
UNIT 8 COGNITIVE LOAD THEORY (CLT) AND COGNITIVE FLEXIBILITY THEORY (CFT)

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8.1 INTRODUCTION

Cognitive Science, which deals with the psychological processes of learning, memory, and problem solving, has made major contributions to education and training, and on the effectiveness and efficiency of instructional strategies. In the previous unit, you have studied Elaboration Theory, which prescribes the use of pre-requisite sequences, the systematic use of review and synthesis. In this unit, we will discuss the cognitive load theory and cognitive flexibility theory.

Cognitive Load Theory (CLT) describes learning structures in terms of an information processing system involving long term memory, thereby associating indirectly with working memory. To understand this, first, we have to know what working memory is. Working memory performs the intellectual tasks associated with consciousness. However, it is extremely limited in both capacity and duration. The uniqueness of working memory is that information may only be stored in the long-term memory after first being attended to, and processed by, working memory. Long-term memory effectively stores all of our knowledge and skills on a permanent basis. The limitations of working memory, under some conditions, impede learning. Cognitive load theory came into the field of education in the early 1980s. The basic principle of cognitive load theory is that the quality of instructional design is

directly proportional to the consideration given to the role and limitations of the working memory. Hence, cognitive load theory has been used to develop several instructional strategies, which have been demonstrated empirically to be superior to those used conventionally.

This Unit outlines some of the basic principles of cognitive load theory. For better understanding, examples of the instructional design strategies generated by cognitive load theory are also provided.

This unit from section 8.8 onwards focus on Cognitive flexibility theory (CFT).

8.2 LEARNING OUTCOMES

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

- establish a relationship between instructional psychology and instructional design;
- explain salient features of cognitive load theory;
- identify predictions for student learning;
- narrate the significance of cognitive flexibility theory towards instructional design; and
- suggest ways to implement Cognitive Load Theory (CLT) and Cognitive Flexibility Theory (CFT) in distance learning.

8.3 THE CHANGING TREND BETWEEN INSTRUCTIONAL PSYCHOLOGY AND INSTRUCTIONAL DESIGN

As a distance teacher, you must be interested in learning or motivation problems of your students and how to solve such problems. You may also have thought of some of the following questions:

- Why are some subjects difficult for learners to understand?
- Why are some of the students more motivated than others?
- Why do we forget to apply our knowledge learned in school/college to real-life problems?
- Why do all students not secure the same grade in the same course?

You can answer these questions regarding cognitive development in the instructional context.

What is cognitive development?

Cognitive development is the development of mental processes, like thinking, learning, remembering, problem-solving, etc. These are different from other psychological constructs like emotions, friendship, or personality traits. These cognitive processes change with age or experience (Klahr & MacWhinney, 1998). You would agree to the fact that no one single instructional technique can work well for all students at all grade levels. Certain instructional techniques are more beneficial to some students than others (Pressley, et al., 1994; Snow, 1994). Stofflet (1994) advised that we must not teach a topic to undergraduate students in the same way as we would teach it to postgraduate students.

Therefore, it is pertinent here that the instruction has to be designed based on the needs of different groups of students. An appropriate instructional design helps a teacher to become more flexible and enables the teacher to help in problem-solving.

What is Instructional Psychology?

To understand the concept of instructional psychology, you need to understand the learning theories. We have discussed these theories earlier in units 2, 3, and 4 of Block-1. Learning theories have evolved from behaviorism (where objectives and reinforcements techniques are used to focus the learning effort) to cognitivism (where information processing occurs within the brain based on inputs) and to constructivism (where a learner creates his or her own meaning). (Please refer to Block-1 for Theories of Learning.) This meaning further depends on the learner's interaction with people, presence at a place, or adoption of a thing in terms of social context. The theories have significant value in instructional psychology.

Instructional psychology is usually referred to as the theory and principles derived from the application of psychological principles in the improvement of instruction, or that result when psychologists conduct research on various forms of instruction.

What is Instructional Design?

We have discussed the concept of instructional design in Block 2, Unit 5. Here, we will focus on the changing trend between the two concepts.

What is instructional design? How it is applicable to instructional psychology?

Smith and Ragan (1993) defined Instructional Design as the systematic process of translating general principles of learning and instruction into plans for instructional materials and learning.

Important components of instructional design include instructional materials, learning activities and an assessment of instruction and learning (Gentry, 1994).

Global trends show that distance education and training are being increasingly used in campus mode learning settings. If we speak of distance education, the nature of distance learners, gender, cultures, self-concept, etc., need to be taken into consideration while thinking of instructional design. There is a need to know the learners, offer them orientation, design for differences in learning styles, etc.

Since distance learners are adult learners, therefore, distance educators need to look more closely at their use of behavioral and cognitive approaches to instructional design (Olgren, 1998).

Deubel (2000) found that behaviorism plays a significant role in instructional design. Olgren (1998) considered a constructivist perspective as a base for learning strategy. This idea was not supported by Sfard (1998) who indicated that we may not opt for only one metaphor for learning as "dictatorship of a single metaphor, like a dictatorship of a single ideology, may lead to theories that serve the interests of certain groups to the disadvantage of others". Sfard (1998) considered two factors important in learning: acquisition and participation. Learner participation is achieved through constructivism and skill building is achieved through acquisition. Deubel (2000) commented that the idea that new knowledge germinates in old knowledge has been promoted by all the theoreticians of intellectual development, from Piaget and Vygotsky to contemporary cognitive scientists.

Therefore, the above discussion indicates that there has been change in the approaches to learning theories towards the practice of instructional design. Although it seems that cognitive theory is the dominant theory in instructional design, the instructional strategies adopted by behaviorists are also used by cognitivists. Behaviorists prefer learners to decide a starting point for instruction, while cognitivists expect the learner to decide their predisposition to learning.

If we take the instructional design from a behaviorist/cognitivist point of view, the instructional designer analyses the content and learning environment, and then formulates the goals. The main emphasis is on identifying what is significant for the learner to understand and then to adopt an instructional strategy to create knowledge.

The constructivist approach considers that instruction is more facilitative than prescriptive in nature. In this strategy, the content is not pre-decided, and the learner selects the path to progress in that content. This strategy requires a kind of self-evaluation of the learner.

Check Your Progress 1

- Note:** i) Write your answer in the space given below.
ii) Check your answer with the answer given at the end of this Unit.

Describe the changing trend in instructional psychology and instructional design.

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8.4 COGNITIVE TEACHING MODEL

The Cognitive Approach is the basic approach to the learning process. By studying the structures of thinking and remembering, the cognitive approach to learning tries to understand an individual's thought processes. According to Driscoll (2001), the cognitive approach refers to all the processes by which sensory input is transformed, reduced, elaborated, stored, recovered, and used. This includes hypothetical stages or aspects such as sensation, perception, imagery, retention, recall, problem-solving, and thinking.

The basic Cognitive Information Processing model is concerned with mental operations, related to how an individual perceives and remembers events and information as to how it was explained initially to the learner. Thus, the cognitive theory states that learning is a process that is dictated by the students' previous experiences, and how the information is presented to the student.

The following are the *implications* for designing instruction in the cognitive teaching model:

- The students' informal knowledge is the base. This is because new material is learned with ease when it is related to what is known to the learner initially.
- The students' current mindset should be identified.
- The errors committed by the student, and the misconceptions prevailing in the student's mind should be viewed as a source of information to know about their mental makeup.
- Since think-aloud activities help to uncover current models, they should be used.
- Hands-on experience should be used, besides explicitly teaching problem-solving strategies. This is because when students learn from observation, certain minute details may be missed, but they remember it better when they do a task/activity themselves.
- Processes, structures, and decisions develop conceptual understanding and this is a focus area.

The major teaching approach under the cognitive approach includes learning, problem-solving, and discovery learning. Although they are commonly done inside the classroom, these are also applied while designing distance learning materials.

Check Your Progress 2

- Note:**
- i) Write your answer in the space given below.
 - ii) Check your answer with the answer given at the end of this Unit.

Discuss the implications of Cognitive Teaching Model.

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8.4.1 Cognitive Strategies

Cognitive strategies are very important for the development of intellectual skills when it comes to learning and thinking. The cognitive theories of learning explain cognitive strategy as a control process (an internal process) by which a learner selects and modifies his ways of attending, learning, remembering, and thinking and has also established the relevance and usefulness of cognitive strategies in problem solving. Let us discuss the various cognitive strategies.

Weinstein and Mayer (1986) identified the following cognitive strategies:

- Rehearsal Strategies
- Elaboration Strategies
- Organizing Strategies
- Comprehensive Monitoring Strategies
- Affective Strategies

Rehearsal strategies

You must have heard the famous saying that “Practice makes a man perfect”. The rehearsal strategy allows a learner to carry out the practice of a skill or activity, like knowing through repetitions. If the content being mastered is complex in nature, then the learners underline main ideas or copy important text during rehearsal.

Elaboration strategies

In this type of strategy, the learner associates the item to be learned with other easily available material. For example, to learn words of a foreign language, the learner can associate those words to a mental image of a similar word in his/her mother tongue. Other activities, which are undertaken in this strategy are paraphrasing, summarizing, note-taking, and generating questions with answers.

Organizing strategies

In this strategy, the learner arranges the material to be learned in a particular framework, for example, if you want to learn a set of words, you may arrange them in a meaningful category for easy remembrance. Sometimes learners make an outline of main ideas

and generate new organisation. In this strategy, the relation among ideas is important, like when we make a comparison of different concepts, we are using some relation among different parameters.

Comprehensive monitoring strategies

Brown (1978) called this strategy as a metacognitive strategy as it “pertains to the student’s capability of setting goals for learning, estimating the success with which the goals are being met, and selecting alternative strategies to meet the goals”. Golinkoff (1976) noticed the element of monitoring in this strategy, which is conspicuous in reading for understanding. Meichenbaum and Asarnow (1979) suggested that the students may develop statements and questions to be used in guiding and controlling their performance.

Affective strategies

Affective strategies are very useful when the learners want to focus on an item and keep their attention and anxiety, controlling and managing time effectively. Dansereau (1985) and McCombs (1982) recommended that the students must be made aware of their operation and how to practice such affective qualities.

Assessing the effectiveness of cognitive strategies

Assessing the effectiveness of cognitive strategies through direct means can be a difficult exercise. However, we can make our judgements by employing other intellectual skills. Ericsson and Simon (1980) suggested the way by asking learners to “think aloud” while they are learning, remembering, or solving problems. The performance of cognitive strategies depends upon internal conditions and external conditions.

Internal conditions

Internal conditions denote the prior knowledge (intellectual skills and verbal information) associated with content to be mastered.

External conditions

We can explain the strategies to the students either by verbal communications or through demonstration. Learning through discovery is also an external factor. This external factor depends on the facilities or opportunities for practice provided to the students.

Check Your Progress 3

- Note:** i) Write your answer in the space given below.
ii) Check your answer with the answer given at the end of this Unit.

Explain briefly the various cognitive strategies.

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8.4.2 Pre-requisites for Cognitive Strategies

An understanding of the prerequisites for cognitive strategies of learning has its implications for the effective development of mental abilities (like thinking, remembering, deducing) of students. Suppose a learner wishes to remember a list of items. An effective cognitive strategy that this learner can adopt is to create different mental images for each item and link them. To accomplish this, the learner needs to have the pre-requisite of “ability to have visual images”.

Table 8.1: Essential and Supportive Prerequisites for Five Kinds of Learning Outcomes

<i>Type of learning outcomes</i>	<i>Essential prerequisites</i>	<i>Supportive prerequisites</i>
Intellectual Skill	Simpler component intellectual skills (rules, concepts, discriminations)	Attitudes, cognitive strategies, verbal information
Cognitive Strategies	Specific intellectual skills	Intellectual skills, verbal information, attitudes
Verbal Information	Meaningfully organized sets of information	Language skills, cognitive strategies, attitudes
Attitudes	Intellectual skills (sometimes) Verbal information (sometimes)	Other attitudes, verbal information
Motor Skills	Part skills (sometimes) Procedural rules (sometimes)	Attitudes

Source: Gagne, Briggs and Wager (1988)

Let us consider another example. Suppose a learner wants to solve a complex mathematical problem. She or he can break this problem into parts and try solving individual parts first and then combining them. This strategy involves the pre-requisite of the ‘ability to divide a verbally described situation into parts’.

An important factor here is the level of the innate ability of the learner (developed through maturation) and how much they have learned. Piaget (1970) gave more significance to maturation, whereas Gagne (1985) considered cognitive strategies as generalizations from learned intellectual skills.

Check Your Progress 4

- Note:**
- i) Write your answer in the space given below.
 - ii) Check your answer with the answer given at the end of this Unit.

Explain the various pre-requisites of cognitive strategies.

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8.5 THE ROLE OF TEACHING MODELS (COGNITION AND LEARNER ACHIEVEMENT)

During our lifetime we keep learning. This learning includes learning of motor skills (like eating with a fork, tying shoe laces, writing letters of alphabets in childhood), acquire information (like adding new words to our vocabulary), make patterns and relationships among different pieces of knowledge, etc.

Besides, learning in your mother tongue creates less pressure than studying in a foreign language. This is because while studying in a foreign language, the brain must work to translate the language besides trying to grasp the new information.

Cognition also facilitates in understanding, how prior to the occurrence of information loss, individual units of information can be retained in short term memory. Therefore, teaching models must be applied in such a way that helps students to retain the information, which has been presented to them in the classroom permanent in their memory. This can be achieved: (a) by maximizing the opportunities the learners have to practice the recently learned content, and: (b) encouraging elaborative encoding of the information and knowledge (for example, by pondering over why, how, when, etc., of the content). It has been found that memory can be improved when such teaching environments are created, which leads to higher emotional responses on the part of learners.

You must have noticed that there are students in counselling sessions who have the skill to do well (knowledge of how to do a thing or what is that concept), but they lack the 'will' to do that. These students are called under achievers. There are cases too where the students were not skilled to that extent, but by trying hard, they are able to achieve a lot. These students are known as over achievers. We need to make an assessment of the situations when a student performs poorly in a class. Is it due to a lack of motivation? Motivation is generally described as a construct denoting initiation, direction, intensity, and persistence of an individual's behaviour in a particular situation. These constructs can be grouped under three categories. They are:

- a) Goal related constructs,
- b) Knowledge related constructs, and
- c) Metacognitive constructs.

Goal related constructs deal with the reason why students do what they do. Knowledge related constructs deal with behaviours where we study what they do. Metacognitive constructs deal with activities of monitoring and appraisal.

The counsellors have a significant role in fostering the ability to reflect in the students and helping them to understand the process of learning. Therefore, teaching models emphasize on activities such as providing enough time for the students to ponder over a problem and come out with an answer for that and then rewarding their effort.

Another implication of the teaching model in cognition and learner achievement is comprehending the information. When content is presented, it is advisable to have the student classify things into categories, arrange things along with some parameters, make hypotheses, draw inferences, analyze things into their components, and solve problems. These cognitive processes can apply to any subject matter, but the more important factor here is that the student knows and comprehends the fundamental information first.

When tests are created, there should be adequate cues in questions to maximize the chances that the students will be able to reclaim the information. This can be accomplished by arranging questions in the same order that the material was presented in the classroom. This helps students in using their episodic cues (like they can recall what they wrote in their notes while listening to the lecture in the class or what things happened in the class on a particular day). Providing examples similar to those presented during teaching the content would also be beneficial.

8.6 TYPES OF COGNITIVE LOAD THEORY

Cognitive Load Theory (CLT) originated in the 1980s, and afterwards a lot of research has gone into this to provide a framework to look into the cognitive processes and instructional design (Paas, Renkl, & Sweller, 2003). According to Sweller, van Merriënboer, and Paas, (1998), “Cognitive load theory is designed to provide guidelines intended to assist in the presentation of information in a manner that encourages learner activities that optimize intellectual performance”.

In 1956, G. A. Miller gave the concept of working memory capacity and suggested that human beings are only able to hold seven plus or minus two digits of information in their short term memory. As a beginner, a learner associates with things in the environment and sees patterns in the world around him/her, which is referred to as ‘schema construction’ by Simon and Chase (1973). This gives the concept of cognitive load. Cognitive load refers to the total amount of mental activity imposed on working memory at an instance in time.

Miller (1956) further suggested that the capacity limit of the working memory is reduced if the pieces of incoming information are related to each other, and need to be stored in memory till the understanding about them happens. This leads to high interactivity. Further to this discussion, it has been established that the limit of working memory can be extended through recoding or chunking. Recoding means that a learner uses the prior knowledge of the solution steps (which are isolating, grouping, simplifying, and checking), and then organises the incoming information into this schema. What is schema? A schema is an organised pattern behaviour which the learner develops when s/he is engaged in an activity. It connects the individual with the environment. The schema formation is the basis of the cognitive learning theory. This schema is processed in the working memory as one unit, so that memory space is freed for other information.

Cognitive load theory states that learning will be maximized by ensuring the learners’ working memory to be free to attend solely to encoding to-be-learned information. The cognitive load theory is based on the following tenets of cognitive learning:

- The short-term memory (working memory) is limited in capacity to about seven informational units.
- Long-term memory is unlimited in capacity and is where all the information and knowledge is stored.
- Knowledge is stored in long-term memory as schemas or schemata.
- Schemas, no matter how large or how complex, are treated as a single entity in working memory.
- Schemas can become automated.

Cognitive load theory differentiates between three types of cognitive load, namely:

- Intrinsic cognitive load,
- Extraneous cognitive load, and
- Germane cognitive load.

Let us now discuss in detail what these terms are.

8.6.1 Intrinsic Cognitive Load

Intrinsic load is the load on memory needed at the time of doing the current task. It denotes the quantum of the working memory being utilised by the interactivity of the units of tasks being processed. These different tasks differ in their interactivity, and thus, the intrinsic cognitive load will also vary. This cannot be manipulated by instructional activities. For example, what you have studied in Class Four English would definitely be less in content to what you have studied in your Class Tenth English course.

In other words, the intrinsic load is the load on memory required by the thinking task at hand. The intrinsic load serves to quantify how much of the working memory is used, due to the interaction of the units of information being processed in the mind of the human being.

8.6.2 Extraneous Cognitive Load

Extraneous cognitive load can be represented as a teacher's presentation, external distractions, textbook instructional format, etc. These variables use a large amount of working memory, and little is left for the learning task at hand. Thus, the extraneous cognitive load does not contribute to the learning. The significance of the extraneous cognitive load increases when the intrinsic cognitive load is high. When the intrinsic cognitive load is less, the level of extraneous cognitive load would also be low, the reason being that the total cognitive load may not exceed the working memory capacity. Thus, the extraneous cognitive load can be influenced by the instructional designer.

8.6.3 Germane Cognitive Load

When a learner learns something new schema is formed and is added to the working memory capacity. Thus, the working memory needs to process this new learning into the next higher level of advanced schema. This is known as the germane cognitive load. Like extraneous cognitive load, the germane cognitive load can also be influenced by the instructional designer.

Intrinsic, extraneous, and germane cognitive loads are additive in that, together, the total load cannot exceed the working memory resources available if learning is to occur. The relations between the three forms of cognitive load can be shown as below:

Intrinsic + Germane + Extraneous = Total Cognitive Load

The following facts need to be kept in mind while discussing the cognitive load theory:

- 1) Individuals differ in their information processing capacity.
- 2) Irrespective of the task in question or the processes an individual uses in solving any given task, each individual has a fixed capacity for processing information. This fact is applicable for tasks varying from remembering simple words to performing advanced calculations.
- 3) It is worthwhile to identify the information processing capacity of individuals. This is useful in adapting instruction and understanding the behavior of the learner.

Cognitive load theory has implications for instructional designers for the following reasons:

- It has its implications for the way the instructional material is presented to students.

- Learning can be enhanced by redesigning instructional materials to reduce the levels of extraneous cognitive load.
- Controlling the elements of to-be-learned information and their interactivity with one another would exhibit better results.
- Instructional designers can control the conditions of learning within an environment, or more generally, within most instructional materials.
- Instructional designers can decrease the extraneous cognitive load during learning and increase the germane (schema related) cognitive load.
- Cognitive load theory stresses the need to minimise the total cognitive load, and maximise cognitive resources available to be utilised in the learning process. In other words, if for some reason, cognitive load increases rather than decreases, then learning will be inhibited.
- Cognitive load theory facilitates the development of strategies and techniques that result in both reduced training times and enhanced performance. This is of vital importance to the education and training industries.
- Cognitive load theory has applicability to subjects that focus on problem-solving skills such as Mathematics, Physics, Chemistry, and Computer Science, and hence are inbuilt in the instructional process of these subjects.

Check Your Progress 5

- Note:**
- i) Write your answer in the space given below.
 - ii) Check your answer with the answer given at the end of this Unit.

What do you understand by the term Cognitive Load Theory?

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8.7 PREDICTIONS FOR STUDENT LEARNING

When you ask your students to learn something, exactly what do you think, how, and what the student would be learning? Do you expect an improvement in student behaviour or a change in some other personality traits?

Learning is a continuous process. We learn about new words, associations, relationships, etc. Did you ever think of what cognitive processes are involved in learning? As a teacher, how can we facilitate learning in students? What are various factors which affect the process of learning among the students?

As learning is said to be a relatively permanent change in behaviour due to experience, therefore, educators focus on how students' behaviour changes over time. They also pay attention to the environmental conditions that bring such changes about. But note that all changes in behaviour cannot be termed as learning. Some changes are short-lived and unrelated to any specific experience. For example, the feeling of fatigue or stomach ache is temporary, and once this is over, we come back to our normal state of being. Therefore, as teachers, we need to focus on the processes involved in learning new knowledge and skills. The mental processes like memory,

attention, concept learning, problem-solving and reasoning, etc., must be given due attention. Let us see some factors that help a teacher predict student learning. These factors may be in the form of:

- simple content,
- high levels of interactions, and
- instructional prescriptions.

8.7.1 Simple Content

During the learning phase, individuals construct knowledge from their experience, rather than simply cramming it from the material presented to them. Constructive processes during the learning phase have an impact on short-term memory and long-term memory storage and retrieval. When a student learns a thing, he or she organises it in different ways. The students may make a mental group on the categorisation of objects, concepts, or events. They are expected to understand a concept when they can explain it in their own words, and identify the negative and positive instances associated with that event or concept.

The four processes involved in learning content are:

- memory
- storage
- encoding
- retrieval

Memory is the ability of an individual to retain or store the learned knowledge or skill over a period of time. The storage is defined as an acquisition of new knowledge, and is the process of putting what is learned into memory. Encoding is the way we store information, which may not be necessary when we received it. The students may change or encode it, as per their learning ability, so that they can make their own meanings and interpretations of that knowledge. When we need to use the stored knowledge, we retrieve it from our memory. It is a sort of finding information in memory.

Thus, the students must be able to use all four abilities for effective learning. This can be ascertained when the content is simple in nature and facilitates these four processes. Most people can attend to only a very small amount of information at any one time, as attention has a limited capacity. Therefore, when the content is simple, it can be stored easily, and later on, when required this stored information is moved into the working memory.

8.7.2 Instructional Prescriptions

As we said in the previous section, we must remember that the students may not necessarily learn the content the way it is presented to them. The students will interpret the content material in their own way. Therefore, it is a good strategy that we may ask questions, encourage dialogue, and when students reply, we must listen to their ideas and explanations carefully.

We need to remember that students' prior experiences play a great role in their ability to understand and learn the content matter.

The following instructional prescriptions are recommended:

- Try to present the content matter in more than one way in the classroom.
- Prove to the students that the new content they are learning is related to their previous knowledge.

- The content matter needs to be presented in an organised manner.
- The students may be encouraged to form visual images of the content they are studying. This enhances memory.
- We must proceed from known to unknown. The instruction must begin with the level consistent with the students' existing knowledge base.

Check Your Progress 6

- Note:**
- i) Write your answer in the space given below.
 - ii) Check your answer with the answer given at the end of this Unit.

Explain the various factors that help a teacher in predicting student learning

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8.8 THE COGNITIVE FLEXIBILITY THEORY (CFT)

Cognitive Flexibility Theory (CFT) is a conceptual model for designing learning environments based on cognitive learning theory. This theory focuses on learning in complex and ill-structured domains, which symbolize real life. According to Spiro and Jehng (1990), cognitive flexibility is defined as “the ability to adaptively re-assemble diverse elements of knowledge to fit the particular needs of a given understanding or problem-solving situation”.

This theory represents an integration of learning, mental representation, and instruction. The instruction designed using Cognitive Flexibility Theory prevents over-simplifying instruction by providing:

- Practical oriented real life situation cases,
- Multiple representations of the content in order to enhance transfer, and
- Facilitates the knowledge construction by learners.

The main principles of the CFT (Spiro, Feltovich, Jacobson, & Coulson, 1995) are as follows:

- Over-simplification of instruction should be avoided.
- Subject content must be presented in multiple ways to enhance learning.
- Case-based instruction should be given more importance. This is more beneficial than instruction based on a single example or case.
- Real-world examples and phenomena serve better for knowledge construction.
- Purpose of instruction should be the construction of knowledge and not the transmission of knowledge.
- Different constructs of knowledge must be interrelated instead of being isolated.
- This theory has been found effective in advanced knowledge creation.

8.8.1 Constructivism and Cognitive Flexibility Theory

The cognitive flexibility theory and constructivism are related to each other in how they focus on the ways the learners construct knowledge. The knowledge of a learner is not based merely on a collection of isolated pieces of information. It also depends on

accumulated information, and also, how the learners construct their knowledge based on that. Therefore, for cognitive flexibility theory, constructivism suggests that the students should be motivated to construct their own knowledge. Instruction should be designed to encourage the learners to imagine beyond the information presented to them.

8.8.2 Cognitive Flexible Hypertext

Before we close, it would be relevant to know the cognitive flexibility theory in relation to hypertext/hypermedia. Hypertext refers to “computer-based texts that are read in a non-linear fashion and that are organized on multiple dimensions.

This concept has great significance for the multimedia content. Multimedia content is comprised of an integration of text, audio, video, and images. The cognitive flexible hypertext highlights that when such content is presented to the learners, they view it in different ways, and thus make, their own understandings. Therefore, this approach has been found quite suitable for advanced learning, whereby the learners are enabled to apply, evaluate, and synthesize their knowledge.

Check Your Progress 7

- Note:** i) Write your answer in the space given below.
ii) Check your answer with the answer given at the end of this Unit.

Discuss the main principles of Cognitive Flexible Theory.

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8.9 LET US SUM UP

As a learner, you would have experienced that there is a changing trend between instructional psychology and instructional design. Layout, content and presentation are given the utmost importance so that it attracts the learner, and makes him or her learn amidst the various commitments. In this unit, we have developed an understanding about the Cognitive Teaching Model, the Role of Teaching Models, Cognitive Load Theory, and the Cognitive Flexibility Theory. The various Cognitive strategies are: rehearsal, elaboration, organizing, comprehensive mentoring, and affective strategies. The cognitive load theory focuses on how to present instruction and material to students, especially in the case of subjects such as Mathematics, Physics, Chemistry etc. that focus on problem-solving skills

8.10 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

Please see section 8.3. Explain the changes taking place in use of cognitive theory in instructional design, and also how the instructional strategies of behaviorists are also used by cognitivists.

Check Your Progress 2

Please see section 8.4 on cognitive teaching model.

Check Your Progress 3

Please see sub-section 8.4.1 and explain the cognitive strategies adopted by Weinstein and Mayer i.e. Rehearsal Strategies, Elaboration Strategies, Organizing Strategies, Comprehensive Monitoring Strategies, Affective Strategies

Check Your Progress 4

Please see sub-section 8.4.1 and explain the cognitive strategies adopted by Weinstein and Mayer.

Check Your Progress 5

Please read section 8.6 carefully and write about CLT in your own words.

Check Your Progress 6

Please read section 8.7 and explain simple content, high levels of interactions, instructional prescriptions.

Check Your Progress 7

Please read section 8.8 and write about Cognitive Flexibility Theory (CFT).



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