UNIT 6 COMPONENT DISPLAY THEORY (CDT)

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6.1 INTRODUCTION

In the previous Unit 5, you have studied different models of ID. In sub-section 5.4.4, we have discussed the Dick and Carey Model. In this model, you have read about the instructional process and instructional strategies.

The acquisition of different types of knowledge and skills requires different conditions for learning. If the instructional process includes the instructional strategies required for the acquisition of the desired knowledge and skills, then effective, efficient, and appealing learning occurs. Instructional strategies ensure that programmes/courses are developed such that the learner acquires the knowledge, skill, or attitude intended by the instructional objectives. These objectives provide a means for determining the ‘why?’ and ‘how?’ components for the identified programme needs. Therefore, instructional strategies are crucial for both the learner and the instructional designer. The instructional designer analyses the content and conditions that support the instructional system, such as content, the learner, etc. to the intended learning outcomes. This process has two goals—the first goal is to simplify the components to be learned, and the second goal, to translate them into process or method. This is done by identifying content components, then classifying them based on the nature of the content, the learner, and the instructional objectives and goals. In this Unit, we will discuss the component display theory (CDT) of instructional design. This theory deals with the components for presenting content with objectives and instructional sequences. We have also described the new version of CDT, i.e., A Pebble in-the-Pond approach for designing courses/programmes.

6.2 LEARNING OUTCOMES

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

- discuss the facet of Component Display Theory (CDT);
- describe performance-content classification;
- draw a performance-content matrix;
- apply the principles of CDT for distance learning materials; and
- explain a Pebble-in-the-Pond approach.

6.3 COMPONENT DISPLAY THEORY (CDT): AN OVERVIEW

In this section, we will discuss the component display theory (CDT) for its relevance to the development of instructional materials in distance education. We will also discuss the performance-content matrix and the different dimensions of CDT.

The prescriptive instructional design theories prescribe optimal methods of instruction for different combinations of conditions and desired outcomes. It emphasizes what components the instructional designer should use for designing the learning environment. These components could be facts, concepts, procedures and principles. A design theory improves instructional methods and helps to provide effective and efficient instruction. Instructional Design theories such as the Component Display theory (CDT) and the Elaboration Theory (ET) are two examples of design science.

The CDT integrates knowledge about instruction and learning from all the three major theoretical perspectives: behavioural, cognitive and humanistic (Ref. Block 1, Units 2 & 3). This theory was propounded by M. David Merrill in 1983.

This theory addresses the following issues. They are:

- Classification of learning outcomes (content and performance).
- Presentation forms, consisting of presentation modes and presentation elements.
- Methodology prescriptions.

6.3.1 Dimensions of CDT

The component display theory is a very comprehensive prescriptive theory, which deals with methods of organizing more than one idea. Merrill integrated most of the existing knowledge in such a way that it would improve our ability to design more effective instruction. The theory benefits from previous knowledge accumulated in other areas, such as performance, task analysis, taxonomies, content analysis, and strategy selection. The theory provides principles for the optimal combinations of presentation strategy components for effective and efficient instruction at the micro level. CDT is relevant to instruction and training in the cognitive domain.

The heart of CDT is the performance-content classification system as shown in Fig. 6.1. In this figure, you can see that the three performance levels are: remember, use, and find.
Four content dimensions are: fact, concept, procedure, and principle. These categories are discussed below:

1) Content Categories

The different content categories are as follows:

- **Facts**: A fact is a piece of information that is assumed to be true and is presented without any evidence. Facts state specific information about people, places, and events that already exist. Examples of facts are:
  
i) Newton is the inventor of the ‘Law of Gravity’.
  
ii) There are five vowels in the English language.
  
iii) New Delhi is the Capital of India.

- **Concepts**: Concepts are groups of objects, events or symbols that have common characteristics and are identified by a common name. Some examples are a table, democracy, an angel, etc. Here, while learning a concept, the learner responds to stimuli by identifying its concern as well as abstract characteristics like shape, colour, features, functions, etc.

- **Procedures**: A procedure is an ordered sequence of steps to complete a task or to find a solution to a problem. For example, steps to prepare an assignment response, steps to design a unit, and steps to draw a triangle.

- **Processes**: A process is a series of events, stages or phases that take place over a period of time. Processes describe how things work instead of how you should perform the steps. For example, selecting a book in a bookshop, information processing in a computer and describing the life cycle of a butterfly with the help of a flow diagram.

- **Principles**: A principle is a content category that can be stated in the form of rules to guide certain actions or explain some changes. For example, rules for playing football; do’s and don’ts for using a computer, guidelines for writing a project report.
2) Performance Categories

The different categories of performance are as follows:

- **Remember** is the performance that requires the student to search memory in order to reproduce or recognize some item of information that s/he previously stated.
- **Use** is that performance that requires the student to apply some abstraction to a specific area.
- **Find** is that performance that requires the student to derive or invent a new abstraction.

For example, *our goal is to present principles or facts* from geography. The instructional designer must select learning activities and organize learning activities that enable the learners to remember the information and use the skill for locating different places on a map while receiving instruction.

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<th>Check Your Progress 1</th>
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<tr>
<td><strong>Note:</strong></td>
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<tr>
<td>i) Write your answers in the space given below.</td>
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<td>ii) Check your answers with the answers given at the end of this Unit.</td>
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<tr>
<td>1) Discuss the content categories of CDT.</td>
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<td>2) Describe the performance categories of CDT.</td>
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Presentation Forms

In the above discussion, we have described two components of CDT: a category system for subject matter and a set of categories for student performance. The third component is presentation forms.

This is based on the idea that the different types of content can be learned at different levels of behaviour, and different strategies are required for each content type and task level.

According to Merrill, the important presentation strategy variables are first discussed, and labelled as ‘primary presentation forms’. Also, the adequacy of presentations and the consistency among objectives, presentations and tests were facilitated through the use of task/content classification.
Merrill identified four primary presentation forms. These are: generality, generality practice, instance, and instance practice. A generality is defined as an abstract or general statement that can be applied in a variety of specific situations, such as the definition of a concept, or the statement of a procedure or a principle. Every generality has at least two specific situations associated with it. An instance is the application of that generality to new situations, and practice is applying that generality to different situations (Merrill et al., 1979). Merrill also identified secondary strategy components, which are elaborated or helped by primary presentation forms. These secondary strategy components are labeled as ‘helps’ and include ‘mnemonic help’ (For example, ARCS, where A-Attention, R-relevance, C-confidence and S-satisfaction), alternative representation help, etc.

The following questions for adequate presentation of instructions are stated as:

- What adequate primary presentation forms should be used for teaching at the desired task level? For example, for an objective like teaching at remember-an-instance task level, the appropriate primary presentation forms are instance and instance practice.

- What secondary strategy components should accompany each primary presentation form? For example, for the same objective mentioned above, the inclusion of some memory aids like rhymes, chunking devices, etc., helping the students to remember the given instance.

- What characteristics should each of these primary strategy forms have? For example, for an objective at the use-a-generality task level, the instance should be presented with all critical attributes in order to make it possible for the student to compare relevant and irrelevant attributes.

On the basis of all this information, we can see that this instructional theory (CDT) at the micro-level includes the following components:

- Information presentation (it could be either a generality or an instance)
- Example (this should be included in instruction if it is necessary, depending on the difficulty level of the subject matter and/or the ability level of the learner); and
- Feedback (of course, each practice item is followed by immediate feedback).

The above discussion emphasizes that component display theory (CDT) is a set of prescriptive relationships used to guide the design and development of learning activities. What are the learning activities? Learning activities are events in which the learner must participate in order to achieve the objectives, and tests are events that assess the degree to which the student achieves the objectives.

CDT also emphasizes that instruction is more effective when it contains all the primary and secondary forms. Thus, objectives are followed by a combination of rules, examples, recall, practice, feedback, helps, and mnemonics, suitable to the content of a subject and learning task.

A significant aspect of the CDT framework is learner control, that is, the idea that the learners can select their instructional strategies in terms of the content and presentation components. In other words, instruction designed according to CDT provides a high degree of individualization as learners can adapt learning to meet their own learning styles and preferences.
According to Merrill, the four primary instructional strategy forms are:

- Presentation (tell);
- Demonstration (show);
- Recall (ask); and
- Apply (do).

The instructional outcomes for each type of instructional strategy as suggested by Merrill (2007) are as follows:

For kinds of content the presentation is tell a definition (information); the demonstration is to show an example (portrayal); the recall is remember the definition (information); and the application is classify a new example (portrayal).

Merrill (2007) has also suggested an integrated task-centred instructional strategy that incorporates strategies for learning different knowledge components. How can these knowledge components be combined to form a task-centred instructional strategy? We have discussed about task-centred strategy in section 6.5.

Therefore, Merrill's different presentation forms are: Primary Presentation Forms (PPFs), Secondary Presentation Forms (SPFs) and Inter Display Relationship (IDRs):

- PPFs consist of expository generality (rule), expository instance (example), inquisitory generality (recall), and inquisitory instance (practice).
- SPFs consist of information added to facilitate learning such as attention focusing help; mnemonics, and feedback.
- IDR are sequences involving example and non-example matching, example divergence, and range of example difficulty.

For each performance-content classification, CDT prescribes the combination of PPFs, SPFs and IDRs. The combination of these three strategies is essential for most efficient and effective instructional strategies.

**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.

What do PPFs consist of?

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*6.5  CDT: RECENT DEVELOPMENTS*

In Unit 1 and 5 we have discussed first principles of instruction suggested by M. David Merrill. These principles are activation demonstration, application and integration. The tasks is central to the above principles.

Merrill (1994) had presented a new version of CDT, which focuses on Course Structures (instead of lessons/units) and instructional transactions rather than presentation forms, as discussed in the previous section. The advisor strategies have taken the place of learner control strategies. This new version of CDT is related to work on expert systems and authoring tools for ID.

6.5.1  A Pebble-in-the-Pond approach

A Pebble-in-the-Pond approach to instructional development prescribes a task-centered, content-first instructional design procedure. This approach integrates previous instructional strategy prescriptions from the Component Display Theory with the content components of knowledge objects. The application of this component analysis and task-centered instructional strategy is discussed below:

Pebble-in-the-Pond Approach to CDT of Instructional Design

The Pebble model is a content-first approach. The first step in this approach is to identify a collection of real-world tasks that will later form the actual content of the instruction. There are four steps for designing instruction.

The first step identifies a typical whole task and produces a fully worked out example of that task. The second step identifies a series of similar tasks of increasing complexity. The third step identifies component skills common to these tasks, while the fourth step specifies the instructional strategy for the task-centered instruction approach. Figure 6.2 elaborates the first four ripples in this design approach. These are:

1) Specify a real-world task;
2) Identify a progression of tasks;
3) Specify component knowledge and skill for each task; and
4) Specify an instructional strategy for task-centered instruction.

The first three steps in the Pebble-in-the-pond approach are concerned with the first principle of task centered instruction, and specify how this material will be presented. Starting with whole tasks assures that the component knowledge and skill to be taught are relevant and integrated. Only in the fourth step, after the content has been identified and specified, does the pebble model specify the instructional strategy to teach this content.

Effective instructional strategies for the whole tasks and for the component knowledge and skill that comprise these tasks require, consistent demonstration and application at both the individual component level and at the whole task level. The instructional strategy described in this emphasizes demonstration and application of knowledge.

Figure 6.2 indicates that the Pebble-in-the-Pond design approach consists of a series of expanding activities initiated by first casting in a pebble, that is, a whole task or problem of the type, that the learners will be taught to accomplish, by the instruction. Having identified an initial problem, the first ripple in the pebble model identifies a specific complete real-world task. What is a real-world task? A real-world task is one that a learner can expect to encounter in his/her life following instructions.

The second ripple in the pebble in pond design model is to specify a progression of tasks. Each task in the progression involves problems of increasing difficulty or complexity similar that if the learners are able to do all the whole tasks thus identified, they will master the knowledge and skill to be taught.

The third ripple in the design pond is to identify the component knowledge and skill required to complete each task or solve each problem in the programmes, and help them acquire the component knowledge and skill required to complete the tasks or solve the problems.

The fourth ripple is to specify an instructional strategy for task-centered instruction.

The fifth ripple is interface design. It is at this point in the design process that the content to be learned and the strategy used to engage learners are adapted to the delivery system and instructional architecture of the learning situation or product i.e., the sixth ripple.

The ripples have now expanded sufficiently to engage in the production of the instructional materials or situation. In the Pebble-in-the-Pond approach the content to be learned is specified first. One unique characteristic of this approach is casting in the problem or whole-task pebble and specifying a progression of such whole tasks. Pebble-in-the-Pond is primarily a design approach. The instance of instruction is the pebble thrown into the pond; the ripples from that pebble are the subsequent steps provided in the design process.

**Instructional Strategy**

The implications of this approach in the design process is that, all the content that will enable the learner to acquire the desired knowledge and skill should be identified and specified. Another unique aspect of the Pebble-in-the-Pond approach is that this is a complete content specification, including all the information and portrayal that will be used in the instruction. An instructional strategy consists of combining four modes or instructional interaction with the components of knowledge to be taught: tell, ask, show, and do. The demonstration phase of instruction is to tell the learner information components and show the learner portrayal components. The application
phase of instruction is to ask the learner to remember information components (the most common but usually inadequate form of practice) and to have the learner use information components to do something with the portrayal components. In addition, an appropriate sequence for presenting the knowledge components. Instructional strategy also specifies appropriate learner guidance and coaching during the demonstration and application phases of instruction.

6.6 IMPLICATIONS OF CDT FOR DESIGNING INSTRUCTION

According to Rita Richey, CDT provides a basis for creating specification for the design and development of instructional materials

1) CDT is generic to all types of subjects and settings, and addresses very specific aspects of presenting instructional sequences.

2) It provides guidelines for making detailed design decisions.

3) This theory provides design for group instruction/group learning with the assumption individual learner that will control both content and presentation strategies.

4) The theory can be applied to the design of programmes, courses, teaching materials or individual lesson and individual units.

5) CDT provides a comprehensive set of models that integrate research-based principles to improve the professional’s ability to design better instructions. This instructional design theory is selected for its relevance to the following important instructional contexts in open and distance education.

i) When developing instructional materials for distance education, clarity in the presentation of textual information in terms of content, readability and teaching effectiveness, should be taken into consideration. These materials, unlike a usual textbook, should include self-teaching elements for students who are working primarily on their own.

ii) Sequencing of the subject matter is another important aspect to be considered. As we all know, the textbook as a reference source of information follows a logical sequence, which does not help students very much to understand the content. This is a typical pattern generally used by subject matter specialists.

iii) One of the most important contributions of CDT is the provision of a comprehensive set of clearly labelled, described and classified instructional variables. The classification helps the designers by indicating what kind of strategy components should be included in the design; what kind of conditions may influence the effect of each strategy component; and how and when these strategy components should be used.

iv) The pebble-in-the-pond approach to instructional design provides steps for designing instruction and offers a different approach to content analysis.
6.7 LET US SUM UP

Component Display Theory has two categories. These are content categories and performance categories. The content refers to facts, concepts, procedures and principles, so, the performance-content matrix determines the level of performance and content. Each of the task levels requires different combinations of these presentation components based on the desired task levels and content types.

CDT is a comprehensive prescriptive theory. The instructional designer may decide to use a certain instructional design theory or a mix of theories at a theoretical level, but still it has to be translated into the practical form of a lesson or topic. Instructional designers have to use various instructional strategies at the lesson or topic level to keep the interest of the learners alive and to facilitate learning. The instructional strategies that go into the design of a lesson or a topic range from expository to exploratory, from the use of analogies to the build-up of progressive display, and from concept stimulation to event stimulations.

6.8 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

1) Please see sub-section 6.3.1. Elaborate on the aspects of content, which refers to facts, concepts, procedures,

2) Please see sub-section 6.3.1. Elaborate on the aspects of performance, which refers to remembering, using, and generalising.

Check Your Progress 2

Please read sub-section 6.4.3. PPFs consist of expository generality (rule), expository instance (example), inquisitory generality (recall), and inquisitory instance (practice).

Check Your Progress 3

Please see section 6.6.