Instructional design in multi-channel learning system

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Abstract

The Multi-channel learning environment is nebulous and incidental configuration where channels reinforce as well as contradict each other. The Multi-channel learning system is a deliberate, planned configuration to create the sync and synergize the power of various media to achieve optimal learning. This article examines instructional design for the classroom, for self-instructional materials, media— and MCLS.

Introduction

There is a logical development from learning to instruction; instructional design optimizes learning outcome. Hence, learning theories have a significant bearing on instructional design. While learning theories are the backbone, instructional design is the articulate or manifest, rather applied form of the theory and its main goal is to optimize learning by using the known theories of learning. The statement, “whereas physicians engineer health, and architects engineer space, instructional designers engineer human performance…” (van Patten, 1989) succinctly focuses on the role and critical importance of instructional design.

Strain (1994) states that a wide divergence of views exists among the researchers in instructional design regarding the relative contribution of various schools of psychology and claims that instructional design has grown out of the systems approach with its roots firmly in behaviourist psychology, that has dominated instructional design for the past three decades. Kember (1991) supports this contention. Systemic as well as systematic changes are two inter-twined components of instructional design (Park et al., 2000). However, Hannafin and Reiber (1989) point out that instructional design developed in the 1980s by Gagne, Merrill, Reigeluth and Scandura is largely due to the cognitive learning theories. Of course, the emphasis has been on how
information is retrieved, selected, processed and perceived. More recent developments are due to constructivist learning theories. The development in the post 1990s indicates an eclectic approach—the emphasis is no longer on any one theory. Instructional designers draw upon and incorporate from different learning theories. Thus, instructional design is seen as a part of a larger design science, in which the designer borrows scientific principles from various theories, mixes those with other information and applies the results to meet human needs (van Patten, 1989). According to Merrill and Twitchwell (1994), David Merrill, one of the leading instructional theorists changed his own contention of Component Display Theory (CDT) to introduce Instructional Transaction Theory (ITT) as he did not find CDT good enough for expert computer modeling in instructional design (Merrill, 1999).

The dual attraction of meeting the human needs and designing instruction led to considerable research on instruction—programmed instruction (PI), personalized system of instruction (PSI), and teaching and teacher classroom behaviour. Whereas PI, PSI and other such interactive methods remained more as innovations, research on teaching and teacher behaviour targeted at the core classroom process, were the most dominant instructional events in schools and colleges. The basic agenda of these researches were to assess the impact of teacher classroom behaviour on student learning; and design instruction (which, later, came to be known as instructional strategy) in a manner that optimizes learning of the majority of students. The works of Flanders (1970), Gage (1979) and a few others significantly influenced the conceptual and methodological aspects of such research.

The Indian researchers picked up the thread as teacher and teacher classroom behaviour was identified as an area of planned research in the Center of Advanced Study in Education, at M.S. University of Baroda. A comprehensive review of such studies completed in 1970s onwards has been published by Jangira and Sharma (1974), Passi and Sansanwal (1991), and Singh and Jaimini (1997). Most of these studies centered around, directly or indirectly, on instructional design resulting in programmed teaching. Instructional design also featured sharply in the researches and developments in PI, PSI, group interactive learning, mastery learning, media based learning, etc.

Learning itself has undergone paradigm shifts, both by design as well as beyond design. Instructional designers are continuously challenged to mix other information with learning theories to meet the human needs better. Classrooms are no more the monopoly of knowledge and wisdom. There have been dramatic developments in and diversification of sources of knowledge, and a quantum jump in the power of the new sources—television, radio, computer and the other forms of knowledge networks. The conventional classroom based learning systems stand challenged. If learning systems were at the threshold of a metamorphosis, can instructional design remain unaltered? That is the burden of this paper. The challenge is to create a resilient mechanism of designing instructional system that can integrate and optimize learning in a multi-channel learning environment and, thus, create a multi-channel learning system.

Essentially then, the challenge is to weave the wide range of sources of learning into a meaningful pattern, to ensure optimal learning for all learners.

**Multi-channel learning environment**

Learning is a life-long process and is both deliberate and non-deliberate. It spans from the womb to the tomb. In reality, learning is the interactive product of deliberate and non-deliberate efforts. It begins at birth and continues till one is laid to rest. Learning accrues at Home, School, Community, and through the Print Media—newspapers, magazines, novels, fictions, etc, and the Electronic Media—audio, video, radio and television, Digital Multi-media or CD-ROM, and Internet. An indicative road map to learning is as follows:

The road map indicates several sources or channels, strewn around the learning path, creating an environment. This, we intend to call as Multi-Channel Learning Environment (MCLE). In this context, the following are note worthy:

- Increasing evidence from research in psychology indicates the paramount importance and influence of home in the first five years of a child’s life. Value systems, that are the core of human personality (Mukhopadhyay, 1999), get fixed at this period. Importantly, it is the values that guide the entire life, including application of knowledge. Thus, home has a determining effect on human learning. At home, it is
not only the parents, siblings and other humans, but also the household equipment, pets and other elements that constitute the home ambiance influence learning.

- The school, as a source of learning, is often wrongly equated with classroom transaction of curriculum. Learning is the combined (productive) effect of curricular and co-curricular activities, teacher behavior in and outside classroom, peers and the school ethos.
- Community with its traditions, social mores and ethos is another influential source of learning. The peers and elders, festivals and practices, prejudices and superstitions, all contribute to human learning.
- Print media—juvenile literature, newspapers, magazines as well as electronic media—audio and video, radio and television are becoming increasingly stronger sources of learning and influencing human lives, the young children in particular. The Internet, as a convergence media, has far reaching implications opening the global treasure at the touch of a key?

Importantly, these multiple channels create both synchronization as well as disharmony. When the multiple channels synchronize powerful sources like print and electronic media, they supplement and compliment classroom processes; also, they outsmart conventional schooling. It is, however, worst when they contradict one another. For example, the more powerful and all pervasive media like television projects consumerism, violence, women as objects, success through competition, etc, whereas, the schools communicate feebly sustaining values like austerity, peace and harmony, dignity of women and cooperation as means of development. Or, the Internet, the new treasure house of human knowledge, is also the repertoire of the world’s most wretched pornography. Schools, the conventional channel of learning, are set in that complex multi-channel educational environment.

**Multi-channel learning systems (MCLS)**
The Multi-channel learning environment is nebulous and incidental configuration where channels reinforce as well as contradict each other. The Multi-channel Learning system is a deliberate, planned configuration to create the sync and synergize the power of various media to achieve optimal learning. Its major effort is to reinforce one another, and also provide alternative learning paths to the learners according to his/her learning styles and channel preference. Certainly, the effort to develop an organized multi-channel learning system demands elimination of the contradictions and (retro-active) inhibitive effects to learning.

Multi-channel learning has been defined and described by various authors (Anzalone, 1995; Mukhopadhyay, 1995). It is, comparatively, a new lexicon though it derives significantly from the known principles and practices of learning. It is a pre-planned and organized mode, in which:

- Channels mutually reinforce each other to optimize learning,
- Channels can be used as stand-alone sources to suit the learning styles and interests of a learner,
- Learner can configure his/her road map using various channels.
MCLE is a reality. It is recognized that MCLE is unorganized. It is also recognized that MCLE can be and has to be converted into MCLS to reap its fruits. The challenge is in designing instruction for the multi-channel learning system that operates in a multi-channel learning environment. Any meaningful paradigm of instructional design for MCLS must accommodate the contributions of learning theories.

**Taxonomies of learning**

As mentioned earlier, contributions of the behaviourist, cognitivist and constructivist theories have a significant bearing on the concept and practices in instructional designs. For example, BF Skinner contended that learning could be facilitated if the subject matter was programmed by keeping principles like self-pacing, immediate feedback and content in smaller steps. This Skinnerian principle is extensively used in preparing the self-instructional material, audio and video programs and CAI packages. Ausubel (1968) emphasized that learning involves subsuming new material to existing cognitive structure consisting of hierarchically organized concepts called subsumers. This means that the concepts become narrower and more detailed. Malcolm Knowles emphasized on "the importance of organizing learning experiences (the curriculum) around life situations rather than according to subject matter units" in case of adult learning (Knowles et al., 1984). DeMartino (1999) derives messages for instructional design from the principles of adult learning; he contends that "learning is an interactive process constructed by the learner and not passively received from the environment".

The emphasis is on purposiveness and integration of knowledge rather than on the conventional discipline based structure of knowledge approach to learning. Correlating Knowles' thesis with Ausubel's theory of sub-sumption, would amount to the fact that an adult will subsume new information on to the existing cognitive structure if the learning experience is around life. Knowles also suggests that the knowledge of goals is a learning tool for adults; hence, learning goals should take the form of either learning objectives that describe the terminal behaviour to be achieved or the direction of improvement in ability. Thus, if Skinnerian self-paced learning in small steps is tied with stated learning goals, learning can be more efficient. Similarly, Bruners' Discovery Learning has serious implications for instructional design in problem solving, exploratory learning, project methods. Reigeluth and Moore (1999) present a comprehensive overview of such learning theories and taxonomies of learning within the cognitive domain by Bloom, Gagne, Ausubel, Anderson and Merrill.

**Social aspect of learning**

Learning is steadily becoming an important vocabulary in the socio-political dimensions of education. Though not strictly based on a particular school of psychology, there are significant implications of these developments. Two important and classic reports are No Limits to Learning, by Botkin, Elmandjra and Malitza (1979) and Learning: The Treasure Within, the Report to UNESCO by the Commission on Education in the 21st Century (UNESCO, 1996). Botkin, Elmandjra and Malitza classified learning into two categories—Maintenance Learning and Innovative Learning. Maintenance Learning is "the acquisition of fixed outlooks, methods, and media for dealing with known and
recurring situations. It enhances our problem-solving ability for problems that are given. It is the type of learning designed to maintain an existing system or an established way of life”. This largely is the concern of schooling; it prepares children to solve problems that are known.

On the contrary, Innovative Learning has been depicted as “the integration, synthesis, and the broadening of horizons. Its meaning derives from dissonance among contexts. It leads to critical questioning of conventional assumptions behind traditional thoughts and actions, focusing on necessary changes. Innovative learning advances our thinking by reconstructing wholes, not by fragmenting reality”. By implication, innovative learning prepares to face problems so far unknown, and it emphasizes on learning to learn skills. Does this imply relevance of Bruner’s discovery learning?

The UNESCO report, Learning: The Treasure Within proposed four pillars of learning, namely, Learning to Know (including learning to learn), Learning to Do, Learning to Live Together, and Learning to Be. This paradigm takes a holistic view of learning—cognitive, affective, psychomotor and moral. In designing instructional systems, it would be necessary to take into cognizance the categories of learning.

Instructional design in MCLS
In the MCLS, as mentioned earlier, there are conventional classroom instruction, innovative self instructional material, electronic media, both mass media as well as modular media, etc. It would be interesting to take a glimpse of instructional design in the various components of MCLS.

Instructional design for classrooms
Instructional design for classroom teaching is based largely on the systems approach to classroom instruction. The basic instructional design model has the following parameters:

Objectives ↔ Content ↔ Method ↔ Media ↔ Evaluation.

The design is indicated in the lesson plan which a teacher is supposed to develop and follow in the classroom.

A typical conventional lesson plan comprises:

- Statement of the topic
- Objectives
- Previous knowledge
- Introduction
- Presentation
  - Concept, explanations ↔
  - Lecture, demonstration, practical, discussion ↔
  - Chalkboard, charts, models, flannel graphs

Thus, from our own experience, the actual transaction in the classroom takes a particular path. A teacher:

- Deals with what he/she had taught in the previous class and connects the previous theme with the present topic,
- Announces the topic of instruction,
- May provide an introduction—an overview of the topic to be taught or an episode linking to the topic,
- Explains the concepts with examples, numerical calculations or illustrations,
- Asks a few questions to check whether the students have understood the concept,
- Takes up the second concept and makes the presentation, and so on,
- The concepts are explained or presented verbally or by using a chalkboard or a chart, models, an OHP, slide projector etc,
- Recapitulates and summarizes the lesson,
- Gives a few home assignments.

In reality, this approach leads to structured or programmed lecturing. Though objectives form a part of the lesson plan and is an important parameter of instructional design the teacher normally does not announce the objectives to the students. The instructional design adapted in the classroom can be termed as Classical Instructional Design (CID).

**Instructional design for self learning material**

In distance education system, the learners make extensive use of printed lessons. Modern open learning institutions use structured self-instructional material. There are comparative studies of self-instructional material and conventional textual material which indicates that self-instructional material is pedagogically better (Parhar, 1999). These self-instructional materials are called “Teacher in Print” because the lessons are highly structured and developed in the model of programmed lecturing. The components of a structured print material are:

- **Introduction**
- **Objectives**
- **Content**
  - Concept I, explanation, illustration, derivations
  - Intext Questions
  - Concept II explanation, illustration, derivations
  - Intext Questions
  - Concept III explanation, illustration, derivations
  - Intext Question
  - and so on
- **Summary**
- **Unit End Questions**
- **References and Suggested Reading.**
The above components are kept in mind while designing the self-instructional material. Let us examine how and why each component is important.

- Objectives are stated in the beginning of the lesson, as these are the milestones in any learning endeavor. The objectives are stated in terms of learning outcome; they are measurable.
- Introduction develops the mindset of the learner by linking the lesson with the previous learning or with some related events. It also provides an overview of the lesson—an advance intimation to what is in store.
- After the introduction, the contents are presented in small steps. The concepts are logically sequenced, uniform, and are explained with the help of illustrations, derivations, examples, etc. Many lessons include activities.
- Evaluation is an important aspect of learning. Intext questions are provided after each section so that a learner may review his or her progress. This also provides an opportunity to the learners to go back to the section and relearn before proceeding to the next section.
- Summary, the last component of the structured printed material, plays the role of closure as it is in live classrooms. Summarization facilitates consolidation and retention of learning.

Thus, the instructional design for self-instructional material will look like Figure 2.
It should be evident that the instructional design for self-instructional material is built in the image of CID. It is a replica of a programmed teacher in print.

**Instructional design for media**

Media has become an integral part of education, though, largely yet, in the “Environment” mode. It is becoming a part of the “system” in open and distance education. There are, however, several formats and status within the overall scheme of instruction. Let us examine some of the possibilities shown in Table 1.

### Table 1: Media format and status in instruction

<table>
<thead>
<tr>
<th>Format</th>
<th>Lecture or Illustrated Lecture—Audio</th>
<th>Documentary visual main focus</th>
<th>Docu-drama Combination of documentary &amp; drama formats</th>
<th>Drama Best combination of audio &amp; video most powerful communication in affective domain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated</td>
<td>01</td>
<td>02</td>
<td>03</td>
<td>04</td>
</tr>
<tr>
<td>Stand Alone</td>
<td>05</td>
<td>06</td>
<td>07</td>
<td>08</td>
</tr>
<tr>
<td>Complementary or Reinforcing</td>
<td>09</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
</tbody>
</table>

Note: Numbers entered into the cells indicate various alternative possibilities

Hence, there are at least 12 alternative possibilities. ID varies among the 12 possibilities — Integrated, Stand Alone and Reinforcing on one hand, and the formats on the other. The Integrated and Reinforcing programs are in part of multi-channel learning system (MCLS) context. Here, the challenge is to design instructional design for multi-channel learning systems or MCLS-ID. Stand-alone programs need instructional design for themselves. Nonetheless, media, integrated or otherwise, does have a design of its own.

Conventionally, ID components are objectives, content (content analysis and level validation), transactional methods (lecture, video, audio, etc. or in combination) and evaluation (interim and end of learning). In SLM all these are explicit. In audio/video that is not usually true, though both objectives and evaluation can be built into the program, in the script and at the production stage. In MCLS, each component, namely print, audio or video makes a specific contribution to content coverage, evaluation and hence, achievement of goals. ID, therefore, for audio and video in MCLS, is part of an ID Systems.

The audio/video programs are close to linear programmed learning material (PLM). The examination of raw scripts indicates that these are developed frame by frame, except for the end-of-frame questions and answers, as is common with PLM. In the conventional audio/video format, there is no way of skipping frames except through fast-forward. In videodisc or CD-ROM, there is random access facility and one can skip frames. Also, it can have built-in alternatives (say on a program on environment—physics or botany related issue, or in a Drama—comedy or tragedy). It can also have the facility of hypertext. Now, let us see what an ID diagram in audio or video would look like (Figure 3).

![Diagram of Instructional Design in Audio and Video Programs]

Figure 3: Instructional design in audio and video programs

The instructional design of media largely depends upon two components, namely, the content, duly analyzed and sequenced and choice of media format. Objectives and assessment can back up the media effectiveness.

**Virtual reality in education: the case of convergence**

The World over and in India, virtual classrooms have become a new reality. Knowledge networks and the Internet is the most powerful media for more than one reason. First, it provides a single learning window through convergence. Text in self-instructional format with or without graphics, voice, animation and moving images, synchronous (chat session) as well as asynchronous (voice mail, email based interaction) interaction is available on the Internet which merges smartly all channels or media known, so far.

Second, with browse facility and facility for searching alternative sites, the learner is likely to hit more than one site containing input on the same theme. It not only brings in a wealth of alternatives in content but also several alternatives in learning paths based on alternative instructional design. On the institutional web sites, specially designed lessons are loaded for the virtual campus of the university. Internet itself offers a cafeteria of instructional designs to choose from. However, a teacher can design instruction with Internet as one component enriching through exploration, contrasting, etc.

The other applications of virtual reality are telephones and interactive radio and television. Several countries, like South Africa, Brazil and India, among the comparatively less developed nations, use interactive radio and television in education. The two-way video interactive media is increasingly replacing the earlier generation one-way video-two-way audio through telephone and fax on the return path.

In fact, the Internet, computer networks, interactive radio and interactive television are now being used extensively for staff development by several institutions in India as well as by some conventional universities like Goa, besides the open universities.

**Configuring ID for MCLS**

Multi-channel Learning Systems comprise print material, face to face instruction (classroom instruction), modular media like audio and video or CD-Rom, mass media like radio and television, interactive media like Interactive Radio, Interactive Television, Computer Network, Internet, Telephone, etc. There are several parameters in designing instructional systems for a multi-channel learning system. These are:

Objectives— all the domains, ranging from simple to complex ends (eg, knowledge or information at the simple end to Attitude at the other end via various levels of cognition and affection).

Content— from shallow end to the deep end based on content analysis, both component and micro-component analysis.

Channel Options—ranging from face to face to interactive media mentioned above.

Design Option—stand alone and complimentary media, where in each channel offers either the whole or part of the content without referring to one another and integrated media in which the content is covered by one or more media in combination, using the best potential of each for optimizing learning, usually with reference to one another (eg, print material calls attention to a specific video or interactive video asking to refer to a diagram in print material).

Evaluation Options—formative and summative including choice of means, eg, on-line or off-line, paper-pencil versus performance, etc.

The various components of the instructional design for a multi-channel learning system and their inter-relationships can be represented as in Figure 4.

**Conclusion: differentiated instructional design (DID)**

There are several important implications of the proposed paradigm. First, a learner can configure his/her own curriculum by drawing upon the micro-components of various

units within the same subject and across the subjects as known today (not shown in the diagram). This makes possible translating Malcolm Knowles' thesis of integration of relevant knowledge. Second, this paradigm is pregnant with innumerable possibilities of designing instructional systems. While each segment of the multi-channel learning system has its own instructional design, the multi-channel mode itself provides a new opportunity in which the focus shifts from the teacher to the learner. A learner can now choose his or her own mode of learning, either with stand alone or integrated media thereby configuring instructional design. He or she may choose his or her:

- Own set of learning goals—some at the higher level of cognition and some at the lowest level,
- Components of the contents including differential depths of different component according to the learning goals,
- Learning channels and create a specific configuration (what to use as initial learning and what to use for reinforcing, for example), and
- Assessment tools and forms.

This will lead to individualizing the instructional design as opposed to the classical teacher centered instructional design—one design for everybody in the class. Hence, the proposed paradigm of instructional design in multi-channel learning systems offers new possibility of Individualizing Instructional Design (IID), indeed superhighway to optimizing learning potential of every learner.

The second implication of instructional design is on the role of the teacher and the classrooms. In MCLS, classrooms are no more the dispenser of knowledge; these are crucibles for integration of knowledge derived out of various sources. As the organized instructional process is initiated in the classrooms, it facilitates setting out a road-map for the learner, with a specific set of goals within the deliberately chosen parameters, the learner derives learning from self-instructional material in print, audio, video, telephone, CAI, Internet, etc. He or she brings back to the classroom all his or her information, experience of retrieving information, perception, etc, often with a lot of loose ends. The teacher, as instructional manager, facilitates tying up those loose ends.

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