspire followers. In other words, finding a new discipline needs adventurous pioneers who are willing to leave their original discipline behind and to cover new ground, which always includes a certain risk that they and their new discipline will possibly fail.

This means that practically every new discipline starts off necessarily as an interdisciplinary project that combines elements from some parent discipline(s) with original new elements and insights. Once the discipline is established a new type of researcher is needed. The new discipline needs people who can consolidate it by filling in the gaps left by the pioneers. Without these consolidators and synthesizers, a discipline will never develop some stable identity and will eventually go nowhere. So, in the consolidation phase disciplines will start restricting too original ideas and will become more and more focused on disciplinary coherence and orthodoxy.

Arthur L. Dirks (1996) gives a comprehensive account of the development of the academic disciplines. The following time-line shows the history of disciplines during the course of time.



Pythagoras' Museum in the 500 BC cultivated studies of mathematics, music, acoustics, and geometry. Other inquiry was pursued by the Sophists, who established the oratorical tradition, but were itinerant teachers. Socrates, advocated his questioning method of provoking discovery. In 392 BC, Isocrates established a rhetorical school in Athens to train students in politics. In 387 BC, Plato opened his Academy in Athens. Mathematics and music were some of the first disciplines that were taught in the Greek era. When Plato opened his academy, he taught social issues such as politics and education alongside the already established discipline of mathematics. His standard studies included Pythagorean number theory, advanced geometry and speculations on science. He explored social issues, primarily, education, jurisprudence, politics, and sex. Aristotle founded his Lyceum in 335 BC in Athens, which resembled the Academy, but was wider in intellectual scope. There was little that escaped discussion: music, botanical classification, biology, anthropology, ethics, law, logic, metaphysics, physics, politics, psychology, poetry, rhetoric. In Constantinople, Theodosius II founded a university in the 400s where the subjects ranged from grammar, letters, medicine, and law to philosophy. By the golden era of Islamic culture in the 1000s, curricula covered a broad range including mathematics (algebra, geometry, and trigonometry), science (chemistry, physics, and astronomy), medicine (anatomy, surgery, pharmacy, and specialized medicine), philosophy (logic, ethics, and metaphysics), literature (philology, grammar, poetry, and prosody), social sciences, history, geography, politics, law, sociology, psychology, jurisprudence, and theology (comparative religions, history of religions, study of the Koran, religious traditions, and other religious subjects). In medieval world, there existed only four main faculties for study. They were Medicine, Theology, Liberal Arts and Canon Law. In the contemporary period the number of studied disciplines increased greatly. From the middle of the nineteenth century, such rather new disciplines as non-classical languages, political science, literature, and economics were added. Besides, as there were made many discoveries in natural science and technology disciplines,

engineering, biology, chemistry and physics were chosen to be studied. During the twentieth century when the development of the whole world was very rapid, new academic sciences were needed to be studied. New level of life and social conscience demanded that psychology, sociology and education disciplines were added into the normal curriculum. In the end of the twentieth century, a new explosion of scientific interest was observed. There appeared rather new disciplines focusing on particular fields of knowledge or specific questions. Many disciplines were intended to prepare students for profession and career building. The development of Medicine led to new medical departments such as hospitality management and nursing. At last, the achievements in geophysics and biochemistry increased so much that there appeared the necessity to outline specific professions in this field because the scientist contribution to this branch was great and became widely known.

The evolution of disciplines is a continuous process. As the human beings, societies and technologies develop. Human understanding and interpretations also develop and results in the formation of new knowledge and emergence of new disciplines. As scientific knowledge, understanding and practices advances, some old disciplines may deprive off its dominance or such disciplines are subjected to different forms of adaptations.

The disciplines, where we find a wealth of specific knowledge, are the building blocks of Interdisciplinary Studies. Understanding the past disciplines is relevant to understand the future disciplines. For example, while learning about medicine, it is important to reflect on the past use of herbs and how far we have come with modern pharmaceuticals today. When reflecting, we are able to see what has worked and what has not worked. This is why disciplines are changed and new disciplines are formed. Academics have been constantly changing based on what society feels as important for the students to learn from the beginning of time.

Education has evolved from past centuries to allow students to learn about the past and take it into consideration when learning about the present and future. All disciplines are built on what they used to be when they were first recognized in the seventeenth, eighteenth, and nineteenth centuries – especially for arts, history, and humanities majors since these disciplines were so prominent in earlier centuries. The great aspect of the twenty-first century is that mostly all disciplines encompass aspects of other disciplines creating a multidisciplinary approach. By combining disciplines, we are able to learn a vast majority of new information in a shorter amount of time, rather than studying each subject separately like students did in the early days. This allows for more skilled and diversified employees in today's society.

In the early days, students were almost forced into higher education based on societal demands. With fewer fields of study available, most students were taught humanities and

religious studies. Nowadays students are allowed to choose what they want to learn based on their own likes and dislikes. Students are able to take courses from many different disciplines and integrate them together to form their own new discipline. This approach is called Interdisciplinary Studies. Without the disciplines, Interdisciplinary Studies would have nothing to build on, nothing to incorporate or weave together in order to find solutions to societal problems.

Emergence of Academic Disciplines in India

I, personally have not come across much work about the formation of acaedemic disciplines in the context of India. This is a fertile area for research. There is no doubt that there were good number of disciplines, in its strict sense in India, which were studied in different educational institutions. The present disciplines which are popular in schools may be the result of the influence of the western countries, but there are evidences to say that number of disciplines emerged and in existence in institutions of education in India. Dear students, give more thought to this area of study, take up studies in depth and deduct appropriate knowledge.

The origin of disciplines in India can be traced back to ancient times when Vedanga , the six auxiliary disciplines of Hinduism developed. (This deduction needs to be supported with more evidences.) These are:

1. Shiksha : phonetics, phonology, pronunciation. This auxiliary discipline has focussed on the letters of the Sanskrit alphabet, accent, quantity, stress, melody and rules of euphonic combination of words during a Vedic recitation
2. Chandas : prosody. This auxiliary discipline has focussed on the poetic meters, including those based on fixed number of syllables per verse, and those based on fixed number of morae per verse.
3. Vyakarana : grammar and linguistic analysis. This auxiliary discipline has focussed on the rules of grammar and linguistic analysis to establish the exact form of words and sentences to properly express ideas.
4. Nirukta : etymology, explanation of words, particularly those that are archaic and have ancient uses with unclear meaning. This auxiliary discipline has focussed on linguistic analysis to help establish the proper meaning of the words, given the context they are used in.
5. Kalpa : ritual instructions. This field focussed on standardizing procedures for Vedic rituals, rites of passage rituals associated with major life events such as birth, wedding and death in family, as well as discussing the personal conduct and proper duties of an individual in different stages of his life.

6. Jyotisha : Auspicious time for rituals, astrology[1] and astronomy. This auxiliary Vedic discipline focussed on time keeping.

7. The character of Vedangas has roots in ancient times, and the Brihadaranyaka Upanishad mentions it as an integral part of the Brahmanas layer of the Vedic texts. Individually, these auxiliary disciplines of study are traceable to the 2nd millennium BCE, and the 5th-century BCE scholar Yaska quotes the Vedangas. However, it is unclear when and where a list of six Vedangas were first conceptualized.

The Vedangas likely developed towards the end of the vedic period, around or after the middle of the 1st millennium BCE. Though Vedangas developed as ancillary studies for the Vedas, but its insights into meters, structure of sound and language, grammar, linguistic analysis and other subjects influenced post-Vedic studies, arts, culture and various schools of Hindu philosophy. The Kalpa Vedanga studies, for example, gave rise to the Dharma-sutras, which later expanded into Dharma-shastras.

It has been found that Indian mathematics emerged in the Indian subcontinent from 1200 BC until the end of the 18th century. Development of Mathematics as a clear discipline is evident in the works of Aryabhata, Brahmagupta, Bhaskara II, and Varâhamihira.

Check Your Progress – 1

Below are given the phases of the evolutionary process of disciplines. Arrange them in proper order.

The evolutionary process of disciplines might have gone through the following phases:

1. Formation of New Disciplines, breaking of disciplinary boundaries and emergence of more specialized new disciplines.
2. Specialization and fragmentation of Knowledge
3. Knowledge accumulation
4. Breaking of disciplinary boundaries and emergence of more specialised new disciplines
5. Formation of Disciplines
6. Diversification and further specialization of knowledge within the discipline

1.4.3.2. Formation of School Subjects

The history of school subjects of today is of recent origin. It has started around last few decades. This area of study has not been explored much and thus a very fertile area of research. This requires one to study the socio economic and political conditions of India at different times, which have significantly influenced the system of education and from which the present system of education, including the set of subjects has emerged. To understand the emergence of school subjects, we need to refer to number of sources like the study of school laws and decrees, external prescriptions to teachers and students form authorities, enforcement of subjects and pedagogic prescriptions. The 80s 'cultural trend' which believed that individual experiences being always the result of a particular social-political context, influenced this trend of looking at school practices as a resultant of socio-political contexts.

To know about the emergence of school subjects, first of all, it is necessary to trace the appearance/disappearance of subject/subjects, its rise and fall at different times, according to the documents. We need to verify the text books, its content, language and style etc which give number of clues to trace the formation of school subjects.

Research and writings by experts reveal that the existing pattern of subjects in majority of our schools today is the result of the historical and cultural phenomena through the years. The system of education, including the pattern of subjects taught in schools is highly influenced by different forces during the course of time.

In ancient India, schools were in the form of gurukuls, where number of subjects, both practical and theoretical in nature were taught according to the needs of students. These were traditional Hindu residential schools of learning. These were typically the houses of teachers or the monasteries. During Mughal rule, madrasas were introduced to educate the children of Muslim parents. We come to know from the records of British times that indigenous education was wide spread in 18^{th} century, with a school for every temple, mosque or village in most regions of the country. The subjects taught in these schools included reading, writing, art, theology, law, astronomy, ethics and medicine, science and religion.

Under the British rule in India, Christian missionaries from England and other countries established schools throughout the country. These schools marked the beginning of modern schooling in India and the subjects they prescribed became the bench mark for schools in India. Today, majority of schools follow the same model given by British.

This does not mean that Indians were not aware of different subjects to be taught in schools. There were well established subjects of Indian origin which were simultaneously taught in Indian schools, as mentioned above. These were closely related to the life of

students and useful for daily living. Developing Reading and writing skills in Indian languages (according to the linguistic background) was the focus of Indian educational institutions. Other subjects had deep support in their disciplines. These subjects were seriously taught in schools and colleges. Nalanda university, which was established in 5th century was offering education in well-established subjects like theology, logic, astronomy, metaphysics, medicine and philosophy. Takshila (800B.C) offered law, medicine and military science along with archery, hunting and elephant lore. Vikramashila (783 B C) had subjects like philosophy, grammar, Indian logic, metaphysics etc.

This theme, the formation of school subjects in India is very vast, and demands an in-depth study of the political, socio-cultural aspects of the country which have influenced the system of education of India. Make a thorough study of this subject to deduct apt findings.

Check Your Progress – 2

Below are given a few incomplete sentences. Complete them using appropriate answers.

1. In ancient India, schools were in the form of _____
2. Nalanda university, was offering subjects like _____, _____, _____,_____,and _____
3. Experts reveal that the existing pattern of subjects in majority of our schools today is the result of the _____
4. The schools which marked the beginning of modern schooling in India were started by _____

1.4.4. Let Us Summarize

- Knowledge is the starting point in the process of the evolution of discipline. This organized body of knowledge of a particular field was termed as 'discipline.
- 'When knowledge gets into the realm of academic discipline, its focus and scope get narrowed. Bringing knowledge under a discipline means, defining the boundaries of knowledge of different nature.
- There are number of good reasons to classify knowledge under different disciplines.
- The evolutionary process of disciplines might have gone through the following phases: Knowledge accumulation, Specialization and fragmentation of Knowledge, Formation of Disciplines, Diversification and further specialization

of knowledge within the discipline, Breaking of disciplinary boundaries and emergence of more specialised new disciplines, Formation of New Disciplines , breaking of disciplinary boundaries and emergence of more specialized new disciplines.

- Emergence of disciplines has a long history. In India, disciplines have developed since ancient times.
- School subjects have developed in India as a result of socio political influences.

1.4.5. Answers to Check Your Progress 1 and 2

Check Your Progress – 1

3,2,5,6,4, 1

Check Your Progress – 2

1. Gurukulas
2. theology, logic, astronomy, metaphysics, medicine and philosophy
3. historical and cultural phenomena
4. missionaries

1.4.6. Unit end Exercises

1. Explain how disciplines were emerged?
2. Describe the process of formation of school subjects in India

1.4.7. References

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Block - 1 : Introduction to Disciplines and School Subjects

Unit - 5 : Importance of School Subjects

Unit Structure

1.5.1. Learning Objectives

After learning through this unit, the student teacher will be able to;

- Express that need for studying school subjects;
- Explain the objectives of school subjects;
- Explain the uses of school subjects in general; and
- Explain the importance of different school subjects.

1.5.2 Introduction

It is education that raises us up above the other animals, the other creatures that crawl the earth; and it is the very breadth of education that empowers us. If we merely regard learning, studying, as the means to secure a certain institution accredited accolade, then we may have acquired some knowledge, but little humanity.

A good, broad education is an asset for a lifetime: it is not just a key to open the doors of various professions, but a social resource, enabling you to mix with many people. The

world itself is a more interesting place to the educated person. Where the uninitiated will just see the rocks and the sea, the learned will notice the wave cut platform, and the variegated influence of erosion on different stone formations. Education changes our eyes, lets us see things differently. A narrow education, merely serving ones chosen profession, narrows the very world. We should strive to be polymaths, studying a whole range of subjects! Schooling helps to achieve our goal of changing for good, to become human, to think differently than others. This will not help in vacuum. The learning of different subjects prepares us for different tasks. Let us understand in this unit, the importance and uses of studying different school subjects.

1.5.3 Learning Points and Learning Activities

1.5.3.1. Importance of School Subjects in general

Why should students learn the subjects that are taught in schools? This question is natural for every learner. As teachers it is our prime responsibility to know the need and importance of teaching my subject. Ask at least 5 teachers, the following questions and analyse their answers.

Why are you teaching the subject that you are teaching? What do you think are the advantages of that subject?

I have listened to many answers. 'Because I have to teach that', 'that is prescribed in the curriculum', 'we have to conduct examination', and many teachers do not think beyond this. The subjects are the vehicles which are intended to take us to our goal, our goals are clear, specific, and focused. Each subject in the curriculum has been introduced with a definite purpose that would serve the individual to lead a 'quality life'. The purpose of teaching subjects is beyond finishing portion prescribed or conducting examination and testing students. We may be able to reach our goals without conducting the regular examinations also, and this may be realised in the class room itself. Then what are the purposes of teaching or learning different school subject? Let us understand the advantages of learning school subjects. They are as follows:

Experts in the field of education have analysed the nature of different subjects and have found that the learning of a few subjects would help to reach our goals. With this knowledge they have prescribed the subjects that are meaningful in the context of school to

reach the goals of education. Let us see, what purposes these school subjects serve in the educational context.

- The school subjects equip the individual with the skills and competencies required to lead a quality life
- They promote the basic academic skills required for day to day living like communication, problem solving analytical thinking etc.
- They give an awareness about the neighbourhood in which the individual lives.
- They prepare students for the process of socialisation
- Learning of these subjects promote the values required to be developed by an individual in the social context, like love, co-operation, brotherhood, tolerance etc.
- The knowledge under different subjects make the individual appreciate people and nature around her/him
- The social behaviour of children is directed through the themes that are dealt under different subjects.
- The school subjects prepare children to develop nationalism, internationalism and other patriotic feelings.
- School subjects have connection with social structure, social relations and they have contributed in the process of cultural transmission too. Now it is being recognized that school subjects are important sources for studying about the society and problems in it.
- Studying school subjects are necessary to investigate the link between school subject knowledge and classroom pedagogy.
- School subjects are now being considered as cultural and historical phenomenon so it is necessary to study about them.
- One of the important reasons for studying school subjects is that they provide a clear picture of school knowledge and practices.
- Studying school subjects involves an understanding of the “theory of content” that is crucial for disclosing the educational potential embodied in the content.
- School subjects are aimed to maintain the academic culture and develop the intellectual capacity of students.

- School subjects are constructed for the primary purpose of maintaining and enhancing economic and social productivity by equipping future citizens with the requisite knowledge, skills, and capital. School subjects are created to provide students with meaningful learning experiences that might lead to liberation and cause social activity.
- School subjects are allowed for construction of knowledge and further provide students with rewarding experiences that contribute to their intellectual growth. The school curriculum encourages a learner-oriented approach to construct knowledge under school subject that allows students to learn according to their needs and interests in their chosen fields of study.
- The school subjects equip the students with general skills and learning abilities, essential for facing the challenges of globalisation and the knowledge-based economy.
- studying school subjects stands to offer a wide horizon for students to create and explore create new corridors leading to enlightenment.
- Studying school subjects helps us to analyses how school subjects are influenced by the society, culture and values of a nation.

Check Your Progress-1

Add any four more advantages of teaching school subject that you have experienced in your career

1.5.3.2. Importance of school subjects -Subject wise.

We teach many subjects in schools. Each subject has unique advantages. Some outcomes may be the combination of subjects, or some subjects may help to achieve and strengthen the set goals. Let us understand the importance of a few subjects taught in schools

Math:

Math is part and parcel of our time. We start our day with math. "oh! 'It is already 7', 'please give me half cup of coffee', ' I have to travel 8 k.m' 'I have to reach the school by 10 a.m' -in all these sentences we are using maths. We cannot live without math. 'Sir, I am sorry, I am late by half an hour' -these expressions demonstrate how we are living with math. Thus it helps to tell time.

It helps to maintain our finances. Balancing one's bank account, for example, is an important life skill that requires math in order to subtract balances. People who know math are therefore less likely to go into debt because they did not know how much money

they had versus how much money they spent. **Math helps us have better problem-solving skills.**

Math helps us think analytically and have better reasoning abilities. Analytical thinking refers to the ability to think critically about the world around us. Reasoning is our ability to think logically about a situation. Analytical and reasoning skills are important because they help us solve problems and look for solutions.

Math is used in practically every career in some way. Obviously, mathematicians and scientists rely on mathematical principles to do the most basic aspects of their work such as test hypotheses. While scientific careers famously involve math, they are not the only careers to do so. Even operating a cash register requires that one understands basic arithmetic. People working in a factory must be able to do mental arithmetic to keep track of the parts on the assembly line and must, in some cases, manipulate fabrication software utilizing geometric properties (such as the dimensions of a part) in order to build their products.

Math is all around us and helps us understand the world better. To live in a mathematically-driven world and not know math is like walking through an art museum with your eyes closed. Learning and appreciating math can help one to appreciate things that would not otherwise noticed about the world.

Science

Science education is the field concerned with sharing science content and process with individuals not traditionally considered part of the scientific community. Teaching science well can nurture curiosity, can satisfy some of that yearning to understand WHY. Having a methodology to turn our native curiosity into knowledge it gives us the **power** and possibility of invention, of finding solutions to problems.

A knowledge and love of science is the ultimate *equalizer,* the pathway to human rights and a better quality of life. Countries with strongly supported science programs are better off economically, have greater numbers of people creating new technologies.

Science studies can help a person develop and gain:

- Awareness of the world
- Increased intellectual capabilities
- Logical reasoning
- Critical thinking abilities
- Creating and testing hypotheses

- Creativity and discovery
- Discovering the beauty of the universe
- Opening doors in research
- Meeting others who enjoy science
- Following one's passions to contribute to society

With the knowledge of science, one can learn to think logically and solve a problem. It is this problem-solving skill, which is learnt in the early years that enables a person to solve problems. Communications, medicine, transportation, and almost everything we see around us are mainly present because individuals have used their knowledge of science to create real life applications. Knowledge in this subject also enables us to understand many other subjects better.

How to conserve natural resources

All aspects of the environment have a deep impact on our lives. Science helps to learn about how the earth functions, and how to make use of natural resources. It also teaches us how the lack of these resources affects living things, and how one can conserve these resources.

Science helps you us to learn about the various weather conditions, and helps us to distinguish between normal weather and dangerous weather. With this knowledge, you can stay alert about natural disasters or survive the disaster.

The processes and ideas of science are of great importance to everybody in three ways. The first is in their personal lives, for example so that they can validly identify the components of a healthy life- style. The second is in their civic lives, so that they take an informed part in social decisions, for example on future options for electricity supply. The third is in their economic lives, where they need to be able to respond positively to changes in the science-related aspects of their employment.

Science is everywhere. Science develops critical thinking. It motivates to ask critical questions and helps to proceed with analytical thinking and results in solving our problems. Every decision we make is based on these processes. We ask questions out of curiosity (what is the problem?), we construct hypothesis (may be this is the cause), we test the hypothesis (how to confirm the inferred cause?) test it with evidence and evaluate the result (Did the solution work?), and make future decisions based on that result. This is the product of science.

Social Sciences

Social Science is a branch of study which deals with human beings – their behaviour, growth and development, relationships, resources they use and the various institutions they require to function and carry on their life smoothly. For example – family, school, workplace, government, judiciary, recreation clubs, etc. All these aspects of life are inter-related and interdependent on one another. So whether one wants to become a doctor or an engineer or a chartered accountant, an artist or a teacher, we all have to live in a society, interact with individuals belonging to different cultural and socio- economic backgrounds, adapt to various situations and circumstances, and also adhere to certain societal norms in order to lead a peaceful and productive life.

The inclusion of Social Studies in the curriculum right from primary to secondary classes signifies the importance of the subject and the role it plays in a student's life. Social Studies is incorporated in the school curriculum through a combination of subjects like – History, Geography, Cultural Studies, Economics, Political Science, Sociology, Psychology, Anthropology, etc.

These subjects help children to develop-

Awareness of The World and Environment: Lessons in Social Studies related to topics like – My Family, My Neighbourhood, Community Helpers, Early Man, Indus Valley Civilization, Modern Period in Indian History, Indian Freedom Movement, etc teach students about the various to know about their locality and nation and the world. This knowledge enables the students to understand how the world and different societies have evolved, the important events that have occurred in the past, enduring ideas and eminent personalities that have created an impact and affected the lives of people both locally, nationally and globally. It also helps students to understand how different societies are structured, managed and governed. This in turn helps students to understand their place in the world.

Lessons such as – Our Earth, Solar System, Major Landforms, Water Resources, Natural Vegetation and Wildlife Resources, Natural Disasters, Disaster Management, Pollution, enable students to learn about – outer space, formation of different landforms; evolution of animals, flora, fauna and man, water bodies, available resources, importance of conservation and preservation, environmental impact on present life and future generations. This information helps students to eventually develop a holistic understanding of their environment and the interrelationship which exists between the natural and human habitats.

Social Sciences help to Develop Critical Thinking Abilities: Social Studies inculcate higher order thinking abilities and skills like – Comprehension, Application, Analysis, Evaluation and Synthesis, Creativity in students. Learning a variety of topics such as – Natural Resources, Water Resources, Transport, Communication, Caste System, Political Ideologies, Social Reformers, Our Cultures, United Nations, etc give students a chance to gain appropriate information and data in various contexts. The information gained allows students to make relevant observations, identify similarities and differences, make connections between related concepts, ideas and resources. Appropriate experiences further enhance the students' understanding about how different things and people affect their day to day lives. For example – in order to investigate poverty in the society, students require knowledge of subjects like – History, Economics and Politics. Students first have to gain information and comprehend ideas such as discrimination, resource allocation and political priorities. They then need to understand, analyse and evaluate the existing connections between those ideas and theories to make sense of how poverty affects certain populations in the country. This knowledge can be further put to use to foster creativity, if students are asked to think about ways or come up with new solutions and policies which they think can help reduce poverty. They could be given a chance to present their ideas in the form of debates, essays, role plays or class projects.

Helps to Enhance the Social Understanding Of Students: Different topics included in the Social Studies curriculum for various age groups like – Festivals of India, Different types of Families, Clothes We Wear, Food We Eat, Our Country, States of India, My Community, Socio-Religious Reforms, Challenging the Caste System – help students to observe, learn and understand human behaviour, values and attitudes and the interrelationships which exist among different people. They come to know about the different religions and cultures which exist in the world other than their own. They also learn about the societal strata and norms of society and the need of various governing bodies and other institutions. This in turn helps the students to develop a wider perspective of society and the human condition.

Furthermore, learning about the different religions, social and cultural beliefs, castes and creed, nationalities and ethnicity, values, languages, festivals, food and clothing, types of families, etc makes students aware that the society they live in, is diverse and multicultural and yet there is interdependence and inter-relatedness between different people, families, cultures, religions and countries. This helps students to recognize the benefits and challenges of living in a world with multiple cultures and ideologies. This awareness helps them to understand the importance of democracy, rights and freedoms and the fact that in order to live and coexist peacefully each and everyone needs to respect, trust and balance the various

opinions, values and attitudes, lifestyles, cultures and practices and ideologies existing in society.

Helps students to become better citizens: Subjects in Social Studies like Economics, Political Science and History educate students on Political Ideologies, Constitutional Laws, Citizenship, Rights and Duties, Morals and Virtues, Social Code of Conduct, thus making children aware of their roles and responsibilities particularly in relation to social and civic affairs. By providing relevant information and knowledge, skills and attitudes, the study of Social Science prepares students to grow up as active, responsible, and reflective members of society. It also teaches them to address societal and global concerns using literature, technology and other identifiable community resources.

In today's global economy and world, only being exposed to the immediate community is not ideal. Through social studies education, students get to learn about the vast array of people and cultures that make up the global community. By studying world populations from both a historical and sociological perspective, students will get a better understanding of themselves and how they fit into the greater world. Further, when they enter the workforce, students will be better equipped to compete in the international marketplace by having some understanding of different cultural norms.

Social studies classes help students understand the responsibilities that citizens—including themselves—have in their communities. Through social studies, students learn how all levels of government function and become familiar with the role that citizens play in shaping the legal and political landscapes. Students also gain the ability to compare and critically analyze different government styles.

Hence, the importance of Social Science as a subject in the school curriculum can be summarised as

- It helps to form efficient citizens of democracy
- It develops national view points
- It makes man duty bound
- It enlightens the path of progress and advancement
- It enhances the moral status of a society
- It helps to solve critical social problems
- It develops imagination, critical thinking among students.
- It clarifies the duties of citizens towards human society
- It develops desirable attitudes

- It develops human qualities
- It promotes appropriate social behaviour
- It develops the power of reasoning
- It develops the feeling of brotherhood
- It helps to mould the individual according to the needs of the environment
- It develops good habits and social efficiency
- It socialises the students
- It develops social and moral values

Languages

You have already studied the importance of language in the school curriculum, under course 4. Language is an evitable part of life as well as curriculum.

The language is always believed to play a central role in learning. No matter what the subject area, students assimilate new concepts when they listen, talk, read and write about what they are learning. Speaking and writing reflects the thinking process that is taking place. Students learn in language, therefore if their language is weak, so is their learning.

Language occupies a key position in the School curriculum. More so at the primary stage, because it is at this stage that the child is receiving formal instruction in language for the first time. Before that, he/she was learning language in an informal way primarily in the home. And since it is through language that the child learns all the other subjects at school, this formal instruction in language leads to his/her learning in other curricular areas as well. Further, apart from its importance as a medium of learning other subjects in schools, language also helps the child in communication and self-expression. As children grow up, they need to express their ideas, feeling and opinions. This self-expression is the basis of the growth of the child's self, his/her personality and individuality. Thus, language helps the learners-

i. in learning their school subjects,

ii. in communicating with others, both at school and outside,

iii. in their day-to-day life situations and

iv. in the learning of concept in other areas. Proper language learning means learning of the four basic language skills i.e. skills of listening, speaking, reading and writing. language learning has been shown to greatly enhance student performance across the curriculum. Language learning has been shown to improve a student's cognitive function, including, but not limited to enhancing problem solving skills, improved

verbal and spatial abilities, improved memory function, enhancing creative thinking capacity.

Hence, the importance and role of language in school curriculum can be summarised as follows:

- It develops the basic skills required in life. They are speaking, reading, writing.
- It helps to develop concepts.
- It is a means of thinking and hence promotes thinking.It is a component of higher order thinking skills.
- It is the most important tool in daily living
- It is the basic means to understand different subjects in the school curriculum
- It is tool for making meaning
- It is a filter for assessing students' outcome

Check Your Progress – 2

You have studied the importance of different school subjects like math, science, social science and language. You are teaching one of these subjects. Mention the outcome you have realised through the subject that you have taught. It may include what has been discussed already or may be something not discussed so far. Quote illustrations and examples

1.5.4. Let us Summarise

- The subjects taught in schools are of great importance because it helps to achieve the objectives of education, in multiple ways. Some of the aspects which make learning school subjects inevitable for students are, the school subjects equip the individual with the skills and competencies required to lead a quality life, they promote the basic academic skills required for day to day living like communication, problem solving analytical thinking , they give an awareness about the neighbourhood in which the individual lives.
- Each of the subject taught in school like math, science, language and social science helps to achieve specific objectives. Each contribute in its own way

1.5.5. Answer to Check Your Progress: 1and 2

Check Your Progress-1

Share your experiences with your colleagues.

Check Your Progress – 2

Share your experiences with your colleagues.

1.5.6. Unit end Exercises

2. Explain the importance of school subjects.
3. Explain the role of math, science, social science and language in the school curriculum.

1.5.7. References

1. Subjects and academic disciplines. In A. Luke, A.Woods & K.Weir(Eds.), Curriculum, Syllabus design and equity: A primer and model. London: Routledge Publication.
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Block - 1 : Introduction to Disciplines and School Subjects

Unit - 6 : Nature and Content of School Subjects

Unit Structure

1.6.1. Learning Objectives

After learning through this unit, the student teacher will be able to;

- Explain the content of school subjects - Languages, Math and Social Science
- Explain the content of school subjects – Science, Physical and Health Education and Fine arts
- Explain the content of school subjects - Peace Education, Work Education and Value Education
- Explain the processes involved to understand the subjects based on different disciplines.

1.6.2. Introduction

Experts in the field of school subjects have suggested that school subjects are not given, nor are they direct translations of academic disciplines. They can have different and variable relationships to academic disciplines and applied fields. School subjects are human constructions in response to social, economic, cultural, political, and educational realities and needs. They are "uniquely purpose – built educational enterprises, designed with and through educational imagination towards educative ends."The formation of a school subject entails a theory of content –a special way of selecting, framing, and translating content for educational purposes. Knowing the content of a school subject thus entails knowing more than the content itself; it entails an understanding of the theory of content that is crucial for disclosing the educational potential embodied in the content. Hence, in the present unit, let us understand the content that forms each of the school subject.

1.6.3. Learning Points and Learning Activities

1.6.3.1. Major disciplines with discipline specific processes to acquire knowledge

It is not enough if teachers know the content of different school subjects. It is important to know the processes which help the students to acquire the content of different subjects. Indeed, these are the processes through which the knowledge has been evolved. If a teacher of science does not understand the processes of science, i.e. the processes which evolve science knowledge, the teacher cannot decide the pedagogy of teaching science content. These processes tell us the ways in which science content or knowledge has been evolved. The same is true in relation to other subjects also. Therefore, let us learn the processes of the emergence of knowledge in different disciplines through which the school subjects are derived and understand that these are the pedagogical processes for respective subjects.

Processes of 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

Processes of Social Science:

- 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

Processes of Math

- 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.

Processes of Language

- 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 metacognitive skills

Check Your Progress -1

Classify the following processes according to the processes of different subjects(Denote by S, L, SS and M: S-Science, L-Language, SS-Social Science, M-Math)

1. Developing inquiry on observable phenomenon
2. Connecting mathematical principles with the daily life of the children
3. Making the children communicate themselves in different situations

4. Engaging in social inquiry, exploration, and understanding cross cultural and cross-sectional dimensions of the society
5. Making children think rationally, and do thing inductively or deductively
6. Critical observation of the natural phenomenon
7. Critical observation of the social phenomenon
8. Establishing linking and correlating the scientific ideas with physical happenings
9. Understanding social, cultural, and economic diversities of the society
10. Developing logical reasoning and make the children to solve mathematical problems
11. Developing the skills of listening, speaking, reading and writing
12. Understanding and reflecting on literature

1.6.3.2. Content of School Subjects: Science, Social Science Language and Math

With this background of processes let us understand the content of different school subjects.

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
- 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

Social Science:

- Citizenship education
- Reflective socio-political enquiry
- Informed social criticism and ethical decision making to social issues
- Social dynamism, mobility and transformation
- 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

Math

Numbers, four operation, simplification, money, metric system, reading clock, basic Geometrical concept.

Number Fractions, decimal fraction Money, measurement Idea of simple Geometric term/concept/properties Unitary method, simple interest Ratio proportion

General Mathematics Number system Sets (basic ideas) Algebra- expression, equations, factors Geometry Mensuration – theorem, properties, Discount Shares Graphs Compound interest Banking Introduction to Trigonometry Statistics Advance Mathematics consists of: Sets Fraction Irrational number, complex number Indices and logarithm Inequality and inequation Quadratic equation Geometry- proofs and application

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
- Socio-cultural issues in language learning
- Construction of language knowledge during the early years of life
- Age wise language development.
- Multilingualism 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

Check Your Progress-2

You have taught a few subjects by now. Select one topic of your choice and recall the pedagogical processes you have employed and match those with the actual processes you need to employ in teaching those topics. Make a plan to teach your next topics using the pedagogical processes described in first part of this unit.

1.6.3.3. Content of School Subjects: Physical Education and Fine arts

Physical Education

- Human Body
- Movement and awareness
- Food and Nutrition
- Safety and Security
- Our environment
- Social health and Sports services

- Sports skills and abilities
- Physical fitness
- Orientation to sports skills
- Orientation to physical education and sports education.

Fine arts Education

- Art education programme should comprise, handling of the materials for drawing, painting, collage, clay modelling and construction of puppets; creating artistic things by free expression method, learn simple concepts of visual arts, knowledge of works of well-known artists both contemporary as well as historical etc. prepare posters, placards and invitation cards related to celebrations of national days like Republic Day, Independence Day, etc.
- Drawing, painting and sculpture/ clay modelling
- Activities of dance, music, drama and craft
- Drawing: contour line, rendering, sketching, value, shading, hatching, crosshatching, stippling, one-point perspective
- Painting: wet-on-wet, wet-on-dry, sponge, wash, watercolour techniques of sponging Printmaking: relief, frottage (rubbing)
- Ceramics: pinch and pulled forms, slab, drape mold, coil, surface decoration techniques
- Sculpture /architecture: carving, additive, subtractive, modelling, constructing
- Fibres: pulling threads, weaving, stitchery, tying and wrapping techniques, braiding, basketry
- Mixed media: collage, bas-relief
- Two Dimensional or Pictorial arts: • Drawing and Painting • Collage making • Print making • Photography and computer Graphics (Wherever possible) • Rangoli/ Mandna/ Wall painting (State/region specific traditional art forms)
- Three Dimensional Arts • Sculpture (using locally available materials) • Clay modelling • Terracotta • Carving and relief work • Paper Mache • Mask making • Construction (using waste materials) • Pottery (If possible) • Installation

Peace Education

- Peace concepts and concerns: Knowing peace, choosing peace, facts about peace, barriers of peace, building blocks of peace; peace within self, Peace at different levels, Harmony with nature.

- Understanding and dealing with conflict, sources of conflicts, analysing conflicts, dealing with conflicts constructively, related strategies and skills
- Humanism: living with human relationships, understanding the concept of 'being human'. Setting the goals of life with humanist philosophy, strategies to achieve the goals; Creating a human atmosphere.
- Towards understanding and enabling self: the self and others, overcoming biases and prejudices, Self-reflection and listening to the inner voice

Value Education

- Values, need to have a value-based life, developing universal human values
- Values derived from the Indian Constitution
- Developing problem solving attitude towards contemporary challenges, holistic development of the individual, responsible attitude towards self and society, nurturing ethical approach, collaborative skills and respect for human rights;
- Positive thinking, compassion, discovering inner peace, learning to live together, respecting human dignity, being true self, critical thinking, resolving conflict non-violently, building peace in the community and caring for the planet.

Check Your Progress-3

Make a study of the syllabus of any 3 schools, of any one subject (physical education, art education and peace education) mentioned in this unit, and deduct the content followed for the subject and compare the same with the content suggested above. Give your observations.

1.6.4. Let us Summarise

- The subjects taught in our schools is unique in its nature.
- The objective of each subject is different
- It is important to know the content and nature of each subject
- The nature of each subject decides the pedagogic processes. Hence it is important to know the nature of each subject which can be understood by the underlying processes.
- Since the nature of each subject is different, its content and underlying pedagogic processes also are different.

1.6.5. Answer to Check Your Progress 1, 2 and 3

Check Your Progress -1

S: 1,6,8

S.S:4,7,9

M:2,5,10

L: 3,11,12

Check Your Progress-2

Make a record of your observations for your professional growth.

Check Your Progress-3

Share your findings with your colleagues and improve your school practices.

1.6.6. Unit end Exercises

1. Explain the content of math, science and social science at school level
2. Explain the content of physical education, art education and peace education at school level.

1.6.7. References

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Block - 2 : Classification and Teaching Across Disciplines

Unit - 1 : Classification of Academic Disciplines

Unit Structure

2.1.1. Learning Objectives

After learning through this Unit, the student teachers will be able to

- Classify the Academic Disciplines
- Explain the criteria of classification of Academic Disciplines
- Describe Biglan's classification of Academic Disciplines
- Explain the Biglan-Becher typology

2.1.1. Introduction

You have already studied about the meaning of 'Discipline' and 'Academic Discipline' in the first block of this course. Did you ever think of how these disciplines come into existence? Do you think knowledge emerged as we study and teach today in our schools? No! Knowledge neither emerged nor developed in the past as we see it today. There was a time when knowledge was not classified as physics, chemistry, history, etc. In the past, Knowledge was considered under a single discipline known as 'Philosophy'. At the time of geographical invasions, people could discover more and more places, and as a result their knowledge got widened. They found that knowledge is so vast, that one person in his life time cannot learn everything and therefore only a part of it can be studied. Hence, they started analysing knowledge in order to classify it. Thus, the single and all-encompassing

knowledge started getting classified under different disciplines. You are familiar about the degree called 'Doctor of Philosophy'. This degree will be given in disciplines like Mathematics, History, Languages and other subjects also. This is because all the subjects were studied under a single discipline 'Philosophy'. This story of the classification of the 'whole knowledge' is very interesting. Let us study, in the present Unit, how knowledge was classified, what are the different classifications and the criteria for classification.

2.1. 3. Learning Points and Learning Activities

2.1.3.1. Need and Importance of Classification of Disciplines

Before discussing about how academic disciplines have been classified, let us understand the reasons for classification.

Classification is a very common and natural activity. Whenever we see some object, or person or place, we categorise them with related previous knowledge. It helps us in number of ways. It helps us to recall and retrieve. Hence, people in the past realised the advantages of classifying knowledge and made attempts for it.

Classifications or Typologies are important because

- They help to bring order to a chaotic world. Just imagine, you have a bulk of information and you want to make a study of that. What will you do first? You will categorise the information under different headings to comprehend better, or to make more meaning out of it.
- Typologies allow scholars to group things under few categories that assist in grasping relationships and trends. For example, if you have information about different animals, and if you classify them on the basis of some criteria, it will help you to know the differences and similarities among them. This will help you to understand the relationship among different aspects like colour of the animal and its food, size, geographical condition, strength, mobility styles etc.
- Preliminary classifications of new sets of objects or phenomena can lead to the detection of previously undiscovered patterns and to the generation of theory to be tested. The more you study based on the classification, better will be your understanding. You understand the objects or phenomena in depth, collect more information, go for more observation leading to formulate theories. Many of the theories have been put forward based on typological studies.
- Makes our study simple and clear
- Allows to gather more details about specific aspect.
- Makes our path of study easy.
- Allows for the investigation of further knowledge through the processes of compare, contrast, and application of observed knowledge.
- In both scientific and non-scientific fields, as in daily life, classification is a common activity. It is employed with the purpose of getting more clarity of

content. There is no one general classification of academic disciplines. Different researchers take different bases of their organizations. However, the majority of them have some identical features.

Check Your Progress – 1

Identify the correct answers using "" mark.

Classifications are important because they _____

1. allow for the investigation of further knowledge.
2. assist in grasping relationships and trends.
3. allow to gather more details about specific aspect.
4. lead to the detection of previously undiscovered patterns.
5. allow for understanding of practical issues.
6. make evaluation of content easy.

2.1.3.2. Different Classifications of Academic Disciplines:

The academic disciplines have been classified by different people at different times with different criteria. Let us understand such three classifications and they are as follows:

a) The Approximate Classification of Academic Disciplines

b) Aristotle's Classification

c) Biglan's (1970) Classification

d) Biglan-Becher typology

a) The Approximate Classification of Academic Disciplines

In approximate classification of academic disciplines, disciplines are arranged into following subgroups:

1. Fine Arts: This include such disciplines as Art, Music, Theatre, Visual Arts, and Performing Arts. The task of Fine Arts is to evaluate the human activity from the aesthetic point of view.
2. Humanities which are History, Language, Literature, Philosophy, and Religion etc. This subgroup also has its own task which is to comprehend a human creature as a unique phenomenon.
3. Social Sciences are Anthropology, Archaeology, Area Studies, Cultural and Ethnic Studies, Economics, Gender and Sexuality Studies, Geography, Political Science, Psychology, Sociology. The aim of this group of academic disciplines is to investigate social role of a human and the results of human activities. Social Sciences are divided into General and Concrete Sciences. General disciplines explore general human activity, and Concrete Sciences investigate humanactivities in a concrete situation.

4. Sciences include Chemistry, Astronomy, Botany, Biology, and physics etc. The task of this group is to explore the nature.
5. Mathematics covers such disciplines as Computer Sciences, Logic, Mathematics, and Statistics. The aim of this branch of knowledge is to explore and systemize abstract notions and relations between them.

b) Aristotle's Classification

Aristotle divides the disciplines into three classes, each has different aim and each requires special kinds of subject matter and special competence:

Theoretical: The aim of the theoretical is to know or to understand. Theoretical disciplines, such as mathematics and the natural sciences require investigators who are able to reason logically, to deal with abstractions, to build comprehensive theories; and the objects of study must possess at least relative permanence and uniformity. Thus, it is that, say, physics deals not with singular facts (particular events) but with general facts (invariant associations).

Practical: The aim of practical is to do. In contrast to the theoretical discipline, the practical disciplines are concerned with subject matter capable of change or alternation. Such subject matters, for example, as human character and social institutions have the necessary characteristics. The chief practical disciplines for Aristotle were ethics, politics, and education. The practitioner obviously needs certain skills and abilities that differ from, or go beyond those needed by one undertaking theoretical investigations.

Productive: The aim of the productive is to make or create. The productive disciplines, such as engineering, fine arts, and applied arts, require material that is even more malleable and skills that are more specialized and distinctive. Aristotle's classification is still relevant. Beyond a few traditional academic disciplines, the majority of disciplines in contemporary institutions of higher learning are applied, dynamic, and relatively young- such as management, information technology, interior design, or dental hygiene.

c) Biglin's (1970) Classification of Academic Disciplines

In the early 1970s Anthony Biglin carried out a study to investigate the faculty's judgment about similarities and differences between several academic fields. These perceptions were classified as

i. Pure vs applied

ii. Hard vs soft (or paradigmatic vs non-paradigmatic disciplines)

iii. Concerned with life systems vs those not concerned with life systems.

i. Pure vs applied:

Pure Disciplines: Pure discipline is studying a discipline purely for the sake of knowledge and not for its application. For example, Mathematics is a Pure Discipline. In Mathematics, we solve problems, find facts and answer questions that do not depend on the world around

us, but on the rules of Mathematics itself. That is the reason why some theorems and rules appear vague to us and we cannot understand its application. The research outcomes in Mathematics add to the body of knowledge in Mathematics, not every knowledge can be applied to the world around us directly. Hence, pure disciplines refer to those disciplines that tend towards fundamental research. There is systematic observation of phenomena solely for discovering unknown facts which may develop into theories. The product of these disciplines is some kind of new knowledge. Simply put a pure discipline is a discipline that involves study purely for the sake of knowledge and not for its application. Some examples are Pure Physics, Pure Chemistry, and Pure History and so on.

Applied Disciplines: Applied disciplines as the phrase indicates it relates existing knowledge to real world situations. These disciplines make significant contributions to the world by articulating the theoretical foundations in their field of study. The Applied Disciplines use knowledge from one or more disciplines as its sole purpose is Application to solve problems related to the world around us. For example, Human Resource Development is an applied discipline that draws heavily from pure disciplines like Psychology and Sociology. Engineering is an applied science dependent on the pure sciences of Mathematics and Physics. Similarly, in Education we draw knowledge from the foundation subjects namely, Philosophy, Psychology, Sociology and History and focus our attention on applying the knowledge to the field of Education. Hence, Education is an Applied Discipline.

ii. Hard vs Soft (or paradigmatic vs non paradigmatic disciplines)

Hard disciplines: Some Disciplines like Physics, Engineering, Computing and Chemistry etc. tend to use quantitative data, which tend to be predictive and use experimental methods, are called as hard disciplines. These hard Disciplines use experimental methods to build their repository of knowledge. Braxton (1995) represents the hard disciplines as being characterized by greater concern for career development and cognitive goals (such as the learning of facts and concepts).

Soft Disciplines: Soft disciplines are those disciplines that rely on qualitative data. They generally do not use experimental methods and hence cannot make conclusive predictions concerning the future. Examples of soft disciplines are Languages, Law, Anthropology and Education. The soft disciplines as being characterized by greater concern for general education development, character development, critical thinking and 'scholarly' activities (such as the reading of research articles)

iii. Concerned with life systems vs those not concerned with life systems.

The third classification of Academic Disciplines given by Biglin (1970) is concerned with life systems and those not concerned with life systems.

Academic Disciplines like Biology and Psychology that deal with life systems or living beings are classified into one group and Academic Disciplines like Physics, Mathematics, Geology that deal with inanimate objects are classified into another category.

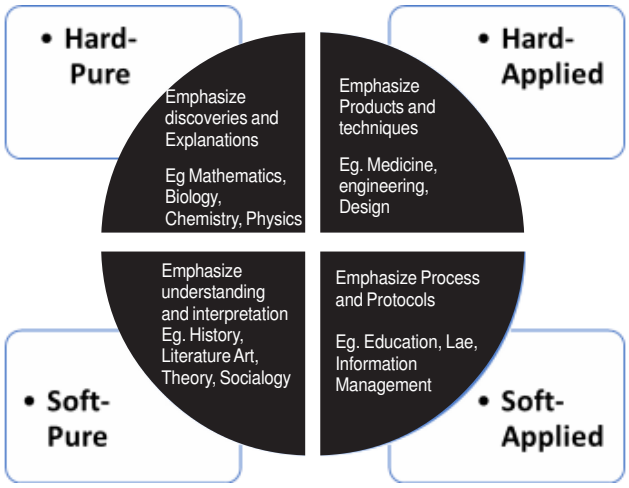
Emphasis of Academic Disciplines as Knowledge integration and application

Further, a study by Smart and Ethington (1995) reports the opinions on the goals of undergraduate education from over 4000 university faculty members who regularly taught undergraduate students. The conclusions were that soft and applied disciplines place greater emphasis on knowledge acquisition, and hard disciplines have more concern for knowledge application. Knowledge integration and application were both perceived to be more important in the applied disciplines than in the pure.

d) Biglan-Becher typology

While Biglan's work concentrated on the cognitive dimension of disciplines, Becher in 1989 called attention to the **social dimensions** of academic disciplines. From this emerged the **Biglan-Becher typology** of academic disciplines. According to this typology, four main types of groups are possible.

1. Hard and Pure disciplines
2. Hard and Applied disciplines
3. Soft and Pure disciplines
4. Soft and Applied disciplines



Hard-Pure disciplines involve general areas of human understanding and are clustered around limited number of problems. The nature of knowledge in these disciplines is cumulative and concerned with universal phenomena. The result of such knowledge is discovery of something new or expansion of already existing knowledge. Just like a crystal grows as more and more molecules add on to it, so is it in case of this group of disciplines. As new knowledge keeps adding, the older form of knowledge is enhanced. For example,

consider the knowledge about an atom. As research on the atom progressed, our knowledge about atoms made incremental progress. The relationship between the knowledge seeker and knowledge is unbiased and very objective. There are very definite criteria to verify knowledge in such disciplines. There is a high degree of consensus over significant questions. For example if two scientists are studying the effect of temperature on the states of matter, their results will be similar no matter which parts of the world they perform their experiments in. Academic communities in hard-pure disciplines are well organized, their work is quite competitive and publication rates are high.

Hard-Applied Disciplines are involved in purposive work. The emphasis is on application of theories resulting in creating techniques and products. These disciplines are practical in nature and are concerned with solving problems, addressing challenges and mastering the environment around us. The focus is on application and hence heuristic approaches find more importance in such disciplines. They use both quantitative and qualitative approaches. The criteria for judging the product of such disciplines are functional. Such disciplines result in new techniques and products being created. Engineering, for example, is a hard-applied discipline which draws from Mathematics, Physics and Chemistry. Clinical Medicine is a hard-applied discipline dependent upon Biology and Chemistry. The ethos in such disciplines is entrepreneurial and dominated by professional values. Patents are submitted for publication.

Soft-Pure Disciplines stress on understanding and interpretation of phenomena. Knowledge in these disciplines is reiterative which means there may be repetition of knowledge when examined in different situations. These disciplines are concerned with particular happenings rather than general occurrences. Unlike hard sciences, here data is qualitative. The researcher and knowledge share a personal relationship. There can be different views regarding what verification of data. Subjectivity can be high when interpretations are made. There is no definiteness as to what significant questions are to be answered. Anthropology and History are some examples of disciplines in this type. The academic communities of such disciplines tend to be less structured compared to those from hard-pure disciplines. Publication rate is also lower. It is interesting to note that while a discipline like Sociology is a soft-pure discipline, Sociometric, a subfield of Sociology, is hard-pure.

Soft-Applied Disciplines emphasize processes and protocols. These are functional and utilitarian in nature. They are concerned with the enhancement of professional practice. Often their status is uncertain. They also appear to be dominated by intellectual fashions. They use a mix of qualitative and quantitative data for their growth. Case studies form an important tool in such disciplines. Law and Education are examples of soft-applied disciplines. Education depends upon other soft disciplines like Psychology, Sociology, and Philosophy. Publication rates in these disciplines are low.

Check your Progress-2

Below are given incomplete sentences. Complete them using appropriate answers.

1. Professionals classified the disciplines on the basis of _____
   a. Content
   b. Nature
   c. Properties
   d. Similarities
2. Pure discipline is a discipline that involves study for_____
   a) Purely Knowledge sake
   b) Purely Application sake
   c) Knowledge and Application sake
   d) Neither Knowledge nor Application sake
3. The sole purpose of Applied disciplinesis _____
   a) To add to the body of knowledge
   b) To apply existing knowledge to real world situations
   c) Both a & b
   d) To draw knowledge from one or more disciplines
4. Nature of knowledge in Hard-Pure disciplines _____
   a) cumulative and concerned with universal phenomena
   b) application of theories
   c) concerned with particular happenings
   d) utilitarian in nature
5. Hard discipline tends to use_____
   a) Qualitative data.
   b) Quantitative data
   c) Both qualitative and quantitative data
   d) Neither Quantitative nor Qualitative
6. Soft disciplines use_____
   a) Qualitative data.
   b) Quantitative data
   c) Both qualitative and quantitative data
   d) Neither Quantitative nor Qualitative
7. Nature of knowledge in Hard-Applied Disciplines_____
   a) cumulative and concerned with universal phenomena
   b) application of theories

c) concerned with particular happenings

d) utilitarian in nature

8. Nature of knowledge in Soft-Pure Disciplines_____

a) cumulative and concerned with universal phenomena

b) on application of theories

c) concerned with particular happenings

d) utilitarian in nature

1. Nature of knowledge in Soft-Applied Disciplines_____

a) cumulative and concerned with universal phenomena

b) on application of theories

c) concerned with particular happenings

d) utilitarian in nature

2.1.4. Let us Summarise

- Classifications or Typologies are important because of number of reasons like they bring order, assist to grasp relationships, lead to the detection of previously undiscovered patterns and to the generation of theory, Makes our study simple and clear, allows to gather more details about specific aspect, makes our path of study easy, allows for the investigation of further knowledge through the processes of compare, contrast, and application of observed knowledge.
- The academic disciplines have been classified by different people at different times with different criteria. Some of the classifications are, the Approximate Classification of Academic Disciplines, Aristotle's Classification, Biglan's (1970) Classification and Biglan-Becher typology.
- There is no typology of academic disciplines that is complete and final.

2.1.5 Answers to 'Check Your Progress'

Check Your Progress – 1

1 to 4 - ""

Check Your Progress – 2

1-a, 2-a, 3-b, 4-a, 5-b, 6-b, 7-b, 8-c, 9-d

2.1.6 Unit -end Exercises

1. Explain the Classification of Academic Disciplines.
2. Explain any two classifications of academic disciplines.

2.1.7 References

1. Academic Disciplines: Disciplines and the Structure of Higher Education, Discipline Classification Systems, Discipline Differences- https://education.stateuniversity.com/pages/1723/Academic-Disciplines.html #targetText= Discipline%20is%20 defined%20by%20the, academic%20 world%20inhabited%20by%20scholars.
2. Outline of academic disciplines: https://en.wikipedia.org/wiki/Outline_of_academic_disciplines
3. What are Academic Disciplines?: http://eprints.ncrm.ac.uk/783/1/what_are_academic_disciplines.pdf

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Block - 2 : Classification and Teaching Across Disciplines

Unit - 2 : Interdisciplinary and Multi-Disciplinary Teaching and Learning

Unit Structure

2.2.1. Learning Objectives

After learning through this Unit, the student teachers will be able to –

- Explain the Meaning of Interdisciplinary teaching and learning
- List out the Characteristics of interdisciplinary learning
- Explain theconcept of Multidisciplinary learning
- List out the Characteristics of Multidisciplinary learning
- Differentiate between Interdisciplinary and Multidisciplinary Learning
- Justify Significance of Interdisciplinary learning and Multidisciplinary learning in education
- Enlist the role of the Institution in organizing interdisciplinary and multidisciplinary learning
- Illustrate the Strategies to Promote Interdisciplinary Learning

2.2. 2. Introduction

In the previous unit you have already studied about the meaning of Academic Discipline and the basis of its classification. Have you ever realised, while learning one discipline the knowledge of other discipline becomes helpful or what you have learnt in one discipline is linked to what you are learning in other discipline? There are two approaches we can observe when we try to link knowledge from different disciplines, they are Interdisciplinary and Multidisciplinary approaches of Learning. Two metaphors have been used by Moti Nissani to illustrate the concepts of interdisciplinary and multidisciplinary approaches to learning. Multidisciplinary approach is like a bowl of mixed fruit, each fruit representing a single discipline. On the other hand, interdisciplinary learning is more like a 'smoothie' which is a blend of fruits so well blended into one another that the original distinctive flavour of each fruit is no longer recognizable. Multidisciplinarity refers to the placing side by side of insights from two or more disciplines. Here different disciplines help to develop a detailed understanding of the topic being studied. These disciplines however make separate contributions unlike interdisciplinary learning where an interdependent relationship is emphasized. No integration between these disciplines is expected in a multidisciplinary approach.

2.2.3. Learning Points and Learning Activities

2.2.3.1. Interdisciplinary and Multi-Disciplinary Teaching and Learning: Meaning, significance and Nature.

Interdisciplinary and multidisciplinary Teaching and Learning:

As we know the traditional approach to learning organizes content into compartments based on subject matter boundaries. In interdisciplinary and multidisciplinary approaches, content revolves around questions, themes, problems and projects. Interdisciplinary and multidisciplinary approaches make educational experiences authentic. Curricula that reflect real life are more meaningful to students. Students are able to see natural and logical connections that cut across content areas.

Meaning of Interdisciplinary teaching and learning

Heidi Jacobs defines interdisciplinary learning as "a knowledge view and curriculum approach that consciously applies methodology and language from more than one discipline to examine a central theme, issue, problem, topic, or experience".

Keith Barto and Lynn Smith suggest that interdisciplinary learning is especially important in the early grades so as to "provide authentic experiences in more than one content area, offer a range of learning experiences for students, and give students choices in the projects they pursue and the ways they demonstrate their learning."

Barton and Smith explain that interdisciplinary units enable teachers to use classroom time more efficiently and address content in depth, while giving students the opportunity to see the relationship between content areas and engage in authentic tasks.

Academic disciplines are good platforms to impart and generate new knowledge. But interdisciplinary learning is required to solve complex problems and gain an understanding of issues as it may be beyond the ability of one single discipline to address an issue comprehensively or resolve a problem effectively.

To summarise, Interdisciplinary Learning is a process of answering a question, solving a problem, or addressing a topic that is too broad or complex to be dealt with adequately by a single discipline, and draws on the disciplines with the goal of integrating their insights to construct a more comprehensive understanding.

There can be two distinct approaches to interdisciplinary:

i. The integrationist approach, which considers a process by which ideas, information, methods and tools from two or more disciplines are connected, synthesized or blended.

ii. The generalist approach where there is a dialogue or interaction between two or more disciplines but the disciplines are not blended into one another. Some experts consider this approach multidisciplinary.

Characteristics of Interdisciplinary learning

1. Interdisciplinary learning **draws from more than one discipline.**

   For example when studying about 'War', we may draw from History (to study about wars that have occurred), Economics (to study economic causes and effects of war), Geography (to study which regions have been afflicted by war), Literature (to see how poets and writers express events related to war), Political Science (to see how Political affairs determine events related to wars). Various disciplines contribute towards interdisciplinary learning. The content drawn from each discipline enables the learner to understand varied perspectives of the issue being investigated.

2. Interdisciplinary learning must have a **definite focus** which is beyond the sphere of a single discipline. In interdisciplinary learning, the focus is such that a single sphere cannot give a complete understanding of the same. For example, the topic 'Health' is not just related to Science. It will include perspectives from Geography (as climate may be related to health) and Economics (as some diseases are related to economic status).

3. Interdisciplinary learning is **pragmatic in approach** meaning it should promote new understanding or a new solution about the issue being investigated. Students using interdisciplinary approach to learn develop a problem-solving attitude.

4. Interdisciplinary learning is a **dialectical process** requiring team work between people from more than one discipline. There is logical discussion of ideas and opinions that draw from different disciplines. To gain understanding of an issue from varied perspectives, one may need to confer with people from various fields and this help to come to logical and more objective conclusions about the issue being investigated.

5. Interdisciplinary learning is **integrative**. Students and teachers integrate disciplinary perspectives deliberately and productively. Elements of different disciplines (knowledge, understanding and skills) are put into a productive relationship with one another, and connections made help students to accomplish a new, deeper and broader understanding of the topic under study.

Allen Repko, Director of Interdisciplinary Programmes at University of Texas identifies **four cognitive abilities** fostered by interdisciplinary learning.

a) Perspective Taking Techniques: The capacity to understand multiple viewpoints on a given topic is improved. Students develop an appreciation of the differences between disciplines and especially their perspectives on how to approach a problem.

b) Development of structural knowledge: Problem solving requires declarative knowledge and procedural knowledge. Declarative knowledge is factual information related to the problem and procedural knowledge is information about the process involved. Both these are enhanced due to use of interdisciplinary learning.

c) Integration of conflicting insights: Variety of ideas from different disciplines are incorporated due to interdisciplinary approach. Rather than use approaches from a single discipline, students are encouraged to look out for alternatives from different disciplines and hence insights are enriched.

d) Interdisciplinary understanding increases and hence holistic thinking occurs. It promotes higher order thinking skills such as creativity, critical and systems thinking, synthesis, evaluation and analysis.

Interdisciplinary Learning and contemporary education

There is much emphasis on interdisciplinary learning in the 21st century. The International Baccalaureate Middle Years Programme (MYP) incorporates interdisciplinary learning supports students to understand bodies of knowledge from two or more disciplines or subject groups, in order to integrate them and create new understanding. Students demonstrate interdisciplinary understanding when they bring together concepts, methods,

or forms of communication from two or more disciplines or established areas of expertise so that they can explain a phenomenon, solve a problem, create a product, or raise a new question in ways that would have been unlikely through a single discipline.

The National Curriculum Framework 2005 proposes five guiding principles for curriculum development:(i) connecting knowledge to life outside the school; (ii) ensuring that learning shifts away from rote methods; (iii) enriching the curriculum so that it goes beyond textbooks; (iv) making examinations more flexible and integrating them with classroom life; and (v) nurturing an overriding identity informed by caring concerns within the democratic polity of our country. These principles are enshrined in the basics of interdisciplinary learning. The executive summary of this landmark document categorically states 'The NCF recommends the softening of subject boundaries so that children can get a taste of integrated knowledge and the joy of understanding'. A careful scrutiny of the document shows that it supports interdisciplinary learning. One comes across statements like 'For an enabling curriculum, certain themes that facilitate interdisciplinary thinking need to be incorporated'.

Here is an example of how Interdisciplinary learning is visualized for the topic 'Migration'.

<table>
<tr><td colspan="2">Issue being investigated
Migration</td><td>Level
Secondary Level (Class IX or X)</td></tr>
<tr><td colspan="3">Disciplinary Understandings</td></tr>
<tr><td>History</td><td>Geography</td><td>Economics</td></tr>
<tr><td>Students explore the trends of migration in different eras and different nations.</td><td>Students explore patterns of migration, reasons for migration and types of migration (migration within a nation and out of the nation)</td><td>Students study how migration has affected livelihoods, population. They study the impact of migration on countries where migrants settle</td></tr>
<tr><td>Science</td><td>Literature</td><td>Political Science</td></tr>
<tr><td>Students learn about migration of animals. They study patterns of migration. Students reflect on similarities and differences in animal and human migration</td><td>Students can see how migrations have influenced the language of migrants and locals. Eg impact of migration on language of Parsis. Students will investigate how migrations have influenced literature and language by looking at diasporic literature.</td><td>Students research into how politics affects migration. They find answers to questions like: which nations have had large number of people leaving the country? What are the plausible reasons for the same? How are migrants treated in the new nation?</td></tr>
</table>

Integrative Understandings

Through this unit, students will

- Understand economic, political, social reasons for migration.
- Comprehend the impact of migration on individual and society.
- Comprehend the impact of migration on language, art, science.
- Connect issues like war and migration, economic development and migration, business and migration.
- Understand how migration modifies the economic, social, political scenario of a nation.

Understand how human migration is different from that of animals

Assessment of Learning

Multiple assessment strategies can be used eg reflective journals, group discussions, poster presentations, analysis of literature and art forms influenced by migration

Focus must be on ability to analyse and synthesize inputs from different disciplines, ability to integrate information

Some guiding questions to ensure interdisciplinary learning

- Is the unit conducive for interdisciplinary learning?
- Are the disciplinary understandings robust and adequate?
- Are the disciplinary understanding suited to the age and maturity of the learners?
- Are the integrative understandings tied to the purpose of the unit?
- Are the activities for assessment comprehensive? Do the foster interdisciplinary approach?

Multidisciplinary learning

Multidisciplinary refers to the placing side by side of insights from two or more disciplines. Here different disciplines help to develop a detailed understanding of the topic being studied. These disciplines however make separate contributions unlike interdisciplinary learning where an interdependent relationship is emphasized. No integration between these disciplines is expected in a multidisciplinary approach.

A multidisciplinary approach in learning involves drawing appropriately from multiple disciplines to redefine problems outside of normal boundaries and reach solutions based on a new understanding of complex situations.

According to Langa and Yost, multidisciplinary instruction is an approach that thoughtfully incorporates and connects key concepts and skills from many disciplines into the presentation of a single unit.

According to Garner (1995), the term ‘multidisciplinary’ refers to a combination of various disciplines as independent and separate components of learning, which allows students to work within discipline specific parameters and attain discipline specific goals.

Multidisciplinary learning "refers to the involvement of several different professional areas, though not necessarily in an integrated manner" (Shafritz, Koeppe, &Soper, 1988).

Characteristics of Multidisciplinary learning

Most characteristics of interdisciplinary learning will be found in multidisciplinary learning as well.

1. Multidisciplinary learning gives the learner **varied perspectives** of the topic. Different disciplines contribute towards enriched learning. For example if the topic being learned is 'Water' , the learner gets an idea about the chemical composition and properties of water from Science, whereas Geography will throw light on distribution of water over the Earth, sources of water.
2. Content matter gathered from different disciplines may **retain their distinct identities** but will help the learner get a more comprehensive view of the topic of study.
3. **Multidisciplinary learning may not be integrative in its approach**. Each discipline retains its own uniqueness in multidisciplinary learning. While the topic is examined through the lens of different subjects, there **is no conscious effort to merge these perspectives** or integrate these views.

Difference between Interdisciplinary and Multidisciplinary Learning

The multidisciplinary learning differs from interdisciplinary learning in the following ways.

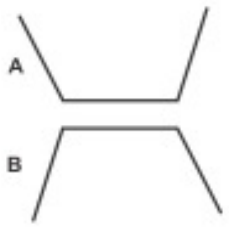
In interdisciplinary learning, the selection of disciplines and their insights is purposefully done with the end product clearly in view whereas in multidisciplinary learning, disciplines need not be chosen purposefully.

In multidisciplinary learning, the contribution of each discipline remains unique whereas in interdisciplinary learning there is a complete blend of thoughts and thus the disciplinary insights got from each discipline merge into each other.

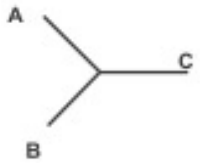
Interdisciplinary learning focuses on more collaboration and interactions between disciplines as compared to multidisciplinary learning.

Multidisciplinary learning highlights learning of topics from diverse disciplines; while interdisciplinary learning is based on a mixture of diverse disciplines to solve a problem.

While interdisciplinary approach may involve one teacher dealing with the content, multidisciplinary learning will involve different experts from various disciplines.



Multidisciplinary learning is represented in the figure alongside where insights from two disciplines A and B are consulted but there is no integration.



Interdisciplinary learning is represented alongside where insights from two disciplines A and B are integrated to construct a more comprehensive meaning.

Significance of Interdisciplinary learning and Multidisciplinary learning

• Interdisciplinary learning and multidisciplinary learning share several common features. The significance of these approaches to learning is profound.

• Interdisciplinary learning and multidisciplinary learning promote a broadened outlook with the learner becoming aware of the perspectives offered by more than one discipline. Interdisciplinary studies courses provide students with opportunities to understand the diverse perspectives of and the links among discrete subjects/disciplines and to develop their knowledge and skills beyond the scope of individual disciplines to solve problems, make decisions and present new findings.

• Narrow allegiance to one discipline is prevented. Considering only one discipline to understand a complex issue can lead to incomplete learning. An interdisciplinary or multidisciplinary bent of mind forces one to look at the issue through the lens of other disciplines

• It encourages a more comprehensive way of looking at real life problems. Real life problems are not confined to one discipline. One may need to examine the problem from different disciplines to identify the most effective solution.

• Objectivity in learning is encouraged. Holding on to only one discipline is likely to produce biased views. Neutral decisions can be taken when an issue is examined by referring to more than one discipline.

• Interdisciplinary learning and multidisciplinary learning bring an appreciation of other disciplines. The more we know about other disciplines, the more we will appreciate the knowledge they contain. For example, suppose the issue being discussed is that of human progress. A person who is basically from the Science discipline can appreciate the contribution of Art to human progress. If the issue is only examined through the lens of science, a lopsided view of human progress is viewed.

• One can reflect how the real world works when one uses the interdisciplinary or multidisciplinary approach. This is useful to understand complex phenomena that affect our daily interactions. For example, when examining how international trade is carried out, one needs to consider the perspectives offered by Political Science, Economics, Geography and Business.

• Sensitivity to ethical issues is fostered by such learning. Consider an issue like euthanasia or mercy killing. If a person is declared brain dead, should life support be discontinued? A question like this will need to look at implications from the point of view of Science, Law, Religion and Sociology. Ethical issues cannot be resolved by looking at just one discipline.

• Interdisciplinary learning and multidisciplinary learning enhance the ability to synthesize information. Information used is drawn from many disciplines and hence needs to be effectively analysed and synthesized.

• Unconventional and original thinking is enhanced. A single discipline may promote one way of thinking. Consideration of more than one discipline forces to consider different modes and thus promotes unconventional thinking.

• Interdisciplinary learning and multidisciplinary learning help students to develop a new awareness of the meaningful connections that exist among the disciplines. One realizes that the real world does not support fragmented knowledge. One appreciates true knowledge, the sources from where one gets knowledge and the means to garner knowledge. Thus, a zest for lifelong learning is developed through interdisciplinary learning.

Check Your Progress- 1

Complete the sentences using appropriate answers.

1. Interdisciplinary Learning is_____

a) solving a problem

b) generate new knowledge

c) enriching the curriculum

d) All the above

2. Interdisciplinary understanding promotes_____

a) solving a problem

b) higher order thinking skills

c) increases Application

d) None of the above

3. Content matter gathered from different disciplines may retain their distinct identities in _____

   a) Inter Disciplinary Learning

   b) Academic Discipline

   c) Multi Disciplinary Learning

   d) None of the above

4. Interdisciplinary learning and multidisciplinary learning enhances_____

   a) original thinking

   b) increases Application

   c) involving more than one discipline

   d) None of the above

5. One of the Strategies to Promote Interdisciplinary Learning is _____

   a) Self-learning

   b) Start Off Small

   c) Academic learning

   d) None of the above

2.2.3.2. Educational Implications of Interdisciplinary and Multi-disciplinary Learning

Role of Institutions in organizing in interdisciplinary and multidisciplinary learning

Today interdisciplinary and multidisciplinary learning are widely acknowledged as means to offer learners a more comprehensive view of knowledge the way it actually exists in the real world. The benefits of such learning are vast and institutions must make efforts to ensure that they offer viable means for learners to immerse in meaningful interdisciplinary and multidisciplinary learning environments. Let us discuss the role played by institutions in organizing effective interdisciplinary and multidisciplinary learning.

Role of the Heads of Institutions in promoting interdisciplinary and multidisciplinary learning:

- Heads of institutions must ensure that there is a varied choice of subjects made available to the students. This will facilitate interdisciplinary bent of mind. At the school level, generally subjects are predetermined by the board to which the institution is affiliated. In higher education, there is greater likelihood of offering variety of subjects.
- Individual departments of different disciplines must be strengthened. This can be done by subscribing to various journals, encouraging the faculty to be part of academic groups. A strong foundation in one's own discipline will help to make better contribution towards interdisciplinary and multidisciplinary endeavours.
- While selecting the faculty, heads of institutions should ensure that while they have in depth knowledge and understanding of their own disciplines, it is vital that they possess an interdisciplinary and multidisciplinary attitude. A fairly good understanding of other disciplines is always an advantage.
- Training sessions may be conducted to assist teachers plan for interdisciplinary and multidisciplinary learning experiences. Interdisciplinary units should be shared with all faculty so that they can have the opportunity to contribute their knowledge and skills.
- Provide flexibility in timetable so that teachers can co ordinate together to organize for interdisciplinary and multidisciplinary learning experiences.
- Information Technology plays an important role in promoting for interdisciplinary and multidisciplinary learning. The website of the institution can provide useful links to encourage such learning. Collaborative documents can be prepared, resources can be shared, discussion can be carried using online forums thus promoting for interdisciplinary and multidisciplinary learning.
- The institution can document good practices in interdisciplinary and multidisciplinary approaches so that the students and teachers learn from these experiences.
- Involvement of stake holders as industry personnel and prospective employers in planning and transacting interdisciplinary learning activities will help learners get the views of those involved in real world applications of knowledge learned.
- Healthy campus culture with equal respect accorded to all disciplines and an ethos of sharing and collaborating contribute to effective interdisciplinary learning.

Role of teachers in promoting interdisciplinary and multidisciplinary learning:

- Teachers must design and implement curriculum based on the scope and sequence of the integrated disciplines and be flexible enough to form and revise the curriculum according to the students' needs.
- Teachers must choose appropriate topics that offer scope to indulge in interdisciplinary and multidisciplinary learning. While planning for the year, teachers teaching a particular class could look out for common topics that can be dealt with through interdisciplinary or multidisciplinary approaches. Various learning approaches and techniques can be incorporated to facilitate interdisciplinary learning. Most curricula these days incorporate project based learning. This is a good opportunity to plan for interdisciplinary learning. Provide a range of curriculum experiences that reflect both a discipline-based and an interdisciplinary orientation. A basic grounding in disciplines needs to be followed up with interdisciplinary studies.
- By attending seminars and workshops of other disciplines a teacher can widen his/her understanding of these disciplines. This will help to think beyond the realms of one's basic discipline.
- Undertaking interdisciplinary and multidisciplinary research will ensure that the teacher thinks across disciplines. This will help to provide better guidance to students when working towards interdisciplinary and multidisciplinary learning.
- Simply planning for interdisciplinary and multidisciplinary learning is not enough. Teachers must engage students in epistemological questions such as "What is knowledge?" "What do we know?" and "How can we link knowledge with real world application?" Constructivist approach (where students explore and take responsibility for their own learning)will be effective in interdisciplinary learning.
- Teachers can invite experts beyond the field of academics to provide their inputs on the topic being explored. For example when dealing with the theme of 'Pollution' experts such as officers from the Pollution Control Board, doctors and environmentalists can be invited to interact with the students.

Role of students in Interdisciplinary and Multidisciplinary learning

- Students should develop a healthy attitude towards all disciplines. Considering one discipline superior to another is harmful as it only gives a lopsided understanding of a topic.
- Reading and reflecting is an assured way of assisting multidisciplinary and interdisciplinary learning. By reading articles from different disciplines and more importantly by reflecting over what each discipline has to offer, meaningful interdisciplinary learning is possible.
- Extended learning places as historical museums, monuments, libraries, laboratories, science centres are opportunities to promote interdisciplinary learning. These visits should not be seen from a recreational point of view. Rather they should be viewed as opportunities that promote integrated learning.
- If possible, students should be involved in the planning and development of interdisciplinary units. This may be possible in higher education where students are mature and think critically.

  Thus, ensuring interdisciplinary and multidisciplinary learning is the joint responsibility of the curriculum framers, the institutional head, teachers and students. Others like experts from the community and researchers may also add their own inputs to make this endeavour effective.

Strategies to Promote Interdisciplinary Learning

There are several designs for interdisciplinary teaching. Some of these involve integrating interdisciplinary teaching in a single course, while others tie together a combination of different courses in a series. Regardless of the format used, integration by design is an important starting point. The examples below provide some ideas for different methods for interdisciplinary teaching.

Promote Buy-In

Student, department, and institutional buy-in for interdisciplinary teaching is an important first step in developing activities and courses that cross disciplinary divides. At the institutional level, redesigning courses and curricula to include interdisciplinary teaching presents an opportunity to increase enrollment was noted as a way to appeal to administrators. Further, interdisciplinary teaching can broaden the enrollment in courses offered in individual disciplines, integrating geoscience, engineering, humanities, policy, education, and other majors. At the student level, interdisciplinary teaching appeals to students interested in multiple disciplines and who realize the necessity of tackling real-world problems through an interdisciplinary lens.

Start Off Small

Small-scale implementations and practices can be a great way to start to incorporate interdisciplinary teaching into your classroom. While challenges and barriers may exist in incorporating disciplines outside your area of expertise, these small scale changes can build bridges between disciplinary divides and equip you to better overcome these challenges. Small scale changes include:

- Make connections with faculty from other departments, industry, and the community! Informally talk with them, learn what they do, and draw connections to your teaching.
- Invite guest speakers to give a presentation. Guest speakers can provide a way for you and your students learn about topics outside your expertise and speakers from the community or industry can serve as a model for how what students are learning in class is applicable to their life and the importance of building a culture of collaboration to solve problems.
- Partner with faculty from other departments to develop projects that incorporate aspects from different disciplines.
- Make use of pedagogies that lend themselves to interdisciplinary teaching such as service learning, teaching with the local environment/ campus, teaching systems thinking and teaching with real world examples.

Team Teaching

While potentially expensive, there is substantial added value in true team-teaching of courses. In addition to bringing more expertise to instruction, team teaching allows students to sort through and then integrate multiple perspectives, hypotheses, and opinions. Team teachers can also serve as role models to demonstrate effective interdisciplinary cooperation in tackling a problem or a solution.

Traditional team teaching involves two or more instructors actively involved in teaching a cohort of students in a single course. This popular method for teaching in an interdisciplinary fashion and may involve instructors from the same department with different specialties or from different departments. The coursework is generally integrated into a single syllabus for a single class. Course work can be either assessed by both instructors to ensure the course outcomes are being addressed or done by each faculty independently based on the assignment topic.

Check Your Progress - 2

To promote Interdisciplinary learning,

a) Heads of institutions must ensure that _____

b) Individual departments of different disciplines _____

c) faculty, should have in depth knowledge and understanding of _____

d) Training sessions may be conducted to assist teachers _____

e) Teachers need to follow strategies like_____

2.2.4. Let Us Summarise

The following table summarises the differences between multidisciplinary , interdisciplinary and disciplinary learning

Learning mode	Interactivity	Student identity	Teacher identity
Mono disciplinary learning	Subject driven	Knowledge receiver with limited choice	Knowledge deliverer
Multidisciplinary learning	Disciplines retained their individuality. No emphasis on synthesis of knowledge got from varied disciplines	Knowledge consumer with no limits on choice of subjects	Knowledge facilitator
Interdisciplinary learning	collaboration between disciplines is sought. Emphasis is on integration of knowledge for problem solving	Knowledge collaborator .choice of subjects limitless. No limits on integration of knowledge	Learning designer

2.2.5 Answers to 'Check Your Progress' 1 and 2

Check Your Progress- 1

A,b,c,a,b

Check Your Progress- 2

a. there is a varied choice of subjects made available to the students

b. must be strengthened.

c. their own disciplines,

d. plan for interdisciplinary and multidisciplinary learning experiencese.

2.2.6 Unit -end Exercises

1. Explain the Meaning, significance and characteristics of Interdisciplinary and Multi-disciplinary teaching and learning
2. Analyse the educational implications of Interdisciplinary and Multi-disciplinary teaching and learning

2.2.7 References

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Block - 2 : Classification and Teaching Across Disciplines

Unit - 3 : Humanities and Social Science in the Curriculum

Unit Structure

2.3.1. Learning Objectives

After learning through this Unit, the student teachers will be able to -

- Explain the meaning of Humanities & Social Sciences
- List out branches of Humanities
- Justify the need and importance of Humanities and Social Sciences in the School Curriculum
- Explain the Approaches of organizing social science curriculum

2.3. 2. Introduction

We have already discussed about the meaning and processes of Social Science as a branch of humanities. We also know that it is not enough for teachers to know the content of the subject they teach, but they need to know the nature of the subjects so that they can decide the pedagogical procedures appropriate to the content. Once they know the nature of the subject, it is easy to organise the content in the curriculum of that specific subject. Hence, let us understand the nature of Humanities and Social Sciences and also their organisational implications in the present unit.

2.3.3 Learning Points and Learning Activities

Humanities is a stream of study which primarily deals with aspects of human behaviour and its effects on society. This covers the areas of human behaviour, psychology, philosophy, criminology, sociology, anthropology and much more. It provides a well-developed understanding of the social strata systems, sociological theory, and social policy. Both humanities and social sciences are the study of human behaviour and interaction in social, cultural, environmental, economic and political contexts. The humanities and social sciences have a historical and contemporary focus, from personal to global contexts, and consider challenges for the future.

In the Curriculum, the Humanities and Social Sciences learning area includes a study of history, geography, civics, citizenship, economics, business and much more. Through the study of Humanities and Social Sciences, students develop the ability to question, think critically, solve problems, communicate effectively, make decisions and adapt to change. The Humanities and Social Science subjects in the Curriculum provide a broad understanding of the world in which we live, and how people can participate as active and informed citizens with high-level skills needed for the 21st century.

2.3.3.1. Meaning, Branches and Importance of Humanities

Let us try to understand the nature of Humanities through different interpretations.

Humanities is one of the major groups of academic disciplines. The field of study teaches students how history, art, music, religion and culture have shaped the modern world. While on one hand, Humanities centres on art, music and literature, on the other hand, Social Sciences focuses on anthropology, archaeology and politics. That is why even though the two streams are different they are often studied together as both complement each other.

Humanities are academic disciplines that study aspects of human society and culture. They use methods that are primarily critical, or speculative, and have a significant historical element—as distinguished from the mainly empirical approaches of the natural sciences, yet, unlike the sciences, it has no central discipline. The humanities include ancient and modern languages, literature, philosophy, history, human geography, law, politics, religion, and art.

The humanities are studies about human culture, such as literature, philosophy, and history. Studying the humanities gives general knowledge, but not a practical trade.

Humanities is a broad academic field under which students study various types of human interactions, using methods that are largely analytical, critical or exploratory. Humanities contain something explicit to explore in itself. As it serves several disciplines where human beings and the society focus on different kinds of studies. Humanities are

also referred to 'Integrated Humanities' which states this stream as the study of the following subjects:

- History
- Geography
- Religious Education
- Sociology
- Psychology
- Government and Politics
- Law

Branches of humanities

The different branches of humanities include literature, art, music, philosophy, history, religion and language. People use humanities to document and explore the human experience, and there are further branches that intersect with the scientific world.

Literature, most generically, is a body of written works. More restrictively, literature refers to writing considered to be an art form or any single writing deemed to have artistic or intellectual value, often due to deploying language in ways that differ from ordinary usage.

Importance of Humanities in School Curriculum

- The humanities help us understand others through their languages, histories and cultures.
- They foster social justice and equality.
- They reveal how people have tried to make moral, spiritual and intellectual sense of the world.
- The humanities teach empathy.
- They teach us to deal critically and logically with subjective, complex, imperfect information.
- They teach us to weigh evidence sceptically and consider more than one side of every question.
- Humanities build skills in writing and critical reading.
- The humanities encourage us to think creatively. They teach us to reason about being human and to ask questions about our world.

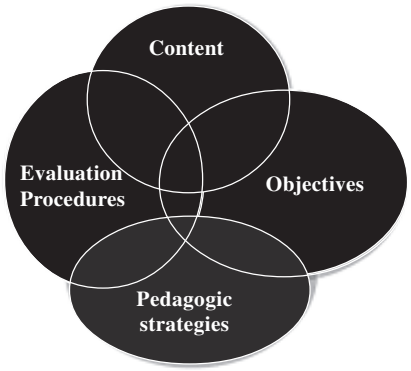
- The humanities develop informed and critical citizens. Without the humanities, democracy could not flourish. .
- Humanities can help us think critically and help us reason well so that we can gain insight into a variety of subjects and topics.
- Humanities have been an important field since the times of Ancient Greece, and the knowledge was used to explore poetry, history, culture and the arts.
- Humanities teach many fundamental skills such as critical thinking, analysis and creativity. These skills are useful not only for those considering graduate level studies or professional degrees, but also for those considering careers in business.
- The humanities play a number of roles in a man's life, including providing greater insight into the world, helping to better understand both the past and the future and fostering a sense of empathy. Broadly defined, the humanities are the study of human culture through art, literature, philosophy, music and languages.
- Better curriculum coverage and coherence: When a school humanities curriculum uses the National Curriculum objectives for history and geography as its platform, rather than its aim, the overarching story of history can be developed through cross-phase planning, making sure that children are learning in a progressively sequenced way. Coherence, organising content into well-sequenced orders, can be difficult to achieve when tied to themes or topics, since they may be interpreted in a variety of ways. Being explicit with children that they are learning 'geography' might also make it easier for them to see how the content fits into the bigger picture of the subject.
- A subject-based humanities curriculum supports high-quality teaching: With the National Curriculum as the platform and coherence as an aim, there is scope for learning to be systematically developed over time. When National Curriculum objectives are mapped out and taught sequentially, assessing learning within the humanities subjects becomes a far simpler task. Aligning this with knowledge organisers that carefully outline the substantive knowledge that needs to be learned can help to make assessments more accurate, more so than in one unit of work.

Check Your Progress:1

Explain the meaning and importance of humanities in school curriculum.

3.3.3.2. Social Science Curriculum

Curriculum is an important component of any system of education. Curriculum is planned for the entire course of study as well as for different subjects. The overall aims of education are achieved by achieving the aims and objectives of different subjects taught in schools. The success in achieving the aims mainly depends on the appropriateness of the procedure in which curriculum is framed. Hence, to achieve the objectives of social science, a well-formed curriculum will prove to be inevitable. This is because curriculum is the plan for guiding the goal oriented educative process. This plan involves four important components. They are as foll



The curriculum of social science is supposed to fulfil some important functions. They are as follows:

- Synthesis of the subjects of study and life
- Acquisition and strengthening of knowledge
- Complete development
- Development of democratic values
- Satisfaction of students' needs
- Realisation of values
- Harmony between individual and society
- Cration of suitable environment

Approaches to Curriculum Organization in Social Science:

Though there are number of approaches for the organization of curriculum in social science, no single approach has been proved to be complete and comprehensive. Each approach has merits and limitations. Teachers need to select approaches appropriate to the level and needs of the students and organize the curriculum. Let us understand the different approaches for organising matter in social science curriculum.

The Spiral Approach

The spiral approach is nothing but devising a strategy that fosters continuous un broken learning of the subject matter of social science through the various stages of education. According to this approach, children in primary classes develop simple generalization about man carrying of his everyday activities. They work with more and more complex items of information and as a result deepen and reshape the dimension of the related generalization already developed earlier. For example, it is very important that children should know our freedom struggle in the primary classes the information about this unit will be imparted through the life of some of the great leaders such as Mahatma Gandhi, Jawaharlal Nehru, Balagangadhara Tilak and B.R. Ambedkar. In the middle stage the information will be imparted through event the formation of the Indian National Congress, partition of Bengal, Civil Disobedience, Quit India movement etc. In the secondary stage, the pupils still learn to compare and contrast the freedom movement in our country with other countries of the world and analyse them scientifically by establishing cause effective relations.

Application of this approach will make social science a subject of immediate and real interest for the average pupil. It will be the basis of correlating phenomena and happening with the immediate life of humanity and for those who are more intellectual it will be the basis of which academic insights and specialization in the discipline concerned can be attempted.

If proper care is not taken by the curriculum framers in gradually expending the material without mere repetition and if teachers do not carefully increase the scope of study in psychologically sound and natural way, this approach may cause monotony and lack of interest because of the repetition of information. At the initial stage it will be difficult to give a clear picture of problem by presenting all the relevant details and by considering it in its totality.

Concentric Approach

In this approach the whole curriculum is spread over a number of years. Quite often a general treatment of almost all the topics are attempted at the beginning and it is developed in successive year according to the mental development of the pupil in the beginning in the simplified way. In the next years more and more details of its parts are gradually added. It follows the maxims of teaching such as form whole to part simple to complex easy to difficult etc. Among educationalists of modern times Bruner is the main exponent of this approach as he thinks that discovery learning is only possible only if this approach is maintained and this approach is referred to as concentric approach.

Topical Approach

In this approach, selected topics of study suitable for the age ability and interest of children are included in the curriculum and each topic is dealt with completely in the class where it is first introduction of each topics are linked together by the teacher with the help of link lessons for the children of the age group 13+ (above 13) this approach is quite possible.

The curriculum makers take particular topics as the central theme of social science learning at different levels of instruction. At each stage the topics vary in accordance with the ability and interests of the children. In the primary classes, the child may start the study of the development of concrete and familiar thing such as food, clothing, shelter and means of transportation. In the middle classes, he may be introduced to more important and more difficult topics like history of instructions and of government. In the secondary classes the student may be provided with ideas about ideologies like communism, socialism capitalism etc. In this approach, we can deal with all the aspects of a problem and give an overall view of that particular problem.

'This approach provides an action plan for dealing with vast material in a logical and rational way. It helps the pupils to understand the facts of their developmental setting. This approach can be adapted according to the age ability and aptitude of the children.It imparts a sense of purpose to the pupils because of the total perception attempted.This approach enables the teacher to control the subject matter and adapt it to the varying needs of the children. It destroys the continuity of subject matter. Since aspects involved in a topic may be beyond the cognitive competencies of pupils in lower classes a complete study of the topic will not be possible.

Generally speaking, when a topic is complex and very large and involve units posing varied levels of difficulty it will be advisable to have the unit approach. The only thing is that care should be taken to effectively link all the units of the same topics as and when opportunities arise.

2.3.4. Let us Summarise

- Humanities is a stream of study which primarily deals with aspects of human behaviour and its effects on society. This covers the areas of human behaviour, psychology, philosophy, criminology, sociology, anthropology and much more.
- In the Curriculum, the Humanities and Social Sciences learning area includes a study of history, geography, civics, citizenship, economics, business and much more.

- Humanities are academic disciplines that study aspects of human society and culture.
- There are many advantages of learning humanities subjects
- While framing the curriculum, it is important to know the functions it needs to fulfil. They can be identified as follows:
- Organisation of social science curriculum needs to be meticulous task. It involves mainly four aspects namely, the objectives, pedagogic strategies, content and evaluation procedures
- There are different approaches to organize the content of social sciences and they are the spiral, concentric, and topical approaches. Each approach has merits and limitations. Teachers have to select appropriate approaches based on the level, need and interest of students.

Check Your Progress – 2

Classify the following attributes under spiral, concentric and topical approaches

1. strategy that fosters continuous un broken learning of the subject matter of social science
2. the whole curriculum is spread over a number of years
3. focus is on developing simple generalization
4. organised according to the mental development of the pupil
5. provides an action plan for dealing with vast material
6. details are gradually added
7. themes of interest for students are selected
8. will make social science a subject of immediate and real interest for the average pupil
9. involves logical and rational procedures

2.3.5 Answers to 'Check Your Progress' 1 and 2

Check Your Progress -1

Refer Section 2.3.3.1. of Self Learning Material

Check Your Progress – 2

Spiral: 1,3,8 Concentric: 2,4,6, Topical: 5,7,9,

2.3.6. Unit -end Exercises

1. Explain the concept of Humanities & Social Sciences
2. Justify the need and importance of humanities in school curriculum
3. Explain the approaches of organizing social science curriculum

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Block - 2 : Classification and Teaching Across Disciplines

Unit - 4 : Natural Science in the Curriculum

Unit Structure

2.4.1. Learning Objectives

After learning through this Unit, the student teachers will be able to

- Explain the meaning of natural science
- Describe the branches of Natural Science
- justify the place of natural science in school curriculum
- Describe the major approaches in Organization of Science Curriculum

2.4.2. Introduction

What is Natural science? What are its branches? Why do we teach science to school children? What do we teach them in science? These are the basic questions to which a teacher must know the answers for. This unit will help you to understand the concept of natural science, the purpose of teaching science and objectives of teaching science for the cognitive, affective and psychomotor development of human abilities. You will also learn about the science curriculum and its place in school education.

2.4.3. Learning Points and Learning Activities

2.4.3.1. Meaning, Branches and Importance of studying Natural Science

Natural Science –Meaning

What is Natural science? The natural sciences seek to understand how the world and universe around us works. Natural science is a branch of science concerned with the description, prediction, and understanding of natural phenomena, based on empirical evidence from observation and experimentation. Mechanisms such as peer review and repeatability of findings are used to try to ensure the validity of scientific advances.

Branches of Natural Science

Natural science can be divided into two main branches: life science (or biological science) and physical science. Life sciences, include botany and zoology; and Physical science is subdivided into branches, including physics, chemistry, astronomy and Earth science. These branches of natural science may be further divided into more specialized branches (also known as fields). As empirical sciences, natural sciences use tools from the formal sciences, such as mathematics and logic, converting information about nature into measurements which can be explained as clear statements of the “laws of nature”.

Life Science

Biology is a branch of Life science that involves the scientific study of living organisms from the molecular level to their interactions with one another and their environment. This field encompasses a set of disciplines that examines phenomena related to living organisms. The scale of study can range from sub-component biophysics up to complex ecologies. Biology is concerned with the characteristics, classification and behaviors of organisms, as well as how species were formed and their interactions with each other and the environment.

The biological fields of botany, zoology, and medicine date back to early periods of civilization, while microbiology was introduced in the 17th century with the invention of the microscope. However, it was not until the 19th century that biology became a unified

science. Once scientists discovered commonalities between all living things, it was decided they were best studied as a whole.

Some key developments in biology were the discovery of genetics; evolution through natural selection; the germ theory of disease and the application of the techniques of chemistry and physics at the level of the cell or organic molecule.

Modern biology is divided into sub disciplines by the type of organism and by the scale being studied. Molecular biology is the study of the fundamental chemistry of life, while cellular biology is the examination of the cell; the basic building block of all life. At a higher level, anatomy and physiology look at the internal structures, and their functions, of an organism, while ecology looks at how various organisms interrelate.

Physical Science

Physics focuses on the physical properties of matter and energy and the interactions and relationships between these, and attempts to develop mathematical models to explain physical phenomena. Thus, Physics embodies the study of the fundamental constituents of the universe, the forces and interactions they exert on one another, and the results produced by these interactions. In general, physics is regarded as the fundamental science, because all other natural sciences use and obey the principles and laws set down by the field. Physics relies heavily on mathematics as the logical framework for formulation and quantification of principles.

The study of the principles of the universe has a long history and largely derives from direct observation and experimentation. The formulation of theories about the governing laws of the universe has been central to the study of physics from very early on, with philosophy gradually yielding to systematic, quantitative experimental testing and observation as the source of verification. Key historical developments in physics include Isaac Newton's theory of universal gravitation and classical mechanics, an understanding of electricity and its relation to magnetism, Einstein's theories of special and general relativity, the development of thermodynamics, and the quantum mechanical model of atomic and subatomic physics.

The field of physics is extremely broad, and can include such diverse studies as quantum mechanics and theoretical physics, applied physics and optics. Modern physics is becoming increasingly specialized, where researchers tend to focus on a particular area rather than being "universalists" like Isaac Newton, Albert Einstein and Lev Landau, who worked in multiple areas.

Chemistry

Chemistry Constitutes the scientific study of matter at the atomic and molecular scale, it deals primarily with collections of atoms, such as gases, molecules, crystals, and metals. The composition, statistical properties, transformations and reactions of these materials are studied. Chemistry also involves understanding the properties and interactions of individual atoms and molecules for use in larger-scale applications.

Chemistry is one branch of Natural Sciences but itself consists of many branches, such as inorganic chemistry, organic chemistry, physical chemistry and biochemistry. Chemistry can be viewed as the study of different types, components and properties of matter, and the chemical changes that different types of matter undergo.

Astronomy

This discipline is the science of celestial objects and phenomena that originate outside the Earth's atmosphere. It is concerned with the evolution, physics, chemistry, meteorology, and motion of celestial objects, as well as the formation and development of the universe.

Astronomy includes the examination, study and modeling of stars, planets, comets, galaxies and the cosmos. Most of the information used by astronomers is gathered by remote observation, although some laboratory reproduction of celestial phenomena has been performed (such as the molecular chemistry of the interstellar medium). While the origins of the study of celestial features and phenomena can be traced back to antiquity, the scientific methodology of this field began to develop in the middle of the 17th century. A key factor was Galileo's introduction of the telescope to examine the night sky in more detail.

The mathematical treatment of astronomy began with Newton's development of celestial mechanics and the laws of gravitation, although it was triggered by earlier work of astronomers such as Kepler. By the 19th century, astronomy had developed into a formal science, with the introduction of instruments such as the spectroscope and photography, along with much-improved telescopes and the creation of professional observatories

Earth Science or Geosciences

Earth science is an all-embracing term for the sciences related to the planet Earth, including geology, geophysics, hydrology, meteorology, physical geography, oceanography, and soil science. Although mining and precious stones have been human interests throughout the history of civilization, the development of the related sciences of economic geology and mineralogy did not occur until the 18th century. The study of the earth, particularly palaeontology, blossomed in the 19th century. The growth of other disciplines, such as geophysics, in the 20th century, led to the development of the theory of plate tectonics in the 1960s, which has had a similar effect on the Earth sciences as the theory of

evolution had on biology. Earth sciences today are closely linked to petroleum and mineral resources, climate research and to environmental assessment and remediation.

Importance of Studying Natural Science

The role of Science with reference to sustainable development and Health can be summarised as follows:

- By emphasizing and explaining the dependency of living things on each other and on the physical environment, science fosters the kind of intelligent respect for nature that can inform decisions on the uses of technology to improve the world for humans and all living things. The more science-literate individuals are, the stronger their society can be. Specifically, the lessons and skills science gives us can have effects that help make for more responsible citizens, a balanced economy, a healthier environment, and a brighter sustainable future for everyone.
- Science makes us aware of environmental problems
- Helps to improve our understanding in areas such as climatic change, growth in rates of resource consumption, demographic trends, and environmental degradation
- Use of technology for remote sensing and GIS helps in tracking environmental degradation
- Helps in meaningful resource utilization.
- Science helps suggest alternative practices to reduce pollution
- Scientific knowledge should be applied to articulate and support the goals of sustainable development, through scientific assessments of current conditions and future prospects for the Earth system.
- Such assessments, based on existing and emerging innovations within the sciences, can be used in the decision-making process and in the interactive processes between the sciences and policy-making.
- To develop innovative, green solutions to address the climate, food and energy crises facing the world today, science, technology, research and development capacities for sustainable development must be strengthened

The role of Science with reference to health issues can be summarised as follows:

- Advances in Science & Technology have led to longer, healthier, better lives.

- A generation that understands and honors or celebrates past achievements will welcome and pave the way for future discoveries and inventions that will improve physical and mental health.
- Science helps create an awareness of diseases (Physical and mental health) , Importance of having a balanced diet , measures to prevent diseases.

Check Your Progress – 1

1.Explain the meaning, branches and importance of Natural Science.

2.4.3.2. Science Education at different levels and Issues and challenges in teaching Science

Science Education at Primary Education Level

At the Primary level Science & Social Science are integrated as Environmental Studies.

At this stage Science education should help to:

- nurture the curiosity of the child about the world (natural environment, artifacts and people),
- have the child engage in exploratory and hands-on activities for acquiring the basic cognitive and psychomotor skills through observation, classification, inference, etc.;
- emphasise design and fabrication, estimation and measurement
- develop basic language skills: speaking, reading and writing not only for science but also through science.

Science Education at Upper Primary Education Level

At this stage,

- the child should be engaged in learning the principles of science through familiar experiences, working with hands to design simple technological units and models (e.g. designing and making a working model of a windmill to lift weights)
- continue to learn more about the environment and health, including reproductive and sexual health, through activities and surveys.
- Scientific concepts are to be arrived at mainly from activities and experiments.
- Group activities, discussions with peers and teachers, surveys, organisation of data and their display through exhibitions, etc. in schools and the neighbourhood should be important components of pedagogy.

Science Education at Secondary Education level

At the secondary stage, students should be engaged in..

- learning science as a composite discipline,
- in working with hands and tools to design more advanced technological modules than at the upper primary stage, and
- in activities and analyses on issues concerning the environment and health, including reproductive and sexual health.
- systematic experimentation as a tool to discover/verify theoretical principles,
- working on locally significant projects involving science and technology, are to be important parts of the curriculum at this stage.

Science Education at Higher Secondary School level

At the higher secondary stage,

- science should be introduced as separate disciplines,
- with emphasis on experiments/technology and problem solving.

Issues and challenges in teaching Science

Position Paper of National Focus Group on Science identifies some issues with refer teaching of Science:

- Lack of infrastructure: resource rooms, activity rooms, laboratories, material for models, toys, tools, appropriate books for reference, encyclopaedias, dictionaries, multimedia and internet facility.
- Overloaded syllabus: The most important consideration while developing a science curriculum is to ensure a reduced emphasis on mere information and provide greater exposure to what it means to practice science.
- Inadequacy of textbooks based on constructivist methods.
- Instrument of social change: Need to use science curriculum as an instrument of social change to reduce the divide related to economic class, gender, caste, religion and region.
- Present day science education develops competence but does not encourage inventiveness and creativity.

Check Your Progress 2

Explain the issues and challenges of teaching Science

2.3.3.3. Place of Science in School Curriculum and Organization of Science Curriculum

Place of Science in School Curriculum

It is said that man's future is stubbornly linked to scientific advances and the development of productive activity. Therefore, science must find a respectable place in the school curriculum. All over the world, this feeling is generated. In India, through the efforts of National Council of Educational Research and Training (NCERT), science has been made a compulsory subject throughout the school stage.

The views of Kothari Commission and UNESCO's International Commission on the Development of Education are: Kothari Commission (1964-66) stated that "We lay a great emphasis on making science an important element in the school curriculum. We, therefore, recommend that science and mathematics should be taught on a compulsory basis to all pupils as a part of general education during the first ten years of schooling. In addition, there should be a provision of real courses in these subjects at the secondary stage, for students of more than average ability".

UNESCO's International Commission recommend as under:

"Science and technology must become essential components in any educational enterprise; they must be incorporated into all educational activity intended for children, young people and adults, in order to help the individual to control social energies as well as natural and production ones – thereby achieving mastery over himself, his choices and actions – and, finally, they must help man to acquire a Scientific turn of mind so that he becomes able to promote science without being enslaved by it".

With regard to the nature of science and its relation with humanities, this Commission hoped that "The natural sciences will one day incorporate the science of man, just as the science of man will incorporate the natural sciences; there will be a single science".

In the past, science had to struggle long and hard for its rightful place in the school curriculum. There was a time when science was considered an inferior subject to study and the meritorious students were supposed to study classics and mathematical subjects. New ideas or inventions in science were not immediately accepted in the society and were looked upon with suspicion. Any new idea that went against the prevailing beliefs and codes of the time was condemned.

Science is no longer confined to a few seriously devoted persons. It satisfies the usual needs for its inclusion as a subject in the curriculum such as intellectual, cultural, moral, aesthetic, utilization and vocational values.

According to National Curriculum Framework 2005, people today are faced with an increasingly fast-changing world where most important skills are flexibility, innovation and creativity. Good Science education is true to the child and these imperatives have to be kept in mind in shaping science education.

- The simple observation leads to the following basic criteria of validity of a science curriculum.
- Cognitive validity requires that the content, process, language and pedagogic practices of the curriculum are age appropriate and within the cognitive reach of the child.
- Content validity requires that the curriculum must convey significant and correct scientific information. Simplification of content is necessary for adapting curriculum to the cognitive level of the learners.
- Process validity requires that the curriculum should engage the learner in generating and validating scientific knowledge and nurturing the natural curiosity and creativity.
- Historical validity requires that the science curriculum be informed as to how the concepts of science over time evolved.
- Environmental validity requires that the science curriculum be placed with learner's environment, local and global, enabling them to appreciate the issues at the interface of science, technology and society.
- Ethical validity requires that the curriculum promote the values of honesty, objectivity, cooperation and freedom from fear and prejudice and inculcate in the learner a concern for life and precaution of environment.

Organization of Science Curriculum

The main purpose of every school is "to make the child a complete and perfect man." This will help the child to be able to lead his life in a better way than he is today. Therefore, schooling is an important human activity. In formal school education curriculum is the major means to impart knowledge and skills. The major issue in the field of education today is organizing science curriculum in an effective manner. There are two major approaches regarding organization of science curriculum viz. Disciplinary Approach & Integrated Approach. These two approaches are explained below

(a) Disciplinary Approach

This approach is also known as the subject approach or the traditional approach, as each subject is separately taught by the teacher in the area of the particular subject in question. For example, science was traditionally taught as a subject with different compartments such as physics, biology, and chemistry as separate components of the science subject. Similarly, language was taught as a separate subject from other subjects. English was taught as being different from Hindi, Oriya, History, Geography etc. Thus, each subject has a well-defined boundary from which there is no connection to the other. Thus, the approach in which every subject is taught as a separate discipline is called as disciplinary approach. This approach is based on the premise that, the subject is a store house of facts, methods, theories, concepts & generalizations. In disciplinary approach the focus is more on the subject & its content rather than the process. In India the disciplinary approach is very popular in the higher secondary level. It shall be the responsibility of teacher to show the connection between different disciplines (subjects).

Characteristics of disciplinary approach

a) In-depth Conceptual Knowledge: Every subject has detailed and in-depth conceptual knowledge

b) Disciplinary based teaching: Each subject is taught as a separate discipline.

c) Content based teaching: The teaching of disciplinary based curriculum largely based on content.

d) Source of knowledge/information: In disciplinary approach the teacher is the main source of knowledge / information.

e) Main purpose: The main purpose of disciplinary approach is to prepare specialist, scientists etc.

f) Mastery of the subject: The learner is expected to master the subject matter.

g) Chalk & talk based teaching: This approach mostly leads to chalk & talk based teaching.

h) Text book is main authority: This approach restrains student observations, values or conclusions different from the textbook which is the main authority in disciplinary approach.

Importance /Merits of the disciplinary approach

- Expert in the subject: This approach develops expertise in particular subject
- Subject Growth: The disciplinary approach fosters the growth of the subject.
- Time Saving: Disciplinary approach is very time saving in terms of course completion.
- Detailed Conceptual Understanding: The disciplinary approach of organizing science curriculum provides detailed conceptual understanding of the subject.
- Theory building: The disciplinary approach is very useful in building theory in particular subject/discipline.
- Higher level thinking: As in disciplinary approach the subject is store house of theories, concepts,generalizations etc. This lead to higher level thinking.

Limitations

- Less opportunity for creativity: The disciplinary approach does not provide much opportunities for students creativity.
- Dropout: Disinterest in particular subject / discipline may lead to dropout.
- Require expert teachers: The disciplinary approach requires highly knowledgeable & expert teachers.
- Less Scope of socialization & social skills: Isolated teaching reduces the scope of socialization and social skills.

(b) Integrated Approach

"An integrated approach allows learners to explore, gather, process, refine and present information about the topics they want to investigate without the constraints imposed by traditional subject barriers. "(Pigdon & Woolley, 1992). Integrated approach encourages student to see the interconnectedness and interrelationships between the different curriculum areas. Instead of focusing on learning in isolated curriculum areas, an integrated approach is based on skill development around a particular theme that is relevant to students of a particular class.

For Example: The curriculum set up of science at primary level i.e. general science is an example of integrated approach.

Following are the ways of integration

a. Cross disciplinary approach: This approach examine an issue typically relevant to one discipline through the lens of another discipline.

b. Multi disciplinary approach:- This approach examines an issue from multiple perspectives, without making a concerted effort to systematically integrate various disciplines.

c. Inter-disciplinary approach:- This approach examines an issue from multiple perspectives, leading to a systematic effort to integrate the alternative perspectives into a unified or coherent framework of analysis.

The integrated curriculum approach is successful in making students more aware of content area connections, providing a learning environment supporting academic and social needs, dissolving the boundaries among the disciplines, and fostering stronger student/ teacher relationships. Students participating in an integrated curriculum have demonstrated a more positive attitude about themselves & school. Similarly teachers are provided with a new opportunity to work together, increasing collegiality.

Characteristics of Integrated approach :

i. Wide conceptual knowledge: Integrated approach provides an opportunity for broader & wider conceptual knowledge.

ii. Child-centered teaching: Integrated approach promotes child centered teaching

iii. Integration of skills with contents: Integrated approach of curriculum organization promote integration of skills with contents.

iv. Teacher as a mediator: The role of a teacher is mediator between knowledge and child.

v. Use of modern method:The integrated approach requires use of modern methods of teaching such as inquiry based teaching.

vi. Flexibility: - No rigid disciplines exist. Integrated approach is flexible.

vii. Preparation of future citizens: - The main purpose of integrated approach is to prepare the future citizens of a society.

viii. Openness: -The approach is open to new ideas and procedures.

ix. Multi learning Environment: - The approach requires multi learning environment such as classroom, lab, outdoor, computer, internet etc.

Importance / Merits of integrated approach

1. Detailed conceptual understanding: This approach help the learner to get detailed conceptual understanding of the content.

2. Choice based selection of discipline / subject: Integrated approach help the students to select discipline / subject according to their own interest.

3. Creativity: This approach foster creativity among learner.

4. Promotion of modern methods: This approach promotes modern methods of teaching such as collaborative learning, cooperative learning etc.
5. Development of self concept & socialization: Integrated approach helps in developing self concept & socialization.
6. Realistic Application: This approach has realistic applications.

Limitations of integrated approach

i. Time Consuming: Integrated approach is time consuming as a single theme analysis is done with different discipline point of view.

ii. Need of well equipped & expert teacher: Integrated approach needs well equipped & expert teachers who are capable of using modern methods of teaching.

iii. Create confusion: If this approach is not handled carefully then child may get confuse in various disciplines.

iv. Proper selection & organization of various disciplines: Integrated approach needs expertise to select theme and organization of various disciplines.

Check Your Progress - 3

Explain the approaches to organise science curriculum at school level.

2.4.4. Let us Summarise

- Natural science is a branch of science concerned with the description, prediction, and understanding of natural phenomena, based on empirical evidence from observation and experimentation.
- Natural science can be divided into two main branches: life science and physical science. Life sciences, include botany and zoology; and Physical science is subdivided into branches, including physics, chemistry, astronomy and Earth science.
- According to National Curriculum Framework 2005, people today are faced with an increasingly fast-changing world where most important skills are flexibility, innovation and creativity. Good Science education is true to the child and these imperatives have to be kept in mind in shaping science education.
- The two major approaches in organization of science curriculum viz. Disciplinary Approach & Integrated Approach.

2.4.5. Answers to 'Check Your Progress'

Check Your Progress – 1

Refer Section 2.4.3.1 of Self Learning Material

Check Your Progress – 2

Refer Section 2.4.3.2 of Self Learning Material

Check Your Progress - 3

Refer Section 2.4.3.3 of Self Learning Material2.4.6. Unit -end Exercises

1. Explain the meaning, branches and importance of natural science
2. Describe the major approaches in Organization of Science Curriculum

2.4.7. References

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Block - 2 : Classification and Teaching Across Disciplines

Unit - 5 : Mathematics in the Curriculum

Unit Structure

2.5.1. Learning Objectives

After completing this Unit, the student teachers will be able to

- Clarify the importance and need of Mathematics in the School Curriculum
- Explain the values that Justify the importance of Mathematics Curriculum
- Explain the social, mathematical and practical importance of Mathematics curriculum;
- Understand the Place of Mathematics Curriculum in the School Curriculum
- Identify the aims and Objectives of teaching Mathematics at different levels of Schooling;
- Express the vision of school Mathematics curriculum;
- Conceptualise the concerns of teaching school Mathematics;
- Clarify the underlying principles of development of Mathematics curriculum;
- Describe various Modern trends in the development of school Mathematics curriculum.

2.5. 2. Introduction

All of us agree with the fact that mathematics is considered as one of the most important and essential school subjects. Throughout the centuries, mathematics has been recognised as one of the central strands of human intellectual activity. From the very beginning, mathematics has been a living and growing intellectual pursuit. It has its roots in everyday activities and forms the basic structure of our highly advanced technological developments. It comprises intricate and delicate structures which have a strong aesthetic appeal. It also offers opportunities for opening the mind to new lines of creative ideas and challenging thought. Undoubtedly, the mechanism of resolving an intractable problem offers the most intense of all intellectual pleasures. At the same time, it is reputed to be, and rightly so, the most hypothetical of all sciences. Mathematics is also considered as the mother of all sciences. It exhibits connections between things which can be visualized only through the agency of human reason.

The word "mathematics" has been used in two distinct and different senses, i.e., one as a method used to solve the problems of quantity, space, order, etc., and the second as a set of laws or generalizations of truths that are discovered. Most teachers think of it as a tool in science, commerce and industry and are not able to appreciate its nature as a way to think and what connects its various branches into a single logical framework of proof structure. Many questions which usually arise in the minds of teachers need to be resolved. What are the aims and purposes of teaching mathematics? What are the new methods and new ways of thinking about mathematics? This unit gives an exposure to teachers the importance of teaching Mathematics as one of the school subjects.

2.5.3. Learning Points and Learning Activities

2.5.3.1. Need and Importance of Mathematics in Curriculum

Mathematics curriculum is the “plan for the experiences that learners will encounter, as well as the actual experiences they do encounter, that are designed to help them reach specified mathematics objectives”

Need and importance of mathematics in school curriculum

Why do we need to know Mathematics? Why should we memorise so many formulae, theorems, proofs, etc? How will this information help us in our later life? What is its importance in my life? These are some of the common questions that we can see among those who are not interested in learning Mathematics. How far, as teachers we are able to convince our students to appreciate the importance of Mathematics?

'Why should we learn Mathematics?', is a valid question, and as Mathematics teachers, it is our responsibility to understand and conceptualise its importance and unique place

among other school subjects. Why do our curriculum designers place Mathematics as a core school subject, and what is the significance of Mathematics in the overall school curriculum?

The following values justify importance of Mathematics Curriculum.

Social Aspects

- The routine activities of daily life demand a mastery of number of facts and number of processes. To read with understanding much of the materials in newspapers requires considerable mathematical vocabulary. A few such terms are percent, discount, commission, dividend, invoice, profit and loss, wholesale and retail, taxation, etc. As civilization is becoming more complex, many terms from the electronic media and computers are being added.
- Mathematical operations like addition, subtraction, multiplication, division and so on, are used in our daily activities. From poor to rich, all have to use Mathematics in their real lives in one or the other way.
- Certain decisions require sufficient skill and understanding of quantitative relations. The ability to sense problems, to formulate them specifically and to solve them accurately requires systematic thinking.
- To understand many institutions and their management problem, a quantitative viewpoint (modelling) is necessary. It is illuminating to hear from an economist, an architect, an engineer, an aviator, or a scientist what in mathematics is helpful to them as workers.
- Many vocations need mathematical skills.
- The child should gain an appreciation of the role played by mathematics in many fields of work. Since, scientific knowledge and technology are linked with the progress and prosperity of a nation, we should be able to appreciate the role of mathematics in acquiring these.
- Mathematics has helped in bringing together the countries of the world which are separated from each other physically.
- Mathematics helped man to discover the mysteries of nature and to overcome superstitions and ignorance.

Mathematical Aspects

- Mathematics teaches us how to analyse a situation, how to come to a decision, to check thinking and its results, to perceive relationships, to concentrate, to be accurate and to be systematic in our work habits.
- Mathematics develops the ability to perform necessary computations with accuracy and reasonable speed. It also develops an understanding of the processes of measurement and of the skill needed in the use of instruments of precision.
- Mathematics develops the ability to a) make dependable estimates and approximations, b) devise and use formulae, rules of procedure and methods of making comparisons, c) represent designs and spatial relations by drawings, and d) arrange numerical data systematically and to interpret information in graphic or tabular form.

Application of Mathematics

The history of mathematics is the story of the progress of civilizations and culture. "Mathematics is the mirror of civilization". Egyptian and Babylonian civilizations have given a pertinent position to Mathematics. They considered it as a subject to be learnt in order to perform daily life activities in a better way. Elementary arithmetic and algebra were built up to solve the problems related to commerce and agriculture. They used this knowledge generally for money exchange, simple and compound interest, computing wages, measuring weights and lengths, determining areas of fields, etc. Since ancient times, the subject of Mathematics has been given a pivotal position due to its utilitarian and disciplinary values. It is believed that study of Mathematics improves our mental power and reasoning ability.

- A country's civilization and culture is reflected in the knowledge of mathematics it possesses. Mathematics helps in the preservation, promotion and transmission of cultures. Various cultural arts like poetry, painting, drawing, and sculpture utilise mathematical knowledge. Mathematics has aesthetic or pleasure value. Concepts like symmetry, order, similarity, form and size form the basis of all work of art and beauty. All poetry and music utilizes mathematics. Quizzes, puzzles, and magic squares are both entertaining and challenging to thought. Hence, the teaching of mathematics is inevitable in our schools.

Place of Mathematics curriculum in present school curriculum

It is in this context, that National Curriculum Framework (NCF, 2005), stated that the main goal of Mathematics education in schools is the mathematisation of the child's thought processes. Basically, it means that children should learn to think about any situation using the language of Mathematics. Further NCF argued that, for the realisation of this vision, school Mathematics needs to recognize and try to work to achieve the following aims of teaching Mathematics.

Check Your Progress – 1

Tick the correct answers using '✓' mark

We need to learn mathematics because_____

a) The routine activities of daily life demand a mastery of number of facts and number of processes.

b) To get status in the society

c) To read with understanding much of the materials in newspapers requires considerable mathematical vocabulary.

d) To teach our children

e) To gain an appreciation of the role played by mathematics in many fields of work.

f) To be proud of ourselves

g) To appreciate the role of Mathematics in the development process

h) To learn how to analyse a situation.

2.5.3.2. Mathematics and School Curriculum

Aims and Objectives of Mathematics Curriculum

The narrower aim of teaching Mathematics at school is to develop useful capabilities, particularly those relating to numeracy- numbers, number operations, measurements, decimal and percentage. The broader aim is to develop the child to think and reason mathematically, to pursue assumptions to their logical conclusions and to handle abstractions.

School Mathematics curriculum should help the children learn to enjoy Mathematics. How can these visions materialise? The following objectives will help us in realising the vision of school Mathematics curriculum:

- Attain proficiency in fundamental mathematical skills;
- Comprehend basic mathematical concepts;
- Develop desirable attitudes to think, reason, analyse and articulate logically;
- Acquire efficiency in sound mathematical applications within Mathematics and in other subject areas;
- Attain confidence in making intelligent and independent interpretations; and
- Appreciate the power and beauty of Mathematics for its application in science, social sciences, humanities, arts, etc.

Principles of Formulating Mathematics Curriculum

- Curriculum can be considered as the sum total of all the experiences gained by a child as a result of various formal as well as informal activities at school, at home and in the society
- Basic component while designing a curriculum is nothing but the pre-determined objectives. The next aspect is the curricular activities to be provided to the students for realising these objectives.
- The pedagogical approach that a teacher is going to use for organizing those activities will decide whether the child will be able to learn the concept or not.
- While constructing the Mathematics curriculum we need to consider those topics or themes, which would help children to succeed in their everyday life.
- Secondly child's needs, interests and capabilities should be considered as the base for curriculum construction.
- The content and various activities provided in the curriculum should help the students to understand the social and civic responsibilities.
- Conservation of our cultural heritage is an important aspect that needs to be taken care of while framing curriculum.
- The curriculum should be framed in such a way that different types of children can have opportunity for self-expression and development.
- The most modern and latest development in mathematical ideas should be included in the curriculum.

Discipline of Mathematics in present school curriculum

The sequential curriculum is followed in math across the school years.

Sequence is the presentation of the material in a logical order. The sequence could be determined…

- By increasing complexity ,

- By logic (local environment to world),

- Psychologically (begins with immediate interests and proceeds to more remote ones).

Any curriculum for mathematics must incorporate the progression from the concrete to the abstract and subsequently a need to appreciate the importance of abstraction in mathematics.

Maths Education at Primary & Upper Primary School

In the lowest classes,

- Activities with concrete objects form the first step in the classroom to enable the child to understand the connections between the logical functioning of their everyday lives to that of mathematical thinking.
- Operations on natural numbers usually form a major part of primary mathematics syllabi.
- However, the standard algorithms of addition, subtraction, multiplication and division of whole numbers in the curriculum have tended to occupy a dominant role in these. This tends to happen at the expense of development of number sense and skills of estimation and approximation.
- Operations should be introduced contextually. This should be followed by the development of language and symbolic notation, with the standard algorithms coming at the end rather than the beginning of the treatment.
- Making simple comparisons and classifications along one dimension at a time, and identifying shapes and symmetries, are appropriate skills to acquire at this stage. Encouraging children to use language to freely express one's thoughts and emotions, rather than in predetermined ways, is extremely important at this and at later stages.
- Mathematical games , puzzles and stories involving number are useful to enable children to make these connections and to build upon their everyday understandings.

Math Education at Upper Primary School

- At the upper primary stage, students start the application of powerful abstract concepts .
- Students are introduced to algebraic notation and its use in solving problems and in generalisation, to the systematic study of space and shapes, and for consolidating their knowledge of measurement.
- Data handling, representation and interpretation form a significant part of the ability of dealing with information in general, which is an essential 'life skill'.
- The learning at this stage also offers an opportunity to enrich students' spatial reasoning and visualisation skills. (Involves Set theory , Operations, Ratio & proportion, Simple planar Geometry concepts, basic algebraic Concepts , linear equations etc.)

Math Education at Secondary School

- At the secondary stage, students begin to perceive the structure of Mathematics as a discipline.
- They become familiar with the characteristics of mathematical communication, carefully defined terms and concepts, the use of symbols to represent them, precisely stated propositions, and proofs justifying propositions.
- Topics covered – Concept of IR and R numbers and their operations, Exponential numbers, Quadratic equations, Simultaneous equations ,Theorems on elements of a circle / quadrilaterals , Mensuration , Logarithms ,Trignometry etc.
- At this stage, students integrate the many concepts and skills that they have learnt into a problem-solving ability.
- Mathematical modelling, data analysis and interpretation taught at this stage can consolidate a high level of mathematical literacy.
- Individual and group exploration of connections and patterns, visualisation and generalisation, and making and proving conjectures are important at this stage, and can be encouraged through the use of appropriate tools that include concrete models as in Mathematics laboratories and computers.

Math Education at Higher Secondary School

- The aim of the Mathematics curriculum at the higher secondary stage is to provide students with an appreciation of the wide variety of the application of Mathematics, and equip them with the basic tools that enable such application.

- A careful choice between the often conflicting demands of depth versus breadth needs to be made at this stage.
- Topics – Sequences/ Series, Aritmetic /Geometric Progression, Calculus, Higher algebra, Co-ordinate geometry, Conics (2d Geometry) , Trignometry etc.

Issues and challenges in teaching the discipline of Mathematics

Position Paper of National Focus Group on Mathematics identifies some issues with reference to teaching of Mathematics:

a) A sense of fear and failure regarding mathematics among a majority of children,

b) A curriculum that disappoints both a talented minority as well as the non-participating majority at the same time,

c) Crude methods of assessment that encourage perception of mathematics as mechanical computation,

d) Lack of teacher preparation and support in the teaching of mathematics.

e) Compartmentalisation: there is very little systematic communication between primary school and high school teachers of mathematics, and none at all between high school and college teachers of mathematics

f) Systemic problems further aggravate the situation, in the sense that structures of social discrimination get reflected in mathematics education as well. Especially worth mentioning in this regard is the gender dimension, leading to a stereotype that boys are better at mathematics than girls.

Role of Mathematics with reference to sustainable development and Health

- Mathematical models are used to predict environmental changes. Statistics provides invaluable data to Governments to draw up health care programs
- Risk factors for diseases are estimated through the use of mathematics
- Modeling is important in a range of areas such as:
  - ✓ preparing for flu outbreak
  - ✓ modelling the impact of an epidemic
  - ✓ Predicting health needs of the future
  - ✓ Certain Computational models use gene expression data to diagnose and treat diseases.

Factors Affecting Change in Mathematics Curriculum

Educators are aware that changes have taken place in school mathematics in the past two to three decades. These changes have brought about a near revolution in the content, methods and instruction of mathematics.

Reasons for changes

- The rapid advance of knowledge in mathematics makes increasingly greater demand on an enlightened citizenry.
- The need for more effective articulation from one grade to the next and from elementary to secondary school.
- The recognition that the traditional mathematics programme, limited mainly to emphasis on computational skills and divided into traditional compartments viz. arithmetic, algebra and geometry, is somewhat lacking in a few fascinating and interesting aspects of mathematics.
- The need for a better understanding of the structure of mathematics and the mathematical process, its language and methods of proof.
- The need for the utilization of more effective media (technology and aids) for adapting mathematics learning to the needs of different abilities.

Modern Trends or New emphasis in Mathematics Curriculum:

The following changes have taken place in recent years:

- Concern for the child as an individual and as a learner caused educators to question
- the grade placement of certain topics in elementary school mathematics.
- A change in emphasis to a more generalized language, formulation of laws and of Mathematics in integrating algebraic processes in computational work.
- The drill method of teaching was replaced with methods emphasizing "meaning" and explaining the "whys" of the processes as related to computational procedures.
- Psychologists emphasized the relatedness of learning and explored the process of learning pertinent to the development of fundamental mathematical ideas. They found that there are levels, that is,

(a) the level of the concrete or the world of things;

(b) the level of the semi concrete where experiences are internalized and fit together;

(c) the symbolic level where abstractions and generalizations are formulated;

(d) the level of applications where the generalizations are tested and applied to situations.

This led them to conclude that certain topics should be introduced much earlier than was formerly believed.

- Bruner's hypothesis that any subject can be taught effectively in some intellectually honest form to any child at any stage of development led to an explosion of new methods based on discovery and problem-solving.
- The study of geometry was expanded far beyond Euclid's elements. The basics of transformations, vectors and coordinate geometry were included. In algebra emphasis has now been given to equations by broadening the base to include ideas such as mathematical sentences, replacement set and solution set. Generalizations, of the properties of the real number system and the introduction of the algebra of sets, groups, etc., provided an expansion of mathematical ideas in both depth and breadth. Basic concepts such as function, variable, relations, etc., gained greater importance.
- The use of computers has further enriched the content and practices in mathematics education in schools.
- Subject-Centred Approach: This approach to curriculum lays more emphasis on content in comparison to learners and teaching process. Teachers' role is very crucial who are expected to transact the curriculum with a view to help students to learn different subjects.
- Behaviourist Approach: In this approach, the development of curriculum starts with a plan, called blueprint. Blue print consists of goals and objectives of learning of the particular subject. This approach suggests that teacher should disseminate information in a sequential way and demonstrate how to solve a problem, how to derive a formula, and how to construct a shape, followed by independent practice by students. The role of students in this approach is to repeat what teacher transacted in the classroom.
- Constructivist Approach: It is based on the premise that whenever a child encounters a new experience, he/she can either easily connect it with the existing

knowledge or can make some changes in the existing knowledge to accommodate the new experience.

- Learner-Centred Curriculum: In this approach, the needs and interest of learners are paramount. The role of student will be that of an active participant in the learning process, and therefore, it necessitates that the teacher should know well each child. Learner centred curriculum will definitely help the child to enjoy Mathematics, to make him realize its beauty, and to remove the fear of difficulty of the subject. Another benefit of this curriculum is its flexibility. The new development and thinking in the area of Mathematics can be included at any time through the modification of the curriculum.
- Activity-Centred Curriculum: This is also very similar to learner centred curriculum. The role of the learner is very important and should be very active. This is based on the premise that child loves to play and activity will help to create motivation. When curricular material is presented in terms of activity, it is known as activity centred curriculum. Learning of the prescribed material included in the curriculum takes place through appropriate activities.

Check Your Progress-2

1. The aim of the Mathematics curriculum at the higher secondary stage is _____

   a) To provide wide variety of the application of Mathematics

   b) To provide wide variety of the solicitation of Mathematics

   c) To provide wide variety of the assessment of Mathematics

   d) None of these

2. The approach that makes changes in the existing knowledge to accommodate the new experience is _____

   a) Constructivist Approach

   b) Learner-Centred Curriculum

   c) Behaviourist Approach

   d) None of these

3. Mathematical models are used to _____

   a) predict environmental changes

   b) forecast conservational changes

c) expect recyclable changes

d) None of these

2.5.4. Let Us Summarise

- Learning of Mathematics helps in daily life of an individual.
- Mathematics should be considered as a core subject area in school curriculum due to its wide applications.
- As per National Curriculum Framework (2005), mathematisation of the mind of the child will be the vision of school Mathematics.
- The narrower aim of teaching school Mathematics is to develop useful capabilities, particularly those relating to numeracy- numbers, its operations, measurements, decimals and percentages.
- The higher aim is to develop the child's resources to think and reason mathematically, to pursue assumptions to their logical conclusions and to handle abstractions.
- In order to fulfil the vision of mathematisation, curriculum should be constructed based on measurable and attainable objectives.
- While developing Mathematics curriculum with a vision of mathematisation, curriculum designers should keep in mind some basic principles of curriculum development.
- Some of the curricular concerns like teacher preparation, pedagogical- Mathematics approaches, student assessment, etc, needs to be taken care of, while developing the curriculum.
- Appropriate topics need to be included in Mathematics curriculum at various stages of school education.
- Shift from subject-centred curriculum to constructivist approaches like learner-centred and activity-centred curriculum and their benefits.

2.5.5 Answers to 'Check Your Progress' 1 and 2

Check Your Progress – 1

a,c,e,g,h - '✓'

Check Your Progress'-2

1-a, 2-a, 3-a

2.5.6. Unit - end Exercises

1. List the uses of mathematics in other areas: social studies; the sciences; art; music; health and physical education.
2. Analyse a textbook of mathematics and find out if the branches of mathematics are genuinely integrated.
3. Prepare a report on the Modern Trends in School Mathematics Curriculum at the Global level.

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Block - 2 : Classification and Teaching Across Disciplines

Unit - 6 : Social Justice and School Subjects

Unit Structure

2.6.1. Learning Objectives

After completing this Unit, the student teachers will be able to

- Explain the concept of Social Justice;
- Describe the type of culture to be formed in school to develop the attitude and practices of Social Justice in Schools; and
- Explain how the attitude of Social Justice can be developed while teaching different school subjects.

2.6.2. Introduction

We all know that schools set higher goals to achieve rather than just teaching a few subjects and helping students to get marks in the examination. This is mainly related to developing desirable values and attitude among students that are needed for the development of individual and society. One of the important values that need to be focused in the process of schooling is the value of social justice. The development of social justice will help to

form a truly democratic citizens who contribute to a large extent for the success of democracy. Hence, in the present Unit, let us discuss what is meant by social justice and how the attitude of social justice can be developed through schools in general and subjects in particular

2.6.3. Learning Points and Learning Activities

2.6.3.1. Concept of Social Justice and Social Justice Culture within School Set up

Social justice, if needs to be realised in society should start from our classrooms. Therefore, social justice education should be part and parcel of our school set up. It is concerned with achieving equitable and quality education for all students.

As experts in the field suggest, it is both a process and a goal. The goal of social justice education is full and equal participation of all groups in society that is mutually shaped to meet their needs.

Social justice includes a vision of society in which the distribution of resources is equitable and all members are physically and psychologically safe and secure. It is a sort of society in which individuals are both self-determining and interdependent.

In the school situation social justice should be viewed at two levels: one at the school level, where in social justice is maintained by the teachers and students together and the value of social justice is thus practiced. Second, to develop the thinking and behaviour of students in such a way that they are able to maintain social justice culture in the society in which they live.

Historically, classrooms have been the stage for social change, providing a venue to promote and accelerate new ideas. In addition to academic instruction, one of the important roles of a classroom teacher is to help students develop the critical thinking, collaboration, and self-reflection skills necessary to foster a better society.

Social justice doesn't manifest in a singular fashion, nor is it achieved through a specific means of instruction. Students who focus on this concept and develop related attitude and values, use critical examination of themselves, others, institutions and events to find patterns of inequality, discrimination, then explore possible solutions to the problems they have identified. Social justice advocates hope to build a society in which individuals have equal access to resources and receive equitable treatment regardless of their race, gender, religion, sexuality, income level or disability.

Enabling conversations about these issues empowers students to voice their concern and question unjust situations in their lives or in the lives of those around them. To help students examine systemic inequality, teachers can have them consider questions such as:

- Who makes decisions and who is left out?
- Who benefits and who suffers?
- Why is a given practice fair or unfair?
- What is required to create change?
- What alternatives can we imagine?

Through answering these questions, students can start to recognize injustice existing at the micro and macro levels.

Experts have suggested that we need to 'rethink of our classrooms' because they are not taking into consideration the abilities required to deal with the social and personal situation in 'just' ways. Our Classrooms, in reality can help teachers and students gain indications of the types of society we live in and prepare students to develop critical thinking abilities to deal with it.

In order to develop the attitude of social justice among students, we need to have a special set up in our schools/classrooms. The following practices contribute to build up such an environment.

- The classroom should be a safe and encouraging place for students where they can express their experiences, beliefs, opinions and suggestions. The teacher should create space for students to feel free to say what they intend to say.
- A community of conscience need to be developed within the classroom. What is this community of conscience? It is a group working together based on a 'a set of moral principles. Social justice should be the base to set the norms within this community also. This leads to fairness within classroom behaviour.
- Productive conversations can be created by teaching students to share their ideas and respond to the ideas of others in a way that allows for disagreement but still values the student's perspective.
- Teachers can model questions and answers that illustrate ways to thoughtful conversation rather than making students feel bad or devalued by their classmates. By providing model responses, teachers can illustrate to students how a good response helps to enrich a conversation whereas some responses can shut discussions down.
- Helping students see each other as co-learners rather than opponents. They should view their classmates as academic siblings rather than as competitors.

- Attempts should be made to interact with every student and the views of every student should be respectfully accepted and acknowledged.
- Teachers can also strengthen the classroom community through learning experiences that draw upon the diverse backgrounds of their students. The diverse background should be utilised as a resource in the classroom. This helps the students with diverse background to understand better, at the same time enriching the information of students who are from different backgrounds.
- The messages from the materials from text books, resource books should not be presented as they are, but should be analysed in front of students from the point of view of social justice. For example, most of the times teachers complete the lesson just by saying that 'there were four varnas in Indian society namely, bramhanas, kshatriyas, vaishyas and shudras', but never make a comment on the injustice made for some of these groups by the upper strata of the society.
- Correlate the teaching points with the current issues. For example, while teaching about some event of the past, correlate with the present situation so that the students compare and see to what extent there was justice in the past and to what extent the situation has improved. While teaching about varnas, teacher can relate with the present situation, where our society is in transition as far as this point is concerned, changing from the caste system to class system.
- Give opportunities for self-reflection. At times, teachers can ask students to reflect on their behaviour and find out to what extent they are contributing or not contributing for social justice. The teacher can provide a three point or five point rating scale for students to rate their behaviour.
- Teachers can motivate students to critically analyse the information/ news available from print media, television and social media and discuss from the point of social justice.

Social justice can't be taught in one easy lesson. It is a value that gets integrated into the teaching philosophies and actions of teachers. By helping students feel safe and encouraged, teachers can help students start asking the right questions and then participate in ways that are purposeful and productive.

Check Your Progress - 1

Answer the following questions to understand the extent you promote the culture of social justice in your school.

1. What is happening at your school to address social justice issues as a learning community?
2. What are you doing in your classroom to examine social justice issues?
3. How might your school implement specific practices to address social justice as an institution?

2.6.3.2. School Subjects and Social Justice

you are teaching one or two subjects in your school. You have understood the concept of social justice. Think of some topics which you think have scope to develop awareness and commitment for social justice among students.

Below are given some topics. Identify the topics that are more conducive to develop awareness and commitment for social justice than others.

- Types of democracy
- Administration of Akbar
- Properties of acids
- Water resources
- Social challenges of India
- Economic challenges of India
- Ration and Proportion
- Simple interest
- Compound interest.

It is interesting that school subjects can be very well utilised to develop awareness among number of issues like gender related issues, population related issues etc. School subjects prove to be very effective to teach social justice also. With such applications teaching of school subject become more meaningful and creative for both students and teachers. This demands a teacher who is resourceful, creative and innovative. A systematic and focused planning will certainly help to develop the awareness, attitudes and values required to achieve social justice.

As mentioned earlier, the schools should practice social justice within their system. The practices, rules and regulations of school should be formed based on the principles of social justice. Once students observe social justice within the system, they will realise its meaning and get prepared to practise the same in the larger society.

The teaching of curricular subjects should be planned in such a way that they reinforce the attitude towards social justice which they have already observed in the school system. Subjects like math, science, social science, languages have ample scope to promote the value of social justice. Some topics lend themselves to teach social justice.

Let us take the examples of math classes. Topics like simple interest, compound interest can be related to a larger context, it is, the community in which the students live. The teacher can give a problem where a land lord lends money to the poor farmers with very high rate of interest, and calculates compound interest for the same. The students can be asked to solve the problem based on this situation wherein they are supposed to calculate the amount to be returned by the farmer, based on compound interest. After they finish solving, the same problem can be extended to the community. The teacher can ask the students, "do you see people taking loans with interest, as we saw in the problem just now?" . If so, what will be the consequences? This situation can be used to teach about social justice. Below are given the themes, focal points from the point of view of the subject, focal point from the point of view of teaching social justice. Observe them. The teacher should successfully lead the discussion to achieve the goal.

Mathematics

Content/ Theme	**Task**	**Issues/points for discussion from subject point of view**	**Issues for discussion from the point of view of social justice**
Compound Interest	A land lord gave a loan of Rs at a rate of 20 percent compound interest per year. What is the total amount to be given by the farmer to the land lord after 3 years	What is the total amount to be given by the farmer to the land lord after 3 years	How just it is to lend money at the rate of 20% interest? Is it really happening in our society?
Ratio and proportion	In a farm the daily wages for men is Rs 300 and women Rs 200. If three men and 5 women work for 5 days what is the total amount to be paid to the workers. Find the ratio of wages for men and women.	Find the ratio of wages for men and women.	Does this type of discrimination exist in our society? What measures are required to overcome this discrimination?

Science

Content/ Theme	Task	Issues/points for discussion from subject point of	Issues for discussion from the point of view of
Balanced Diet	Collect information about Balanced Diet.	Collect information about Balanced Diet. Explain the meaning of Balanced Diet.	What proportion of people can afford to have balanced diet every day.
	Collect information about the meaning and status of adulteration in India.	Collect information about the meaning and status of adulteration in India.Collect information about the cases of adulteration in urban and rural areas.	What are the reasons for the current status? How to overcome them?
	Collect information about the cases of adulteration in urban and rural areas.	Explain the concept of adulteration with examples	Why do more poor people suffer from the effects of

Social Science

Content/ Theme	Task	Issues/points for discussion from subject point of	Issues for discussion from the point of view of
Illiteracy	Collect information about meaning, causes of illiteracy and collect data about the rate of illiteracy in India today and the causes for the same.	Explain the meaning of illiteracy and its causes.	Why is it that the poor among masses form a bigger group of illiterates than the middle and higher middle class? Is it just and appropriate?
Dowry	Collect information about the status of dowry system in Karnataka	Explain the reasons for dowry system in Karnataka	What is the relationship between dowry and social justice?

Languages:

Language has more scope than any other subject to teach social justice. Activities like quiz, essay writing, story writing, story analysis, poem analysis, analysis of proverbs, panel discussions, enacting plays etc can be successfully used to develop social justice.

Not all topics under each subject, lend themselves to teach social justice. It is also true that social justice cannot be taught in a manner that is not natural. Such attempts will not take us to reach the goal. A realistic, creative planning, with committed attempts of the teacher along with supportive ambience of the school will prove successful to achieve the goals of social justice.

Check Your Progress -2:

Take a topic of your choice and plan a lesson to achieve the goal of developing the attitude of social justice among students.

2.6.4. Let Us Summarise

- Social justice includes a vision of society in which the distribution of resources is equitable and all members are physically and psychologically safe and secure.
- In the school situation social justice should be viewed at two levels: one at the school level, where in social justice is maintained by the teachers and students together and the value of social justice is thus practiced. Second, to develop the thinking and behaviour of students in such a way that they are able to maintain social justice culture in the society in which they live.
- Social justice advocates hope to build a society in which individuals have equal access to resources and receive equitable treatment regardless of their race, gender, religion, sexuality, income level or disability.
- Social justice can be developed through school practices in general and while teaching different school subjects, following different strategies. These strategies and activities are to be planned identifying appropriate plug points in each subject.

2.6.5. Answer to Check Your Progress – 1 and 2

Check Your Progress - 1

Share your ideas with your colleagues

Check Your Progress -2:

Execute the plan and document your experiences. Share your experiences with your colleagues. Prepare a collection of such plans and share with your colleagues.

2.6.6. Unit end Exercises

1. Explain the importance of developing the attitude of social justice in schools and describe how you can achieve them.
2. Illustrate how you can develop social justice while teaching different school subjects.

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Indira Gandhi
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BES-125
Understanding Disciplines and Subjects

Block

1

UNDERSTANDING KNOWLEDGE AND DISCIPLINES

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BES-125 UNDERSTANDING DISCIPLINES AND SUBJECTS

BES-125 CUNDERSTANDING DISCIPLINES AND SUBJECTS

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

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 preceeded 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

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.

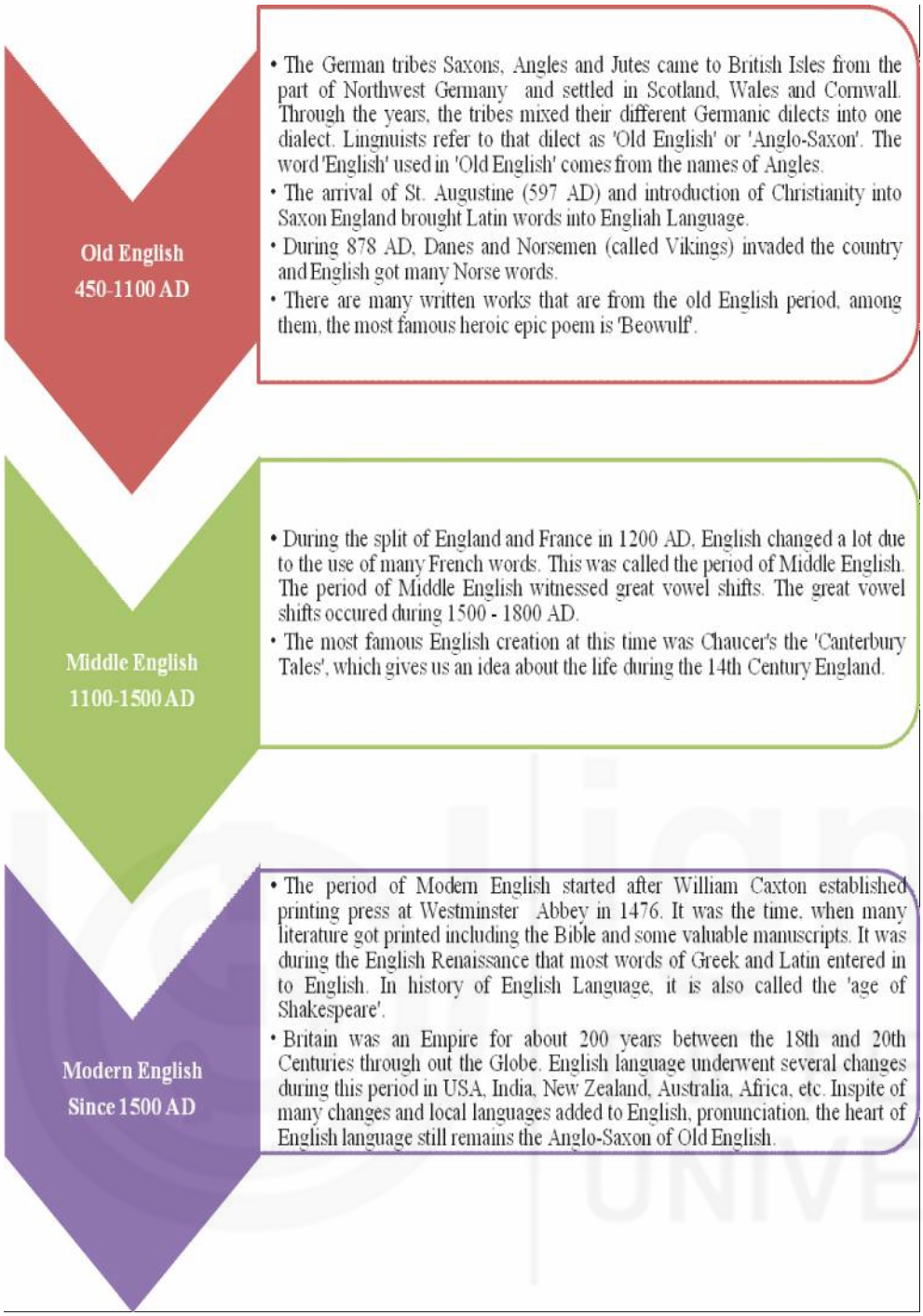

Figure 2.1 : History of English Language

*[**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.

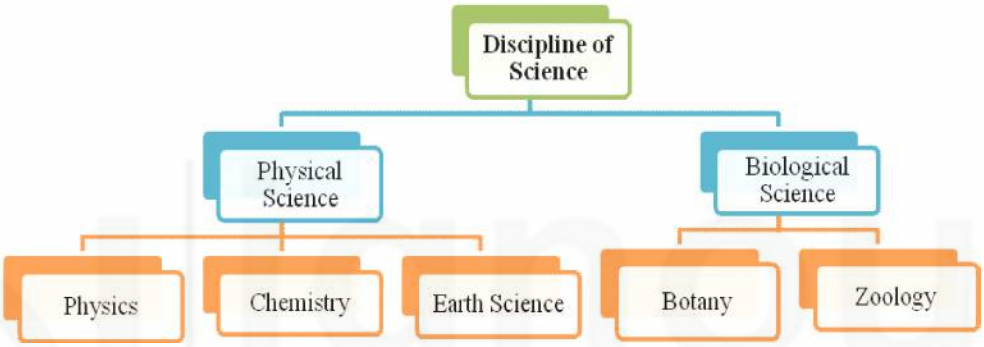

Figure 2.2 : Branches of Discipline of Science

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.

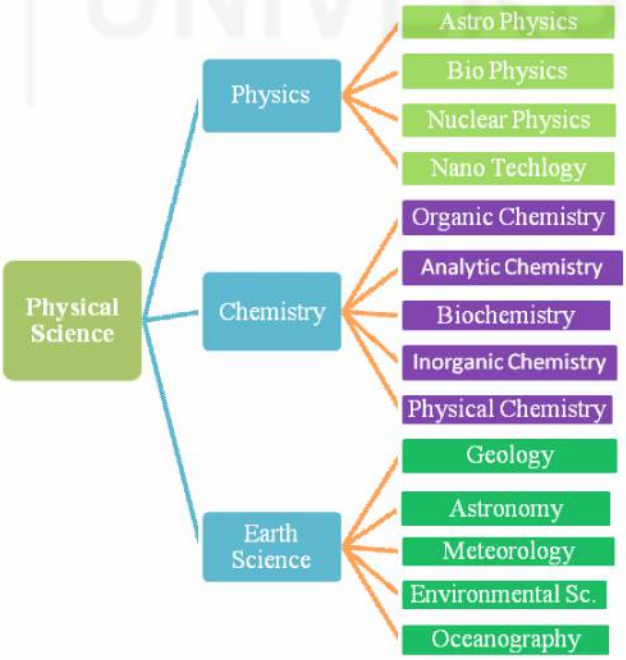

Figure 2.3 : Sub-disciplines of Physical Science

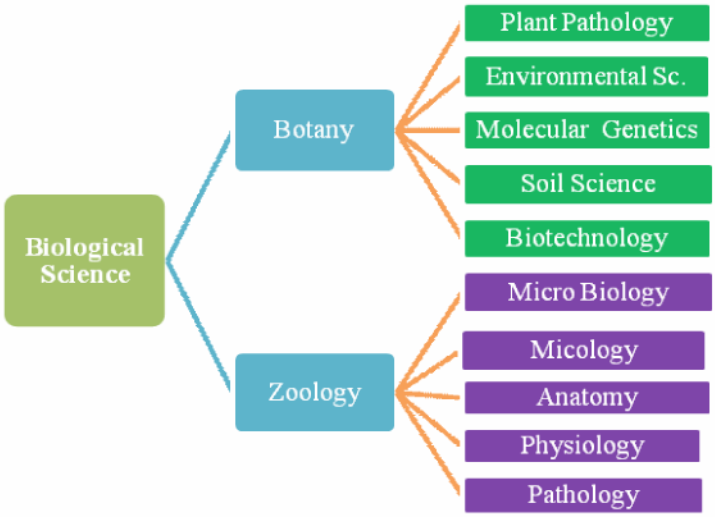

Figure 2.4 : Sub-disciplines of Biological Science

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.

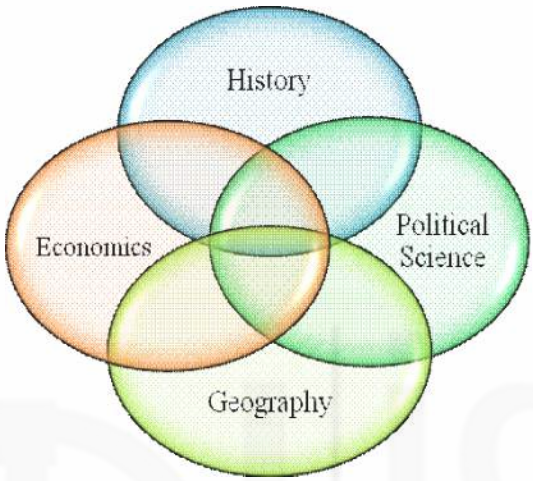

Figure 2.5 : Interrelationships of Social Sciences within the discipline

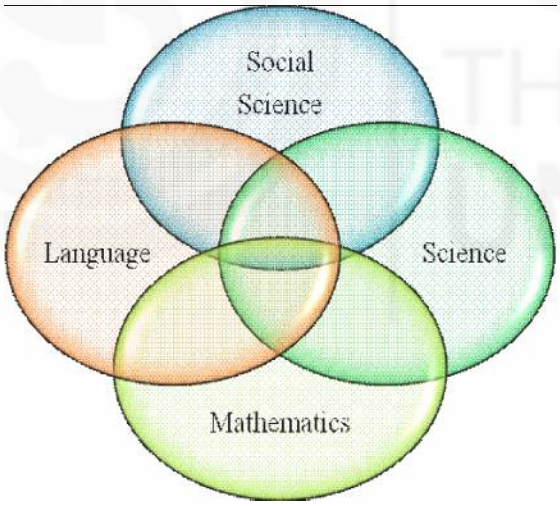

Figure 2.6 : Interrelationships of Social Sciences among the disciplines

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:

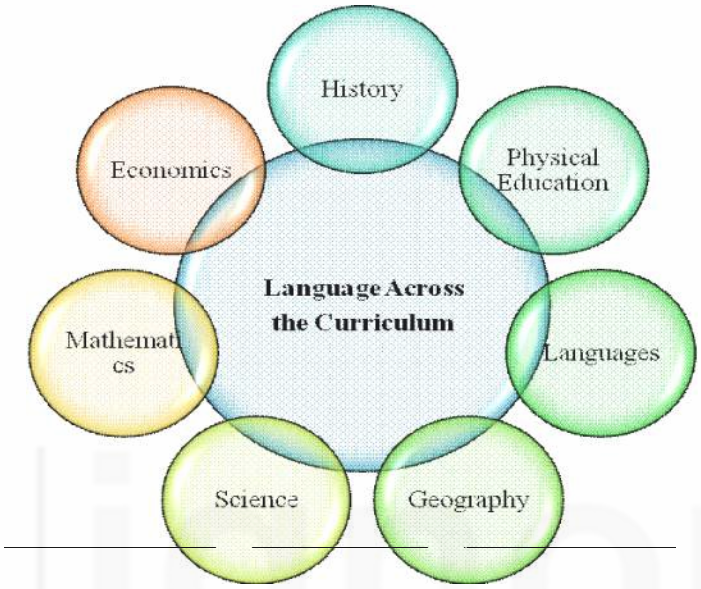

Figure 2.7 : Language Across the Curriculum

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.

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)*

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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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. Analyze the difficulties of classifying and integrating specific areas of knowledge in school curriculum.

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4. Identify the pedagogical methods and techniques for transacting specific areas of knowledge in school curriculum.

   a) Art and Craft Education:

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   b) Work Education:

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   c) Peace Education:

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   d) Yoga, Health and Physical Education:

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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

✓ *G.TM*

The Method	*G T M*
Objectives	• Helping students read and appreciate foreign language literature • Students will be familiar with the grammar of their mother tongue.
Principles	• Translation • The mother tongue is a medium • Accuracy
Language skills targeted	• Reading and writing
Roles of the teacher/learner (type of interaction)	Teacher's Role : centered- corrector Student's role: memorizing rules
Techniques and Activities	• Deductive application of grammatical rules • Students answer reading comprehension questions in the target language. • Translate the target language into their native language.
Respond to learners' errors	• Errors are not tolerated • Peer-correction
Role of L1	• The mother tongue is a medium

✓ *Direct method*

The Method	✓ *Direct method*
Objectives	• Students should learn to speak and understand the target language in everyday situations. • Enable students to use a foreign language to communicate
Principles	• No translation is allowed • L2 is learned naturally, like a baby learning its mother tongue • Students should learn to think in the target language • Grammar should be taught inductively
Language skills targeted	Speaking and writing
Roles of the teacher/learner (type of interaction)	Teacher's Role : monitor – facilitator – guide Student's role: centered – responsible of the learning – autonomous
Techniques and Activities	• conversational activity • self- correction • Use pictures in classroom environment to help understand the meaning. • Fill in the blank exercise • Dictation
Respond to learners' errors	• Errors are indispensable and natural part of learning • Never imitate mistakes: correct
Role of L1	• L1 should not be used in the classroom

The Method	✓ ***Audio-Lingual method***
Objectives	• Accurate pronunciation • Knowledge of vocabulary • Learners learn to use and think in target language
Principles	• The use of dialogue • The use of target language • Speaking is the primary form of language • Positive reinforcement • Teaching of the culture of the target language
Language skills targeted	Speaking and listening
Roles of the teacher/learner (type of interaction)	Teacher's Role : centered and active Student's role: imitator or the teacher's modal or the tapes.
Techniques and Activities	• Repetition • Drilling • Dialogue memorization
Respond to learners' errors	Teacher corrects errors immediately
Role of L1	----------

✓ ***Audio-Lingual method***

The Method	*Suggestopedia*
Objectives	• Eliminating psychological barriers to learning • Accelerate the pace of learning • Make learning a funny process
Principles	• Students remember information coming from authoritative source • Learning is facilitated in a comfortable environment • Positive reinforcement • Teaching of the culture of the target language
Language skills targeted	Speaking and listening
Roles of the teacher/learner (type of interaction)	Teacher's Role : Total control of the class Student's role: Recipient - participant.
Techniques and Activities	• Classroom set-up • Peripheral learning • Visualization • First concert - second concert • Choice of new identity • Role play
Respond to learners' errors	• Errors are corrected indirectly and gently
Role of L1	• L1 can be used to clarify some difficult parts

✓ **suggestopedia**

The Method	***community language learning***
Objectives	• Short term objectives: linguistic/grammatical knowledge of the TL (Accuracy-oriented) • Long term objectives: communicative competency (Fluency-oriented)
Principles	• Counseling-Learning theory (counselor – Client) • Bilingual Educational Program (L1 & L2) • Language as Social Process (sense of community, belonging and intimacy with each other • Consensual validation or "convalidation" (mutual warmth, understanding and positive evaluation of the other person' worth.
Language skills targeted	Speaking and listening
Roles of the teacher/learner (type of interaction)	Teacher's Role : Counselor – provider of the input – translator – model of imitation – adviser – supplier , more like a "father" Students' role: Member of a community – client – imitate the teacher – share ideas with the class in the TL.
Techniques and Activities	• Translation • Rote learning • Group work → Small-group discussions → Preparing a conversation → Preparing a story… • Recording • Transcription • Reflection & Observation • Free conversation
Respond to learners' errors	Since the teacher is the provider of input in the target language for students to remember, learners must not make errors.
Role of L1	The Role of L1 is Essential as long as translation is concerned the back-bone of CLL.

✓ ***Community Language Learning***

The Method	*TPR*
Objectives	• Developing basic communication skills and vocabulary through responses to imperative commands
Principles	• Listening and understanding the target language should be developed before speaking • Focus on the meaning rather than the form of the items • TPR learners should be in a comfortable environment • Incorporate some humour • Coordination of speech and action
Language skills targeted	Listening and speaking
Roles of the teacher/learner (type of interaction)	Teacher's Role : director of students" behaviors Student's role: imitators of the non-verbal model
Techniques and Activities	• Using comments to direct behavior • Role reversal • Action sequence • Role playing scripts, miming
Respond to learners' errors	• Errors are tolerated at the beginning
Role of L1	• ----------

✓ ***TPR***

The Method	***The silent way***
Objectives	• Accurate pronunciation • Knowledge of vocabulary and grammar
Principles	• The teacher should be silent as much as possible • Interference of the teacher when necessary • Learning is based on discovering and creating rather than remembering and repeating. • The use of objects: rods, Cuisenaire, fidel chart • Learner's previous knowledge is necessary • Cooperative learning
Language skills targeted	Speaking
Roles of the teacher/learner (type of interaction)	Teacher's Role : should be silent – facilitator – guide Student's role: centered – responsible of the learning – autonomous
Techniques and Activities	• Group work • Peer- correction • The use of objects: rods, Cuisenaire, fidel chart • Use of body language: gestures
Respond to learners' errors	• Errors are indispensable and natural part of learning • Teacher corrects errors the language only as a last resort
Role of L1	• L1 can be used to give instructions when necessary

✓ ***The silent way***

The Method	*CLT*
Objectives	• Developing communicative competence • Creating meaning rather than developing grammatical structures • Making use of real life situations • Accuracy and fluency
Principles	• Communication principle • Task principle • Meaningfulness
Language skills targeted	• Listening & Reading (input) • Speaking & Writing (output)
Roles of the teacher/learner (type of interaction)	Teacher's Role : Needs analyst – facilitator – counselor – organizer Student's role: Communicator – negotiator – responsible for learning
Techniques and Activities	• Task completion activities • Information gathering activities • Opinion sharing • Role playing • Jig-saw activities
Respond to learners' errors	• Errors are acceptable • Self-correction
Role of L1	• L1 shouldn't be used in classroom

✓ ***The CLT***

Paradigm Shift: Understanding and Implementing Change in Second Language Education

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Abstract

Change seems to be a constant in education. We can better understand and implement change in second language education if we look for connections between changes. The concept of paradigm shift offers one means of making such connections. This article describes eight changes that fit with the paradigm shift in second language education toward what is most often described as communicative language teaching. These eight changes are: learner autonomy, cooperative learning, curricular integration, focus on meaning, diversity, thinking skills, alternative assessment and teachers as co-learners. The paradigm shift of which these changes are part is put into perspective as an element of larger shifts from positivism to post-positivism and from behaviorism to cognitivism. The authors argue that in second language education, although the paradigm shift was initiated many years ago, it still has been only partially implemented. Two reasons for this partial implementation are: (1) by trying to understand each change separately, second language educators have weakened their understanding by missing the larger picture; and (2) by trying to implement each change separately, second language educators have made the difficult task of change even more difficult.

Introduction

Kuhn (1970) did pioneering work on the process of paradigm change or shift in the sciences. He argued that change in a scientific field does not occur as a step-by-step, cumulative process. Instead, new paradigms emerge as the result of tradition-shattering revolutions in the thinking of a particular professional community. These shifts involve the adoption of a new outlook on the part of researchers and others in that community. Well-known examples of paradigm shifts in the physical sciences include from Ptolemeian to Copernican astronomy and from Newtonian to quantum physics.

Paradigm shifts have also occurred in the social sciences, e.g., sociology and the humanities, e.g., art. [-1-]

Since the early 1980s, the term "paradigm shift" has been used as a means of thinking about change in education. We begin this article by briefly explaining the concept of paradigm and paradigm shift and discussing paradigm shifts of the past century. Next, we examine eight aspects of the paradigm shift in second language education perhaps most popularly known as communicative language teaching. We describe each of these eight aspects, connect it to the overall shift in our field and highlight implications for second language education. Our objective in writing the article is to argue that this shift has not been implemented as widely or as successfully as it might have been because educators and other stakeholders have tried to understand and implement the shift in a piecemeal rather than a holistic manner.

Paradigm Shift

The term "paradigm" is another word for pattern. Pattern forming is part of the way we attempt to make meaning from our experiences (Ausubel, 1968). We use these patterns to understand situations, raise questions, build links and generate predictions. The human brain is designed to generate, discern and recognize patterns in the world around us. We resist the notion that no pattern exists.

When a paradigm shift takes place, we see things from a different perspective as we focus on different aspects of the phenomena in our lives. Twentieth century paradigm shifts across a wide variety of fields can be seen as part of a larger shift from positivism to post-positivism (Berman, 1981; Capra, 1983; Merchant, 1992). Awareness of this broader shift helps make clearer the shifts that take place in any one particular field. Table 1 provides a brief look at some contrasts between positivism and post-positivism.

Table 1 -- Contrasts between positivism and post-positivism

Positivism	**Post-Positivism**
Emphasis on parts and decontextualization	Emphasis on whole and contextualization
Emphasis on separation	Emphasis on integration
Emphasis on the general	Emphasis on the specific
Consideration only of objective and the quantifiable	Consideration also of subjective and the non-quantifiable
Reliance on experts and outsider knowledge--researcher as external	Consideration also of the "average" participant and insider knowledge--researcher as internal
Focus on control	Focus on understanding

Top-down	Bottom-up
Attempt to standardize	Appreciation of diversity
Focus on the product	Focus on the process as well

[-2-]

Paradigm Shift in Second Language Education

In second language education, the principal paradigm shift over the past 40 years flowed from the positivism to post-positivism shift and involved a move away from the tenets of behaviorist psychology and structural linguistics and toward cognitive, and later, socio-cognitive psychology and more contextualized, meaning-based views of language. Key components on this shift concerned:

1. Focusing greater attention on the role of learners rather than the external stimuli learners are receiving from their environment. Thus, the center of attention shifted from the teacher to the student. This shift is generally known as the move from teacher-centered instruction to learner-centered or learning-centered instruction.
2. Focusing greater attention on the learning process rather than on the products that learners produce. This shift is known as a move from product-oriented instruction to process-oriented instruction.
3. Focusing greater attention on the social nature of learning rather than on students as separate, decontextualized individuals.
4. Focusing greater attention on diversity among learners and viewing these differences not as impediments to learning but as resources to be recognized, catered to and appreciated. This shift is known as the study of individual differences.
5. Focusing greater attention on the views of those internal to the classroom rather than solely valuing the views of those who come from outside to study classrooms, evaluate what goes on there and engage in theorizing about it. This shift led to such innovations as qualitative research - with its valuing of the subjective and affective, of the participants' insider views and of the uniqueness of each context.
6. Along with this emphasis on context came the idea of connecting the school with the world beyond as a means of promoting holistic learning.
7. Helping students to understand the purpose of learning and develop their own purposes.
8. A whole-to-part orientation instead of a part-to-whole approach. This involves such approaches as beginning with meaningful whole texts and then helping

students understand the various features that enable to texts to function, e.g., the choice of words and the text's organizational structure.

9. An emphasis on the importance of meaning rather than drills and other forms of rote learning.
10. A view of learning as a lifelong process rather than something done to prepare for an exam.

As mentioned earlier, the paradigm shift in second language education was part of a larger shift that affected many other fields. (See Voght, 2000 for a discussion of parallels between paradigm shifts in foreign language education at U.S. universities and paradigm shifts in education programs in business and other professions). Oprandy (1999) links trends in second language education with those in the field of city planning. He likens behaviorism's top-down, one-size-fits-all approach to education to a similar trend in city planning in which outside experts designed for uniformity and attempted to do away with diversity. [-3-] In response, a new paradigm arose in city planning, a bottom-up one that sought to zone for diversity. Describing the current paradigm in second language education, Oprandy writes:

The communicative approach requires a complexity in terms of planning and a tolerance for messiness and ambiguity as teachers analyze students' needs and design meaningful tasks to meet those needs. The pat solutions and deductive stances of audiolingual materials and pedagogy, like the grammar-translation texts and syllabi preceding them, are no longer seen as sensitive to students' needs and interests. Nor are they viewed as respectful of students' intelligence to figure things out inductively through engaging problem-solving and communicative tasks (p. 44).

Another parallel that Oprandy draws between new ideas in city planning and new ideas in second language education has to do with the role of the subjective. In city planning, attention began to focus on people's need for a sense of security and belonging in people-centered cities. These concerns, as Oprandy suggests, are matched in second language education by the desire to facilitate an atmosphere in which students are willing to take risks, to admit mistakes and to help one another.

Eight Changes as Part of the Paradigm Shift in Second Language Education

The paradigm shift in second language education outlined above has led to many suggested changes in how second language teaching is conducted and conceived. In this section, we consider eight major changes associated with the shift in the second language education paradigm. We selected these eight because of the impact they already have had on our field and for the potential impact they could have if they were used in a more integrated fashion. Firstly, we briefly explain each change, explore links

between the change and the larger paradigm shift and look at various second language classroom implications. These eight changes are:

1. Learner autonomy
2. Cooperative learning
3. Curricular integration
4. Focus on meaning
5. Diversity
6. Thinking skills
7. Alternative assessment
8. Teachers as co-learners

Figure 1 provides an illustration of the interdependence of these eight changes of the paradigm shift in second language education. The circular nature of the figure emphasizes that all the changes are parts of a whole and that the successful implementation of one is dependent on the successful implementation of others. [-4-]

Figure 1. Eight Changes in Second Language Teaching

Learner autonomy

What it is. Learner autonomy is linked to Vygotsky's (1978) concept of self-regulation and Csikszentmihalyi's (1990) work on flow. To be autonomous, learners need to be able to have some choice as to the what and how of the curriculum and, at the same time, they should feel responsible for their own learning and for the learning of those with whom they interact. Learner autonomy involves learners being aware of their own ways of learning, so as to utilize their strengths and work on their weaknesses (van Lier, 1996). Intrinsic motivation plays a central role in learner autonomy. The teacher no longer shoulders the entire burden of running the classroom. A form of democratization takes place with students taking on more rights and responsibilities for their own learning.

Connections to the larger paradigm shift. The concept of learner autonomy fits with the overall paradigm shift because it emphasizes the role of the learner rather than the role of the teacher. It focuses on the process rather than the product and encourages students to develop their own purposes for learning and to see learning as a lifelong process.

Second language classroom implications. Many implications for second language education flow from the concept of learner autonomy. For example, the use of small groups--including pairs--represents one means of enhancing learner autonomy (Harris & Noyau, 1990; Macaro, 1997). Learner autonomy is sometimes misunderstood as referring only to learners being able to work alone. By collaborating with their peers, learners move away from dependence on the teacher. Group activities help students harness that power and by doing so they build their pool of learning resources because they can receive assistance from peers, not just from the teacher.

Extensive reading (Day & Bamford, 1998; Krashen, 1993) offers another means of implementing learner autonomy in second language education . Here, students choose reading material that matches their own interests and proficiency level. If a student begins a book or a magazine and it does not seem the right one for him/her, he/she can switch to another. The hope is that extensive reading will aid students in developing an appreciation for the enjoyment and knowledge to be gained via reading in their second language (as well as their first), thus encouraging them to make reading a lifelong habit. [-5-]

Self-assessment provides yet another way for second language students to develop their autonomy (Lee, 1998; Rothschild & Klingenberg, 1990). The idea is for learners to develop their own internal criteria for the quality of their work, rather than being dependent on external evaluation, often by the teacher, as the sole judge of their strengths and weakness. Developing these internal criteria enables learners to make informed decisions about how to move their learning forward. With self-assessment, no longer do students have to wait for the teacher to tell them how well they are doing and what they need to do next. Yes, the teacher remains generally the more knowledgeable and experienced person in the classroom, but the goal is for students to move toward and perhaps even beyond, the teacher's level of competence. Placing value on learners' knowledge helps them feel more capable of playing a larger role in their own learning.

Cooperative Learning

What it is. Cooperative learning, also known as collaborative learning, consists of a range of concepts and techniques for enhancing the value of student-student interaction. In other words, rather than teachers just asking students to work together and hoping all goes well, cooperative learning offers teachers ideas for helping group activities succeed.

Connections to the larger paradigm shift. Cooperative learning relates to several aspects of the paradigm shift. As with learner autonomy, the use of group activities places students at the center of attention, offering them one means of taking on more rights and responsibilities in their own learning. Process is also emphasized, as students

do not just show each other their answers; they explain to one another how they arrived at the answers (Slavin, 1995). Additionally, cooperative learning acknowledges the place of affect in education, highlighting the importance of positive interdependence, the feeling among group members that the group sinks or swims together (Johnson & Johnson, 1994). Positive interdependence helps students feel support and belonging at the same time that they are motivated to try hard to assist the group in reaching its goals (Kagan, 1994).

Second language classroom implications. Group activities have become more common in second language education (Liang, Mohan, & Early, 1998; Oxford, 1997). For cooperative learning to be successful in second language education, a number of issues must be addressed. One of these issues is the teaching of collaborative skills, such as disagreeing politely, asking for help and giving examples and explanations (Bejarano, Levine, Olshtain, & Steiner, 1997). Many students may be unaccustomed to working with others of academic tasks. Thus, they may need to focus explicit attention on collaborative skills if they are to develop and deploy such skills. These skills are also vital language skills, skills that will serve students well in their future academic careers and in other aspects of their lives where they collaborate with others.

Another means of promoting collaboration is to foster an atmosphere in which cooperation acts not just as a methodology for second language learning but also a topic for learning and a value embraced in learning activities (Sapon-Shevin, 1999). Examples of cooperation as a topic for learning would be students writing compositions about the times that they or people whom they interview had collaborated with others, or focusing on some of the many examples in history or science that show collaboration in action. [-6-]

To establish cooperation as a value, the class can look at what processes in the school, such as norm-referenced evaluation and in society, such as contests with only one winner, promote competition as a value. The class can also think about how to establish a better balance between competition and cooperation, e.g., by students working in groups to do service learning projects in their communities (Kinsley & McPherson, 1995).

Indeed, project work, to be discussed further as one implication of another of the changes flowing from the paradigm shift, is becoming increasing common in education (Ribe & Vidal, 1993). Projects, such as those involving service learning, offer students an opportunity to break down the artificial walls that often separate students from the wider world (Freire, 1970). These service learning projects also provide opportunities for students to learn together for a purpose other than to get a high score on an exam.

Curricular Integration

What it is. Curricular integration serves to overcome the phenomenon in which students study one subject in one period, close their textbook and go to another class, open another textbook and study another subject. When various subject areas are taught jointly, learners have more opportunities to see the links between subject areas. By appreciating these links, students develop a stronger grasp of subject matter, a deeper purpose for learning and a greater ability to analyze situations in a holistic manner (Brinton, Snow, & Wesche, 1989).

Connections to the larger paradigm shift. A key link between curricular integration and the paradigm shift that is the focus of this article lies in the concept of going from whole to part rather than from part to whole. For instance, under the traditional education model, students study a given historical period, e.g., the 19th century, in an atomistic way. In history class, they study key events, people and movements. In science class, in another year or term they discuss notable scientific discoveries. In language class, in yet another year or term they read literature from the period. Or, even if the 19th century is simultaneously dealt with in multiple classes, little or no effort is made to build learning links. Thus, students miss valuable opportunities for understanding context.

Second language classroom implications. The concept of language across the curriculum is one route for implementing a curricular integration (Chamot & O'Malley, 1994). The idea is that language competence is necessary for learning in all subject areas. Students cannot understand their textbooks if they have weak reading skills. Further, asking students to write, even in mathematics class, about what they understand, what they are unclear about and how they can apply what they have learned offers a powerful means of deepening students' competence in a subject area. In second language education, the concept of content-based instruction represents a prime manner in which curricular integration is implemented (Crandall, 1987).

Project work, mentioned in the previous section, is yet another method of implementing curricular integration in that projects are often multidisciplinary (Ribe & Vidal, 1993). For example, an environmental project, e.g., on water pollution, could involve scientific knowledge about how to analyze water samples, mathematics knowledge to do calculations based on the sample, social studies knowledge about the role of governmental, private and civic sectors in cleaning up water pollution and language knowledge to write letters and prepare presentations based on the project's findings. This is in line with ideas from the area of critical pedagogy, which seeks to encourage a view of learning as a process in which students actively take part in transformation of themselves and their world, not as a process in which students passively take part in transmission of information from their teachers and textbooks to themselves (Crookes & Lehner 1998; Vandrick, 1999). [-7-]

Focus on Meaning

What it is. Research from cognitive psychology tells us that we learn best when we connect and store information in meaningful chunks. While rote drills and memorization might be of benefit for short-term learning, long-term learning and the extension of that learning require that students focus on the meaning of the language they are using. In second language, "meaning" should be understood in terms of the meaning of individual words and whole texts, as well as the meaning that particular topics and events have in students' lives (Halliday & Matthiessen, 1999).

Connections to the larger paradigm shift. Behaviorist psychology emphasizes that one size fits all for learning. Thus, if one-celled organisms can learn without access to meaning, why shouldn't that also be the best means for learning in humans? In contrast, socio-cognitive psychology stresses that people learn by chunking new information with existing knowledge and that meaning plays a key role in forming those chunks.

Second language classroom implications. We see many examples in second language education of this shift toward emphasizing meaning, the projects discussed earlier being just one. Projects are a means of implementing communicative language teaching. In communicative language teaching, the focus lies in using language, not in language usage (Breen & Candlin, 1980; Widdowson, 1978). Even though recent years have seen a greater role for explicit grammar instruction, this explicit instruction still takes place within the context of whole texts, i.e., beginning with an understanding of the text and its communicative intent, then looking at how the grammar aids the accomplishment of that intent within the specific context from which that intent derived (Long, 1991).

Journal writing is another example of how second language students can focus on meaning. It provides students opportunities to explore within themselves as well as with peers and teachers the particular meaning that a given classroom event or aspect of the curriculum had for them (Kreeft-Peyton & Reed, 1990; Shuy, 1987). Often students' journals are read and responded to by teachers and peers. Additionally, groups can keep journals to be shared with other groups and their teachers, and teachers can keep journals to share with students. In this way, students and teachers have the opportunity to consider what a particular lesson or unit means to different members of their class.

Diversity

What it is. Diversity has different meanings. One meaning lies in the fact that different students attach different connotations to the same event or information (Brown, 1994). Another aspect of diversity in second language involves the mix of students we have in our classrooms in terms of backgrounds, e.g., ethnic, religious, social class and first

language, sex, achievement levels, learning styles, intelligences and learning strategies. Taking advantage of this diversity can be challenging. [-8-]

Connections to the larger paradigm shift. A key tenet of learner-centered instruction is that each learner is different and that effective teaching needs to take these differences into account. In contrast, the old paradigm attempted to fit all students into a one-size-fits-all learning environment, with diversity viewed as an obstacle to be removed. In the current paradigm, diversity among students is not seen as an obstacle, but as a strength.

Second language classroom implications. The concept of multiple intelligences as applied to second language education highlights one form of diversity among students (Christison, 1996). Intelligence is no longer viewed as a unidimensional construct. Instead, intelligence takes many forms and even within a particular intelligence, differing facets exist. The implication of this is not that students should be given new multiple intelligences IQ tests and placed in separate classes based on their intelligences profiles. The implication is that instruction must be differentiated so that in a particular unit at different times each student gets a match with the intelligences in which they are most developed. Each student gets a stretch by working with intelligences in which they are less developed and students come to appreciate the value of working with people of varied intelligence profiles.

Work in the area of second language learners' styles and strategies represents another way that the current paradigm is being applied (Oxford, 1990). For instance, students are helped to become aware of their current learning strategies, analyze them to determine which are most useful in various situations and then develop new strategies or refine present ones, so as to become better learners. This type of strategy awareness helps students to become effective lifelong learners.

Thinking Skills

What it is. The previous section mentioned learner strategies as an example of diversity among students. Among the strategies that learners need to acquire and use are those that involve going beyond the information given and utilizing and building their higher-order thinking skills, also known as critical and creative thinking skills (Paul, 1995). Various typologies of these skills exist. One well-known list focuses on the skills of applying information to other contexts, analyzing the features of a given phenomenon, synthesizing information to create something new and evaluating information (Bloom, 1956). Today, thinking skills are seen as an essential part of education, because information is easily obtained, so the essential task is now to use that information wisely.

Connecting education to the wider world in order to improve that world means that students--along with their teachers - need to analyze existing situations, synthesize new ideas and evaluate proposed alternatives (Freire, 1970). Certainly, a great deal of higher-order thinking is needed here. For example, if students are studying the water pollution problem mentioned above, they will encounter the kind of tangled thicket of variables that make it so difficult to implement solutions to the mess that humans have made of our planet's environment. Indeed, the use of global issues in education, such as environment, peace, human rights and development, represents a venue in which thinking skills very much need to be in attendance (Cates, 1990) [-9-]

Connections to the larger paradigm shift. The concept of thinking skills flows from the current paradigm in a few senses. First, thinking is a process and the emphasis lies in the quality of that process rather than solely on the quality of the product resulting from that process. Additionally, many valid routes may exist toward thinking about a particular situation. Another connection between thinking skills and the current paradigm is the attempt to connect the school with the world beyond. This attempt promotes the idea that learning is not a collection of lower-order facts to be remembered and then regurgitated on exams, but that we learn in school in order to apply our knowledge toward making a better world.

Second language classroom implications. Many attempts are being made to integrate thinking across the curriculum and a large amount of materials exists for doing so (Halpern, 1997). Also, stand-alone materials for teaching higher-order thinking are being utilized. Group activities provide a useful venue for second language students to gain and utilize thinking skills, as they need to teach peers, to provide each other with constructive criticism, to challenge each other's views and to formulate plans for their group (Ayaduray & Jacobs, 1997).

One aspect of implementing thinking skills in second language education involves a move away from sole reliance on forms of assessment involving lower-order thinking alone. Now, more assessment instruments require the use of higher-order thinking, with questions that have more than one possible correct answer. Also, projects and other complex tasks are being used for assessment purposes. These alternative assessment instruments are the focus of next change to be discussed.

Alternative Assessment

What it is. New assessment instruments are being developed to compliment or replace traditional instruments that use multiple choice, true-false and fill-in-the-blank items (Goodman, Goodman, & Hood, 1989). Further, attempts are being made to develop assessment instruments that mirror real-life conditions and involve thinking skills. These alternative assessment instruments are often more time-consuming and costly, as

well as less reliable in terms of consistency of scoring. Nevertheless, they are gaining prominence due to dissatisfaction with traditional modes of assessment, which are faulted for not capturing vital information about students' competence in their second language.

Connections to the larger paradigm shift. The new paradigm informs this change in several ways. First, an emphasis on meaning rather than form underlies many of the new assessment instruments. Second, many alternative assessment methods, such as think aloud protocols, seek to investigate process. Third, the understanding of the social nature of learning has led to the inclusion of peer assessment and to the use of group tasks in assessment. [-10-]

Second language classroom implications. Alternative assessment has developed on many different fronts in second language education. One of these involves the teaching of writing. In the process approach to writing, students go through multiple drafts as they develop a piece of writing (Raimes, 1992). Rather than only evaluating the final draft, teachers now look at earlier drafts as well to gain a better understanding of the process students went through as they worked toward their final draft.

Portfolios offer a complimentary means of looking at students' writing processes (Fusco, Quinn, & Hauck, 1994). With portfolio assessment, students keep the writing they have done over the course of a term or more, including early drafts. Then, they analyze their writing to understand the progress they have made. Next, they select from among their pieces of writing to compile a collection that demonstrates the path of their writing journey and prepare an introduction to the portfolio in which they present their findings.

As mentioned earlier, another alternative form of assessment in second language education involves peer assessment (Cheng & Warren, 1996). This form of assessment is intended to enhance, not replace, self- and teacher assessment. Peer feedback is now common in writing classes. By critiquing the writing of fellow students, learners better understand and internalize criteria for successful writing.

Teachers as Co-Learners

What it is. The concept of teachers as co-learners involves teachers learning along with students. This relates to what was mentioned in a previous section about asking questions that have more than one good answer and doing complex real-world tasks. Because the world is complex and constantly changing, lifelong learning is necessary. Teachers must take part in this never-ending quest and, indeed, model this process for their students. Teachers learn more about their subject areas as they teach, as well as learning about how to teach (Bailey & Nunan, 1996; Freeman & Richards, 1996).

Connections to the larger paradigm shift. Under the "old" paradigm, teachers are workers who need to be supervised by "experts," usually from the university and relevant government agencies, in order to make sure that goals are being met and students are performing according to prescribed schemes. Teaching is seen as a skill that can be learned in discrete items from lesson planning to how to ask questions. When these skills have been learned, the teacher is qualified to teach. In second language teacher education this approach is seen as "training" (Freeman, 1989). However, the current paradigm sees teaching and learning as social processes where the students are active co-constructors of knowledge with their teachers. The teacher is more of a facilitator and fellow learner alongside the students.

In the previous paradigm, second language teachers' opinions and experiences were more often than not excluded. Instead, the "experts" in the universities did the research and administrators did the assessment. Their pronouncements were then handed down to practitioners. In the current paradigm, the notions of qualitative, ethnographic research by and with teachers and self and peer assessment of teachers has unfolded (Fanselow, 1988). [-11-]

Second language classroom implications. Second language teachers as fellow participants in learning takes many forms. For instance, when students are doing extensive reading, teachers do not patrol the classroom or use the time to catch up on paperwork. Instead, they do their own reading and share with students what ideas and feeling this reading sparked. Similarly, when students are writing, teachers can write in the same genre and then give feedback to and receive feedback from students.

Along with empirical formats and objective findings, more field-based methods of teacher research and assessment have been put forward. Second language teachers as researchers employ methods such as conversations, interviews, case studies and these are written in narrative form (Gebhard & Oprandy, 1999). Assessment of second language teachers goes beyond what the teacher is doing and investigates what teachers are thinking from the teachers' perspective (Farrell, 1999).

Paradigm Shift: Fusion

Figure 1 attempts to make the point that the eight changes discussed in this article are related to one another. Does the figure overstate the case by showing lines connecting each change to every other one? Perhaps, but please consider one change and its connections with the other seven.

Cooperative learning (CL) connects with learner autonomy because group activities help second language students become less dependent on teachers. Curriculum integration is facilitated by CL because second language students can pool their

energies and knowledge to take on cross-curricular projects. CL fits with an emphasis on meaning, as groups provide an excellent forum for students to engage in meaningful communication in their second language. Diversity is highlighted in CL when students form heterogeneous groups and use collaborative skills to bring out and value the ideas and experiences of all the group members.

Thinking skills are needed in groups as second language students attempt to explain concepts and procedures to their groupmates, as groupmates give each other feedback and as they debate the proper course of action. Alternative assessment is fostered in several ways by the use of CL. For instance, CL provides scope for peer assessment and an emphasis on the development of collaborative skills calls for different methods to assess these skills. CL encourages teachers to be co-learners for at least two reasons. First, teachers often work with colleagues to learn more about education, e.g., by conducting research and otherwise discussing their classes. By collaborating with fellow teachers, teachers model collaboration for their students and convince themselves of its benefits. Second, because CL means less teacher talk, it allows teachers to get off the stage some of the time and spend more time facilitating student learning. One of the techniques for facilitating is to take part along with students, thus encouraging teachers to learn more.

Has the Shift Actually Taken Place?

Have the eight changes and the overall paradigm shift from which they flow become prominent in second language classrooms? We think that the effects of the paradigm shift are still only being felt partly. Indeed, there seems to be a great deal of variation between countries, institutions within the same country and even classrooms within the same institution. Thus, in second language education, contrary to what Kuhn put forth about rapid, revolutionary, far-reaching paradigm shifts in the physical sciences, the paradigm shift seems to be gradual, evolutionary and piecemeal. [-12-]

Why is this the case? Several reasons suggest themselves. One reason may be that changing beliefs and behaviors takes time in education and elsewhere (Fullan, Bennett, & Rolheiser-Bennett, 1990). Lack of change may also be a result of the difficulty of translating theory into practical application. That is, new ideas need a great deal of work by practicing teachers to translate into their everyday teaching routines.

Another possible explanation for the lack of implementation of this paradigm shift stems from the fact that it has often been presented in a piecemeal fashion, rather than as a whole. The point of this article has been to argue that many of the changes we hear about in education in general and second language education in particular are all part of one overall paradigm shift. This holistic perspective has two implications. First, these are not unrelated changes to be grasped one by one. Attempting to learn about these

changes in such an isolating fashion impedes understanding because it flies in the face of the interconnections that exist and it violates a fundamental concept of human cognition--we learn best by perceiving patterns and forming chunks. Second, when we attempt to implement these changes, if we do so in a piecemeal fashion, selecting changes as if they were items on an a la carte menu, we lessen the chances of success. These innovations fit together, like the pieces in a pattern cut to make a jigsaw puzzle. Each piece supports the others.

Conclusion

In this article, we have urged our fellow second language educators to take a big picture approach to the changes in our profession. We have argued that many of these changes stem from an underlying paradigm shift. By examining this shift and looking for connections between various changes in our field, these changes can be better understood.

Most importantly, by attempting to implement change in a holistic way, the chances of success greatly increase. This point has been made countless times in works on systems theory by Senge (2000) and others. However, it is much easier to state in theory than to implement in practice. Perhaps the best-known and most painful example of the failure to implement holistic change in second language education is that in many cases while teaching methodology has become more communicative, testing remains with the traditional paradigm, consisting of discrete items, lower-order thinking and a focus on form rather than meaning (Brown, 1994). This creates a backwash effect that tends to pull teaching back toward the traditional paradigm, even when teachers and others are striving to go toward the new paradigm.

Yes, implementing change is difficult. Perhaps this is where the eighth change we discussed, teachers as co-learners, plays the crucial role. Many people are drawn to work in second language education because they enjoy learning and want to share this joy with others. All the changes that have taken place in our field challenge us to continue learning about our profession and to share what we learn with others, including our colleagues, so that we can continue to help our field develop. [-13-]

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