UNIT 3 IMPLICATIONS OF LEARNING THEORIES FOR TECHNOLOGY USE

Structure

3.1 INTRODUCTION

Why do we need to study the implications of learning theories for technology use? This is because with increasing access to technology at educational institutions, and with policies urging teachers to use technology (ICT), there is a possibility of ICT use, being guided by its availability, and the policies requiring ICT use in teaching-learning processes. This type of ICT use treats ICT as the focal point and teaching-learning strategies revolve around the technology in which the institution has invested (Suri, 2008). In such cases learning theories and hence, pedagogy may become subservient to technology use, which assumes the central position in teaching-learning processes, instead of being the means for supporting pedagogies. This leads to the possibility of using even digital technologies just for supporting traditional pedagogies involving information transmission (Laurilard, 2002). The potential of technology for supporting a pedagogic shift from traditional teaching methods to those that support knowledge construction may not be utilized in such instances. On the other hand, when the focus is on learning theories, technology is treated as a means to support pedagogy and there are attempts to integrate it seamlessly in the instructional process. Therefore this unit treats theories of learning as key points and describes their implications for technology mediated teaching and learning. Subsequently, it states that optimum

*Please Note :

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utilization of technology depends on the pedagogy, and hence, the learning theory, which can make learners consumers of information transmitted through technology. We will also discuss collaborative learning, situated learning, games and generations of technology in this unit.

3.2 OBJECTIVES

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

- explain the meaning of technology mediated teaching and learning;
- explain the implications of behaviourism for using technology in teaching -learning processes;
- discuss the implications of cognitivism for using technology in teaching-learning processes;
- explain the implications of constructivism for using technology in teaching-learning processes; and
- discuss the ways to utilise technology optimally for teaching- learning processes.

3.3 TECHNOLOGY MEDIATED TEACING-LEARNING ACTIVITIES

In a formal learning environment, the teacher transacts learning experiences through a systematic instructional planning and delivery. Transaction of learning experience means transaction of a given content. In order to transact a given content. a teacher takes the help of same methods. For example, a teacher makes use of methods and techniques like lecture, demonstration, discussion, narration, question-answer, seminar, panel discussion, project work, etc for transacting different kinds of learning experiences. In spite of the best efforts made by the teacher to explain different concepts, principles, laws, ideas, processes, theories, etc in the classroom with the help of various methods and techniques, the teacher might face difficulties in delivering effective learning experiences. Hence there are many events of instruction, which require use of several technologies-audio, visual and audio-visual, For example, a Biology teacher might find difficulty in explaining the functions of a human heart without the help of a picture or a model of human heart or animated video of a human heart. Moreover, it is sometimes difficult or expensive or not possible to have actual objects under study in the classroom. In that case, the teacher can select a visual medium to represent the objects. The learning experiences provided by a teacher through technology, thus, becomes, technology mediated learning experience. Thus, technology has a lot of impact on any kind of teaching-learning activities. Each technology is effective for specific learning tasks and with specific learner groups. Various technologies make teaching-learning tasks easier and more effective.

From the preceding discussion, it is evident that technology enables/facilitates/ enhances learning. This is why teachers right from primary level to tertiary level have been using different kinds of technologies to enable or enhance student learning. These technologies may vary from the simple use of a chalkboard or printed materials to the use of sophisticated electronic gadgets like computer. Although traditional technologies are still popular among the teachers across the world, the advances in information and communication technologies have brought in dramatic changes in the process of organizing learning activities. Learning is no more considered as a teacher driven activity alone. It is now-

a-days being perceived as a technology driven activity. Especially with the increasing use of various forms of computer technologies, namely, Internet, e-mail, Intranet, computer conferencing, online learning, learning has become a learner-centric activity wherein planning, organization, implementation and evaluation of learning activities are completely managed by the learner. Similarly, a multimedia computer which has all the features of text, animation, audio, and video enables a learner to learn on his/her own. Now-a-days, many lessons in mathematics, sciences, languages, social sciences and other subject areas are provided to the learners in CD-ROMs. With the growing popularity of e-learning or online learning, many university courses or even school courses are being made available to thousands of learners across the world. A learner can pursue any kind of academic or professional education programmes through online or e-learning technology. From all these discussions, it is clear that the latest information and communication technologies enable or enhance learning Due to technological support, learning is no more confined to a particular time, place or pace. One can learn at any place, any time and according to his or her pace. Very often, technology mediated learning is perceived as synonymous with web-learning or online learning or e-learning. Although e-learning is the main driver of learning in the context of ICT, technology mediated learning pertains to the use of any kind of technology which enhances human learning. In this context, technology mediated learning would include the use of any technologies right from popular chalkboard and print material to Internet for enhancing learning.

To sum up, technology-mediated learning has the following advantages for the learners.

- Technology can help learners to create multiple representation of reality which constructivist school of thought believes in.
- It can meet the learning requirements of learners with different learning styles-namely tactile, visual and auditory learning styles. It acts as an effective means of motivating learners to learn.
- It can act as a powerful instrument to develop abstract ideas or concepts in learners,
- It promotes collaborative and peer learning.
- It helps the learners to produce creative works.
- It helps the learner in problem-solving and decision making.
- It promotes communication abilities in the learners.
- It helps learner to collect, collate, classify, analyse synthesize and produce data

Source: IGNOU (2009)

3.4 THEORIES OF LEARNING AND THEIR IMPLICATIONS FOR TECHNOLOGY MEDIATED TEACHING-LEARNING

So far as learning theories are concerned, there are mainly three major Schools of Thought on learning. These are: Behaviourism, Cognitivism, and Constructivism. According to Behaviourism, learning occurs due to the bond between stimulus and response. It emphasizes habit formation in the learning process. Cognitivist theorists like Jean Piaget emphasdizes on acquisition, assimilation and

accommodation of new learning in the cognitive structure (Structure of cognition in human mind). Constructivist thinkers like Vygotsky gives importance to scio-cultural settings and language in the learning process. According constructivists, learning is constructed by the learner in the socio-cultural context her/she is situated.

3.4.1 Implications of Behaviourism for Technology Mediated Teaching-learning

According to the learning theories propounded by behaviourists, learning is a mechanical process of associating stimulus with response, which produces a new behaviour. Again, such behaviour according to some psychologists is strengthened by reinforcement. Behaviourists consider learning to be a mechanical process of 'association' of response with a stimulus for producing a new behaviour, i.e. learning. They also emphasize the need for 'practice' for strengthening the association so that the newly acquired behaviour can be performed with speed as well as efficiency, and gains the strength of a habit. For instance, while learning to use a computer keyboard, we gain speed and efficiency with practice. Behaviourists like Pavlov highlight the need for conditioning the response (R) through proper reinforcements and enabling the learner to respond to even a neutral stimulus (S) that assumes the strength of a natural stimulus.

Hull's theory of drive reduction says that learning involves S-R connection but it is directed towards the satisfaction of a need, which in itself serves as reinforcement, while behaviourists like Pavlov, Skinner and Thorndike are of the view that reinforcement provided by an external agency strengthens the S-R connection and thus the desired behaviour. However, Sprinthall and Sprinthall, (1990) say that Skinners' concept of reinforcement differs from Thorndike's concept of reward, which is a satisfying feeling or experience rather than something concrete. Apart from the need for reward and practice, Thorndike also emphasized the significance of other factors like the readiness of learners, and goal oriented learning endeavours, for learning. What are the implications of these aspects of behaviourism on technology use in teaching and learning? We are listing some of the implications. You may take a critical look at them in the light of behaviourism and add some more.

- Learning experience needs to be enjoyable: While using technology for teaching we need to understand that once the novelty of the device wears off, learners may lose interest unless the content taught is interesting. Hence, children may be excited as you take them to a smart classroom and use computers but to sustain their interest you need to teach in a way that they enjoy learning.

Read the following:

> In 1999, as a part of the "hole in the wall" project, carried out in Delhi, a computer was put in hole in a wall in a way that children of a nearby slum could access it. The children started using it and could acquire basic computing skills mostly on their own. The project showed that there can be incidental learning of such skills provided the learners can access suitable computing facility, with entertaining and motivating content and some minimal (human) guidance.
>
> **Source:** Edutopia, February3, 2012.
>
> You may read about this project carried out by Sugata Mitra.

Note the words 'entertaining and motivating content' in the box given above. This explains the reason for designing educational games, using computers and mobile devices, in a way that learning experiences educate as well as entertain and keep the learners interested. For example- for a game built around a pizza party, children, while playing the game, attend the party and learn to count, add and subtract; there are games for language learning while playing the game; an online squabble game requiring players to create meaningful words, encourages thinking and helps the expansion of vocabulary but sustains their interest by challenging them with cues for word making.

- Reinforcing desired learning experience: Skinner is of the view that teachers can be more effective if they act as behavioural engineers and shape behaviour through reinforcement (Parsons, Hinson, Brown, 2001). Therefore computer assisted instructions are developed not just for teaching but also for, assessing learning and providing feedback that reinforces the desired behaviour. You may have also played games on computer or mobile phone and got feedback about your performance in the form of scores, congratulatory messages and so on. When you design technology mediated learning experiences, you need to keep in mind the need for providing such reinforcement verbally/ textually/ pictorially.

Use of emoticons for providing feedback

Thorndike's learning theory is - behaviouristic – ☺

Pavlov's theory of learning is-constructivist- ☹-Read the text again

Feedback in self learning material

Why does this unit include 'check your progress' and their suggested answers? The unit has been developed as a Self Learning Material (SLM), which is based on the concept of 'programmed learning'. Programmed learning aims to introduce behavioural change (learning) through suitable learning experiences that are analysed and presented in small learnable units for introducing learning. This unit also includes small segments of instructional content called frames. Following the teaching of a segment, learning is assessed and 'reinforced' through feedback.

- Practice for learning and its retention: Computer Assisted Instructions often include provision for drill and immediate feedback. This reduces the chances of extinction of response to the stimulus and thereby the termination of the newly acquired behaviour.

A multiplication drill

2X3 = 6 -👍

3X4 = 13 - 👂 -try again

3X4 = 12 -👍

4X5 = 20 -👍

- Learning requires readiness in terms of maturity and previous knowledge: Previous knowledge, maturity, interest determine readiness. For example, a computer training of the advanced level, requires the mastery of the basics.

We need to keep this in mind while selecting/developing content/ learning experiences for our learners. Therefore, while developing an audio/video programme we need to carry out a need survey to understand the academic background of the target group (learners) and pitch the difficulty level of the programme accordingly. For example for a video programme on "states of matter" for fifth standard students will you include content on the molecular structure of water? Why?

- Learning is goal oriented and need based: Formulating clear objectives for teaching-learning purposes and sharing them with learners is important. For example, before engaging children in an addition drill, we may tell them that this will help them in learning addition and subsequently multiplication and thus enable them to calculate the cost of the things they buy.

Behaviouristic approaches are criticised as they lead to the adoption of traditional methods of teaching requiring information transmission through lectures for filling gaps in learner's knowledge. Learners are also engaged in drill and practice for strengthening the S-R association, but not in the generation of new concepts. It also considers learning as an individual instead of a social process and hence, does not take into account the need for discussions and team work for learning. Nevertheless, behaviourism has led to the development of important instructional technologies, tutorials with individual instructions and feedback that reward learning and motivate learners (Shield, 2000; Sutton, 2003). It has also led to the idea of programmed learning, which is still popular for developing SLM.

Behaviourism is although criticized for defining learning as a mechanical process of responding to a stimulus, and encouraging teaching through transmission of information for rote learning but it is difficult to dispense with it altogether. Can we avoid learning by S-R association? How do we learn to stop when the traffic signal turns red and start when it turns green? Do we not get conditioned to stop at a red signal? Can we avoid rote learning? How do we learn our telephone number, our address, songs of a language we may not understand? Do we learn these things by attaching meaning or by rote? Does practice help in learning the use of the computer commands like 'Ctrl+s, Ctrl+b, Ctrl+alt+del'? We learn many things through association, conditioning and repeated practice. S-R association is required even for operating complicated machines like car, computer, aeroplane, mobile phone, and the like. Look at your television remote control device, or your mobile phone. They have many symbols to which you have learnt to respond for operations like increasing or decreasing brightness, volume of audio, and so on. Therefore, when you develop a CD or an online course, you may create various icons for communicating messages like 'forward', 'backward', 'pause', 'start', 'skip', etc., but an icon should require the same response every time it is used so that the S-R connection is established. For instance, if an icon is used once for 'pause', every time it has to be used for pause so that users associate the action 'pause' to it.

3.4.2 Implications of Cognitivism for Technology Mediated Teaching-learning

Piaget, the renowned cognitive psychologist, talked about acquisition of knowledge, and hence about the growth of the mental structure, the schema (building blocks of knowledge). While associationists viewed learning as perceptible change in overt behaviour exhibited as response (R) to stimulus (S), and placed emphasis on what learners 'do', neo-behaviourists went beyond this and included besides overt behaviour, the internal processes involved within

the organism (O) for making S-O-R combination (Parson, Hinson and Brown, 2001). Therefore, cognitivism does not view learning as a mechanical process but a process of thinking i.e. cognition for meaning making. Mental processes like memory, reasoning, organizing ideas, making strategies for acquiring facts and concepts are needed for such learning (Seifert, 1991) and this requires the consideration of the entire field of operation (gestalt) and the relation among the variables comprising it, instead of considering isolated stimuli. Information processing is thus carried out and as indicated in Figure 3.1, the following steps are therefore essential:

- Receiving initial sensory input from sense organ(s) : The sensory register receives the information but holds it for a short duration and retains only the stimuli to which we pay 'attention'. Objective qualities of the stimuli i.e., well defined features of the stimuli facilitate its retention. For example, a teacher points to Assam in the political map of India and taps the pointed end of a stick on it to draw attention to the stimulus; on a website some links are labelled as 'new' and the word 'new' blinks to draw attention. While the information is still in the sensory register, we perceive it by attaching meaning to it. From the sensory register the information perceived passes on to the 'short term memory' but remains there for a limited period. Thereafter, it is either forgotten or becomes long term memory. Hence, information processing is not merely the process of shifting information from sensory register to STM and then to LTM but it also involves the organization of the information and attaching meaning to it for forming concepts (Sprinthall & Sprinthall, 1990). For example, when a child learns about sparrows, the information is transferred to her STM and she makes meaning with the help of her earlier learning of crows and pigeons and her new learning then becomes a part of her LTM but a telephone number she has learnt may be retained in the STM only till she has dialled the number. The learning does not become a part of LTM in this case.
- Transferring STM to Long Term Memory (LTM) as well as recalling the LTM requires effort, but practice lessens the effort. For e.g., unlike those teaching a particular content every year, others who had learnt it long back may need some time to recall it.

  Can rote learning be a part of LTM? You know that rote learning, unlike meaningful learning, implies learning by repetition rather than by comprehension. Although such learning is not considered to be as effective as insightful learning but rote learning may also be transferred to LTM and may become life long memory, like the rhymes and songs we had learnt in our childhood often without understanding their meaning. However, we may not be able to recall the 'laws of motion' we had learnt as adolescents if we had learnt them by rote. This is because like the rhymes and songs we may not have fully understood the laws but unlike the rhymes we may not have rehearsed them to the point of 'over learning' i.e. repetition, which is necessary for transfer to the LTM and retention.

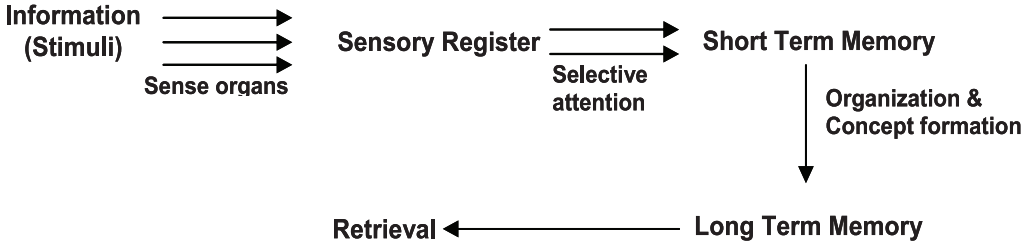

Fig. 3.1: Information Processing Model

What are the implications of cognitivism and especially Information Processing for ICT use in teaching and learning? Some of the implications are the following:

- Learning is basically a process of meaning making. The learner constructs knowledge but individually. Hence, ICT use needs to be directed towards engaging the learner with the content in a way that s/he is enabled to recall earlier relevant learning and use it for anchoring new learning. For example, for teaching the implications of learning theories for ICT use, we are referring to the theories of learning you have learnt earlier but in an online course, you may create hyperlinks and new concepts may be hyperlinked to the content taught earlier. You may have come across such content with hyperlinks, in wikis, that lead to explanations and / illustrations for the hyperlinked word.
- Using ICT for repeatedly playing a particular content like a poem or a song may help in making it a part of LTM but you need to check whether the learner has understood the concept, as the content learnt this way may not necessarily lead to meaningful learning, and may be lost.
- It is necessary to draw learner's attention for learning to begin. If we fail to draw the learner's attention and arouse interest in learning, the information we provide may be lost. Therefore, we use methods like using an interesting introductory message prior to teaching the content, apart from techniques for drawing attention like underlining, using bullets, creating boxes with text, and the like.
- Learners need to be active for learning. Hence activities requiring them to search for information, sift through it, evaluate and select appropriate content, analyze and synthesize it, draw inferences, that make them more active than situations in which they are recipients of the information and inferences drawn by teachers and others, support learning. Hence, learners need to use ICT more while in a classroom teachers usually are the main users of ICT and learners remain passive.
- Goal oriented and self directed learning requires clear objectives. For example, the units of this course begin with clear objectives of teaching and learning. Hence, while developing an audio/video/online course/multimedia CD you should be clear about the goals of teaching and learning.
- Learning requires scaffolding. Hence even while teaching through ICT, advance organizers can be helpful for rooting new learning to earlier one by comparing and contrasting old and new ideas, or by simply linking them.
- Learners do not need to be 'trained' as they can make meaning and be self directed learners, who can take charge of their learning. This, however, requires that irrespective of the medium used for delivering it, the self learning material is structured, focussed and as per the learner's abilities and needs. It should also raise questions that elicit critical thinking. The feedback from teachers may also include comments that encourage thinking.
- As the learner needs to process information, the content, for instance of an online course or any unit of a teaching-learning process, should have a well defined and coherent structure, logical sequencing, summary, relevant examples, analogies, concept maps, and other such features for facilitating information processing.
- Though learners engage in information processing, the importance of drill and practice remains. For examples, we may watch a video showing a process, understand it and reproduce it but practising it will lead to perfection and naturalization.

Check Your Progress 1

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

b) Compare your answers with those given at the end of the unit

1) For designing an online course does behaviourism have any implications?

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2) How should the instructional content be designed for programmed learning?

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3) What are the features that learning material should have, for fostering thought process?

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3.4.3 Implications of Constructivism for ICT

You know that as per the constructivist approaches learners should not be merely recipients of the knowledge constructed by others but they should engage in activities that lead to knowledge construction. You also know that social constructivists like Vygotsky consider learning to be a social process requiring discussion, negotiation, attaining consensus, and hence team work. ICT has the potential to support collaborative knowledge construction (Jarvela, Hakkarainen, Lipponen, & Lehtinen, 2001) and Web 2.0 technologies like wikis, blogs and podcasts if effectively deployed can enhance learning experiences, and deepen levels of learners' engagement and collaboration within digital learning environments (Boulos, Inocencio & Wheeler, 2006). This is because sociability aspects of Web 2.0 tools built through their social softwares make them ideal for educational purposes as they can support conversational interaction, feedback and social networking (McLoughlin & Lee, 2007).

What are the implications of constructivism for teaching and learning with ICT? Some of them are the following:

ICT use for enhancing learner engagement: ICT should enhance the level of active participation of learners in learning processes. The content taught, therefore, has to be interactive that questions, requires learners to critique, contextualize it by bringing into play their own experiences, for cognitive engagement of learners. Activities requiring collaborative work with peers and provision of support from teachers will enhance learners' social engagement.

ICT use for supporting knowledge construction: ICT needs to be used for supporting knowledge construction by learners. For example, ICT may be used just for downloading images of food chain or it may be used for searching for information about the birds and animals of a locality and their food habit; downloading images of the birds and animals, images of necessary icons like arrows, and using the images to organize the organisms in a way that depicts a food chain.

ICT use for making learning a social process: Unlike behaviourists and cognitivists, social constructivists consider learning as a social process. Hence, ICT needs to be used for learning collaboratively. Activities requiring teams to solve problems, making discoveries and using ICT for collecting, processing, managing and sharing information and the resources created are therefore to be planned for teaching. We know that many children today use social media and, often for carrying out school projects and assignments they become communities of practice that engage in computer based collaborative learning. However, do schools recognize, support and channelize such informal and unguided practices for collaborative creation of content?

There is an emerging need for pedagogies that harness web 2.0 technologies to promote collaborative learning (Safran, Helic, & Gütl, 2007). Therefore, while using ICT for teaching and learning purposes you need to see that it brings together learners, and helps them share files, data and messages for negotiated meaning making.

ICT use for situated learning: Situated learning is a form of authentic learning that happens in real world situations. Working in the real world situation leads to the acquisition of knowledge that is embedded in the situation, as well as the application of such knowledge to the real world complex problems emerging in the situation. For instance, while working at schools a teacher may come across a problem related to classroom management that he/she had not studied during teacher education programme. He/she may learn to manage it and also apply his/her learning in similar situations. This type of learning is contextualized and technology helps in simulating the situation and creating a micro world that represents the real world. For example, we can learn to fly an airplane in a simulated situation; the basic operations of mathematics through simulated purchase and sale of goods; to solve problems pertaining to management of organizations by studying the problem, engaging in decision making and reflecting on the outcomes of the decisions.

There are games that have been devised for learning by exploring a topic in authentic setting, collaboration and reflection in an educational scenario that combines mobile computing technologies with stationary computers (Spikol, Kurti & Milrad, 2009). There are also games based on participatory simulation that create a scenario mediated by a set of rules that enable inquiry and experimentation, and while playing them, learners are transformed into players who dive into the simulated situation, which is the micro worlds and learn in-context while playing it (Yin, Ogata & Yano,2009).

Teacher's Role: A teacher can develop a constructivist environment by creating learning communities that comprise students, teachers and experts who are engaged in authentic tasks in authentic contexts (UNESCO, 2002). This is possible with ICTs that for instance enable simulations and create virtual world for collaborative learning. Within the virtual environments modelled by ICT,

virtual communities of practice can carry out real time actions, collect data from different locales, think, act and reflect collectively and make decisions and solve authentic problems. For example, Second Life is a virtual world that allows players to socialize with other participants, interact with objects, participate in activities, take decisions and learn. Some other examples of virtual world created for learning are Sciencesim for collaboratively learning science; heritage key for learning history and culture, and the like.

ICT use for self directed learning: Although collaboration is important for learning, reflection, metacognition and hence self directed learning on part of individual learners is also important. Therefore, the online course you teach may require your learners to maintain a reflective journal for recording their reflections on their learning experiences. Reflection may also be a collective process with the team reviewing experiences and revising the learning process.

The teacher's role is not passive as learners construct knowledge. S/he needs to guide and facilitate learning. S/he has to play an active role in formulating the objectives of teaching, select and organize the content to be taught, chose suitable pedagogy and technologies. S/he also has to design the content, structure the learning experiences and support and monitor learning on a continuous basis and also see that ICT use is focused and ethical.

Check Your Progress 2

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

b) Compare your answers with those given at the end of the unit

4) What is the main purpose of using projected slides by the teacher during teaching-learning processes? Is it beneficial for 'learning' or for 'teaching'?

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5) In what way should ICT be used for facilitating learning?

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6) Which technologies can support learning in a social context?

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3.6 SOCIO-CULTURAL THEORIES AND THEIR IMPLICATIONS FOR TECHNOLOGY USE IN TEACHING-LEARNING

Vygotsky shared many of Piaget's views about child development, but, he was more interested in social context of learning. The social constructivist model proposed by him emphasizes culture as the prime determinant of individual development. Learners are believed to be encultured into their learning community and Learning is considered to be largely situation or context specific activity. Vygotsky suggests that every function in the child's cultural development occurs twice or on two levels: first it appears on the social level, and then on the individual or psychological level. Lave (1988); Lave and Wenger (1991) have developed a view of learning as social construction, putting knowledge back into the contexts. Hence, teachers and more knowledgeable others need to scaffold and transform learning in response to children's prior understandings. We will discuss collaborative learning and situated learning under socio-cultural perspectives in education

3.6.1 Collaborative Learning

Collaborative learning is a teaching-learning technique, which creates an environment where the learners work in collaboration with other learners to achieve a common learning goal. Collaborative learning is considered an umbrella term for a variety of educational approaches involving joint intellectual effort by students, or students and teachers together.

Theories of collaborative learning

The concept of collaborative learning is based on several theories. In the 1920s, the Russian Psychologist Lev Vygotsky introduced the concept of the "zone of proximal development" (ZPD). According to him, a child, when assisted by a more capable person, is able to learn new skills or gain knowledge and gradually is able to independently gain more knowledge and skills without any such help. This theory assumes that a child can develop new knowledge and skills in an environment, which does not need a teacher per se, but has all the other elements, such as the various stimuli required for learning.

Another concept that helped in the development of the concept of collaborative learning was the theory of cooperation and competition propounded by Morton Deutsch in 1949. The theory is based on human psychology and deals with the effect of cooperation upon the functioning of a group. It says that the most important factor in cooperation is the goal; all individuals in the group should have a common goal (or interdependent goal).

Process of collaborative learning

To understand collaborative learning, it is important to first understand how learning takes place. In 1992, Barbara Leigh Smith and Jean T. MacGregor, provided the following prevalent theories about the learning process and then, based on these theories, defined the process of collaborative learning:

1. During the learning process, students take in the new information and relate this to a framework of prior knowledge.
2. Active learning requires a stimulus or challenge for the learner to actively engage his/her peers, and to process and synthesize information rather than simply memorize and regurgitate it.

3. Learning happens when learners are exposed to diverse viewpoints from people with varied backgrounds.
4. In a social environment where conversation between learners takes place, the learning process is enhanced. In this environment, learner creates a framework and meaning to the conversation.

According to Smith and MacGregor, in the collaborative learning environment, learners receive a stimulus to engage and converse with their peers. They are exposed to different viewpoints. In such an environment, learners begin to create their own learning frameworks rather than relying solely on what has been told to them by the teacher or what is written in the textbooks. Thus, in a collaborative learning setting, learners can converse with peers, present and defend ideas, exchange diverse beliefs, question other conceptual frameworks, and be actively engaged.

Let us now understand how to design a collaborative learning environment. The teacher has an important role to play in designing the activities for collaborative learning. S/he needs to select appropriate topics for the activities, divide the students into groups in an appropriate manner, provide leadership, and evaluate the outcomes. The following steps are generally followed while designing the activities of collaborative learning:

1. ***Selecting the topics:*** The first step is to select the topics from the subject which he/she has been teaching and their learning outcomes, which are to be included. The whole course should not be selected but certain aspects of the course that needs to be augmented should be carefully chosen for collaborative learning. Group work or team work is employed in those situations where the students are expected to demonstrate problem–solving skills or decision-making skills or apply theoretical knowledge to real world problems.
2. ***Forming groups:*** The teacher forms groups and assigns students to these groups. The groups are usually kept small, of 4-6 students each, for better outcomes.
3. ***Introducing the activity:*** The teacher introduces the activity to the students, explains the objectives and the processes for carrying out the activity. The teacher also sets a time limit for the activity.
4. ***Teaching students how to work in groups:*** Students are usually diverse with different abilities, academic interests and cognitive styles. It is important for the teacher to know the weaknesses, strengths and learning needs of each student and assign them groups in such a manner that it ensures cohesiveness. There could be different types of students in the group, for example, there would be skeptical students, there would be shy students, and there would be dominating students. The teacher has to teach them how to work in an environment of collaboration by applying their interpersonal and organizational skills. The teacher needs to explain the students to recognize the importance of listening, clarifying statements, providing good feedback, keeping discussions on task, probing assumptions and evidence, eliciting viewpoints and perspectives, mediating conflicts, and summarizing the presentation findings. The ground rules for working in a team also need to be spelt out. The teacher should assign roles to the students, such as facilitator, note taker, planner, evaluator, etc.

5. ***Provide guidance:*** The teacher is not there to dominate the activities but to provide gentle guidance and mentorship. The teacher needs to provide appropriate feedback and ensure the communication is flowing within the group. It is important to allow students make their own decisions about how to proceed.

6. ***Evaluation:*** The teacher needs to take into account the individual effort and the team effort while grading the group work. The group members should also be asked to assess their operations during the activity. The overall achievement should be based on both the final outcomes and the assessment of the group on their operations.

Technology use in collaborative learning

In the previous blocks you have learnt about the various types of technology tools and how they are being used for teaching-learning. You have learnt that the most common ICT tools are the softcopies of various documents and illustrations, audio (radio, MP3 player, mobile, and such devices) and the video (television, computer, mobile, and such devices). Then there is the computer with its various capabilities, and the Internet. Similarly, there are various types of digital teaching-learning resources, such as web TV, web radio, and the various Web 2.0 tools, such as chat rooms, blogs, e-conferencing, social media, search engines, and various new and upcoming mobile tools. Additionally, there are the open educational resources and the educational software application to aid technology-mediated teaching-learning. Indeed technology, with its multifarious types and uses has become an indispensable component of education. The scene is no different in collaborative learning.

Briefly, technology is used in the scenarios of (i) Computer-supported Collaborative Learning, and (ii) Collaborative Learning Using the Internet.

(i) Computer-supported collaborative learning: This happens in an environment of offline computer technology where the computer helps and supports the groups to perform their learning tasks and achieve the learning outcomes. It helps the teacher to regulate the tasks, assign roles, monitor interactions, mediate the acquisition of new knowledge and store the knowledge.

(ii) Collaborative learning using the Internet: Various collaboration tools are available in the Internet for collaborative learning. The examples include Wikipedia (www.wikipedia.com) and GSuites, formerly Google Apps (www.gsuite.google.com). Wikipedia allows the creation of content and sharing. The content is flexible and evolves with the users' inputs. Google Apps enables sharing of documents etc., within a group. The Apps enable updation of the content, editing and storage of content by a group.

The various technology tools assure student engagement in ways which are difficult to achieve otherwise. For example, you can take the help of a video to explain a scientific experiment that involves corrosive chemicals, which would perhaps be dangerous for the children if they do it practically. Or, there could be a concept of music, which is difficult to explain unless you play the sound. Or there could be a situation in life where you need to inspire the students by explaining how an eminent personality had coped with stress, for which you need to play the interview of her video. You could think of various scenarios which could be used as activities for teaching them interpersonal, organizational problem solving and other soft skills. Thus, you will find innumerable ways of designing activities

for collaborative learning using the ICT tools. Can you think of designing some creative activities using ICT tools?

3.6.2 Situated Learning

Situated learning is based on the theory of situated cognition. Situated cognition claims that every human thought is adapted to the environment, that is, situated, because what people perceive, how they conceive of their activity, and what they physically do develop together (Clancey, 1997). Furthermore, what people perceive, think and do develop in the fundamentally social contexts. The unit of analysis in situated cognition is socio-cultural setting and the activities of the people are within it, rather than the individual mental functioning. Knowledge as lived practices must be understood in relation to the social aspect as well as the individual aspect. Situated Cognition has its origin in the research studies where researchers have studied common people as to how they make sense of their surroundings, how they learn, solve problems, attain complex understanding, or acquire complex skills living in a community. For example, work on situated cognition, has focused on methods of price- comparison used by grocery shoppers, the ways in which dieters calculate their portions by physical manipulation, how milkmen figure out their deliveries using the constraints of the delivery boxes, the way tailors learn how to sew through apprenticeship, and so on. The important aspect of research in situated cognition is that it starts from 'cognition' in daily life or daily practice of lay people in natural settings and has tried to come up with the theory of situated learning in everyday life.

Situated cognition approach comes from studies in informal situation rather than formal situation. By studying cognition in real life it tries to come up with a theory for education where children acquire various skills naturally in the way a child grows in a community tacitly acquiring the norms, beliefs and skills of the community.. The terms "situated cognition", 'situated learning", "situated action," or "situativity" denote an array of related perspectives, falling under the broad umbrella of "socio-cultural constructivism." Bruner's and Vygotsky 's theories propose learning to be situated in the cultural context and situated cognition can be seen as the extension of these theories.. Lave (1988); Lave and Wenger (1991) have developed a view of learning as social construction, putting knowledge back into the contexts in which it has meaning to give a new theory of learning called 'situated Learning'. The idea of situated learning explains learning to be a social practice that must be understood through the ever-present relationships between participants, activity, and environment.

Source: IGNOU: Unit-1 Learning and its Scope in Block 1 Learning; concept and Process in MES-013: Learning, Learner and Development, http://egyankosh.ac.in//handle/123456789/8283

Technology Use in Situated Learning

Technology has a lot of applications for situated leaning. As we know, a teacher apart from using various method and techniques makes use of different technologies in his/her teaching activities. The technologies to be used in the case of situated learning need to address the socio-cultural concerns of the learners. As learners belong to different socio-cultural groups and learn as per their socio-cultural practices, technologies have to be developed keeping in mind these socio-cultural concerns. For example, if a teacher intends to teach the difference between climate and weather of a particular region in India, she/he may use a video specifically developed highlighting the difference between climate and weather of

that region. Similarly, in order to teach life of santhal tribe, the technology needs to be developed around the life of santhal tribe. While developing technology for situated learning, learning experiences to be provided through technology need to be authentic and based socio-cultural practices of the learners.

3.7 GAMES

Games are an important aspect of human development. It is said that a sound mind rests in a sound body. They play a significant role not only in physical development of children in schools, but also they develop qualities like self-confidence, perseverance, judgement, foresight, judiciousness, fair play, etc. Through team games, sociability, co-operation, team spirit, spirit of self-sacrifice, and attitude of healthy competition develop. Games are mainly of two types: Indoor games and Outdoor games. Indoor games include chess, table tennis, etc. Outdoor games include cricket, football, volleyball, hockey, etc. With the advancement of computer and mobile technologies, children or even adults get access to a number of games in areas of their choice. It is being observed that now-a-days, people spend their leisure time playing different types of games. These games are not only confined to various sports, but to different areas of human activities. In the field of education computer and mobile games are very popular both among teachers and students. The educational games are available in desktop commuters, laptops as well as in mobiles or smartphones. For example, if one goes to Google Play Store and search for games of his/her interest, he/she can find several games. Solitaire is a popular computer game. One can download these games and play for his/her purpose. Educational games in different subject areas are also available on the Internet. These games are available both offline and online. Moreover, one can find the games according to a particular age group, starting from small kids to young adults.

3.8 SIMULATION

Simulation represents a powerful set of tools that can change the way instructional designers create experiences as well as the way instructors facilitate those experiences. Well designed computer-based simulations can make a valuable contribution to student learning. Well planned simulations can provide an environment for conceptualizing and allow learners to internalize major concepts. However, it is important that the physical characteristics of a simulated environment must inspire a learner's imagination.

Computer simulations can be powerful tools for analyzing, designing and interacting with complex systems or processes. Well-designed computer simulations provide a model of those elements most relevant to the immediate learning objectives. (Lunce, 2004).

Simulations structured by authentic rules that mirror actual results can facilitate learners to model, explore, and try out a variety of strategies. Simulations may include role-playing where they can collaboratively invent, experiment, and practice in a relatively low-risk environment. Experimental simulations provide learners the opportunity to engage in situations that would otherwise be too hazardous or costly to conduct in real situations.

Simulation can provide the following advantages:

i) It avoids the difficulties and complexities of real by using idealised conditions.e.g. changing demands and supplies of commodities to see its effect on the market economy.

ii) It overcomes the prohibitive costs of laboratory field-work based experiments. e.g. providing a variety of acids with different densities in a lab for one single experiment.

iii) The time normally demanded by an experiment can be foreshortened.

iv) Dangerous experiments can be experienced in safety. e.g. increasing proportion of pollutants in an experiments to see its effect.

v) Experiment which would be normally be impractical can be attempted. e.g. creation of civilisation on a different planet.

vi) The level of complexity can be increased slowly. Variables can be added at every stage.

3.9 CONNECTIONISM

Connectionism is a theory of learning which comes under the Behaviorist School of Thought on learning. We have already discussed in the beginning of the Unit the implications of Behaviourism for technology use in education. Connectionism was propounded by Edward Lee Thorndike (1874-1949). According to him, learning is the result of neural connection between stimulus (S) and response(R) through trial and error. For him, trial and error mean selecting and connecting. His notion of learning was arrived at after his famous experiment conducted on animals. He used to put an animal in a cage which was arranged in such a way that the animal made a certain kind of response to escape from the cage. Based on his theory, Thorndike formulated three important laws of learning. These are:

1. The Law of Readiness
2. The Law of Exercise
3. The Law of Effect

Olson and Hergenhahn (2010) explain the Law of Readiness as follows:

"1. When someone is ready to perform some act, to do so is satisfying.

2. When someone is ready to perform some act, not to do so is annoying.

3. When someone is ready to perform some act and is forced to do so, it is annoying."

In a teaching-learning situation, particularly while learning through technology, a learner must be ready to learn the new learning task through technology, then only his/her learning becomes effective. He/she should not be forced to learn even if he/she is ready to learn.

Olson and Hergenhahn (2010) explain the Law of Exercise as "1). Connections between a stimulus and a response are strengthened as they are used. In other words, merely exercising the connection between a stimulating situation and a response strengthens the connection between the two. This is the part of the law of exercise called the law of use. 2) Connections between situations and responses are weakened when practice is discontinued or if the neural bond is not used. This the portion of the law of exercise called the law of disuse." The implications of this law for learning through technology means that the learner practices or repeats a given learning task, learning becomes permanent. If he/she does not practice it, learning becomes weakened. For example, drill and practice in Computer assisted learning (CAL) is based on the Law of Exercise.

Olson and Hergenhahn (2010) explain the Law of Effect as "the strengthening or weakening of a connection between a stimulus and a response as a result of the consequences of the response. If a response is followed by a satisfying state of affairs, the strength of the connection is increased. If a response is followed by an annoying state of affairs, the strength of the connection is decreased." This law of Thorndike implies that when a learner is engaged in some kind of learning and receives feedback on his/her performance, his/her learning gets strengthened. In most computer based self-learning packages, a learner is provided in text questions which he/she has to answer. If his/her response is correct, he/she is provided positive feedback and negative feedback if his/her response is wrong.

3.10 GENERATIONS OF COMPUTER TECHNOLOGY AND THEIR USE IN PEDAGOGY

With the continuous research in science and technology, we find new technologies being developed from time to time in almost all areas of human activities. Although we observe various technological developments in industry, agriculture, health, defence, education, the most notable technological development has been in the area of computer technology. Computer technology has almost impacted the activities of human beings in all areas. It is, therefore relevant to be familiar with the history of computer technology. We find five generations through which computer technology has evolved. Let us briefly know about this evolution.

First Generation: Vacuum Tubes (1940-1956)

The first generation computers were giant calculators, occupying the entire rooms. These computers used vacuum tubes for circuitry and magnetic drums as primary internal storage. These computers used to consume a lot of electricity and generated a lot of heat. It relied on machine language. Punched cards are used for inputs and printouts were used as outputs. The examples of such computers are Electronic Numerical Integrator And Calculator (ENIAC) and Universal Automatic Computer(UNIVAC).

Second Generation: Transistors (1956-1963)

Transistors were used in the second generation computers to replace vacuum tubes. The use of transistors made the computer smaller, faster, cheaper and more energy-efficient. These computers used magnetic core instead of magnetic drums in their memory and still depended on punched cards for inputs and printouts for outputs. They used Assembly Language. Examples of such computers are IBM 7094 series, IBM 1400 series.

Third Generation: Integrated Circuits (1964-1971)

The third generation of computers used integrated circuits. Transistors were miniaturised and placed on silicon chips, called semiconductors, which drastically increased the speed and efficiency of computers. The users used keyboard, and monitors. High-level programming language such as FORTRAN and COBOL were used in these computers. Computers were accessible to mass audience because they were smaller and cheaper compared to earlier computers. The examples of such computers are IBM 360 series and IBM 370 series.

Fourth Generation: Microprocessors (1971-present)

The fourth generation of computers uses microprocessors having thousands of circuits built into a single silicon chip. These computers uses semi-conductor

memories (RAM, ROM). As these computers are small and powerful, they were connected to for a network, which later on led to the development of Internet. In 1981, IBM introduced its first computer for the home user, and in 1984, Apple introduced Macintosh.

Fifth Generation: Artificial Intelligence (Present and Beyond)

The fifth generation computers are based on artificial intelligence and still in the development process. The use of superconductors is helping to make artificial intelligence a reality. One of the applications of artificial intelligence in computer is recognition of voice. It will understand natural language input such as spoken words and hand signals.

(Source:http://www.webopedia.com/DidYouknow/Hardware_Software/FiveGenerations.asp and https://gkbabaji.com)

Role of Computer Technology in Pedagogy

Although the computer technology has passed through five generations of development, its impact on education and pedagogic processes could be observed mainly from third generation of computer technology when the computers were available for mass audience and different uses. A computer has several applications in instructional situations. It is used to find the entry level of students' knowledge on enrolment. It is used to plan and execute individualised instruction, monitor student's progress and compile tests and scores. But the most important contribution of computer in the domain of pedagogy is Computer Managed Learning (CAL) and Computer Assisted Learning (CML).

Computed managed Learning (CML)

CML implies the role of computer in education as management-aids. CML systems are usually conceptualised and implemented as aids to the teachers in their task of controlling and managing the content, pace, sequences and method of learning by the students. As with many computer applications, the data recorded in CML for one purpose can also be used for other purposes. Records of students' performance can be used as a base for career and further counselling; and can be summarised into reports from one school to governmental bodies on subjects studied, pass rates, etc.

Computer Assisted Learning (CAL)

CAL implies the situation in which the learner generally is engaged in two-way interaction with the computer via a terminal. The computer delivers instructions directly to students and allows them to interact with it through the lessons programmed in the system. The computer provides feedback to the learner on the basis of his/her performance. On the whole, the computer acts as a teacher. In order to carry out teaching-learning functions, the computer utilises various learning modes. Let us discuss these modes in brief.

i) **Drill and practice:** In this mode, a computer presents the learner with a series of exercises which he or she must do by giving a response. It provided the learner some feedback about the answer in the form of a congratulatory message, if it is right, or a corrective comment, if it is wrong. Thus, computer-assisted learning provides endless drill and practice with repetition at a pace that can be controlled by the learner. The computer proceeds when mastery is achieved by the learner.

ii) **Tutorial mode:** In tutorial mode, topic is presented in small units called frames followed by a question. The students response is analysed by the computer and appropriate feedback is given.

iii) **Simulation mode:** Learning experiences regarding real life situations are provided to the learner through this mode. We have already discussed about it under 3.8.

iv) **Discovery mode:** This mode uses inductive approach to learning wherein the problems are presented and the learner solves them through trial and error.

v) **Gaming mode:** Teaching through this mode is done by presenting several educational games. Video games as well computer games are very popular among children. If they are provided educational games, certainly they will learn new concepts and skills. We have discussed on games under 3.7.

vi) **Narrative/Presentational Mode:** Here the computer screen is used to present material to the student in a form sometimes referred to as an electronic blackboard . Along with normal verbal approach, movement and animation can be used with colours and music. Simple presentations can easily be developed by teachers to introduce learners to a new information. E.g. a teacher can develop slide shows using MS PowerPoint or even develop web pages using Front-page.

Source ; IGNOU(2000)

Internet and Pedagogy

The Internet acts as an electronic mail system and library access facility. It is a mail system because it allows us to send and receive messages. It is a library access system because it allows our request for information., provided we know what we are looking for. It is a wonderful means allowing access to information, amorphous mass stored in databases. With advent of Internet, there emerges a belief that there is another structure to support teaching and learning. By sharing information it facilitates an educational process.

Internet is growing at a very fast pace all over the world. India is no exception in this regard. Internet is a set of various intranets created by the various agencies. In other words, it is a network of networks, a huge source of inter-connected information. Internet makes information on any topic available to its users linked with networked computers. The user can interact with master computer to navigate for required information. Internet is being used for both the delivery of distance education and assisting regular/conventional classroom courses. Internet also transforms two-way communication, reducing barriers of time and space. The scale of its coverage, its immediacy, the quality of presentation and the ability to interact with it and through it bring new dimensions to the world of knowledge, thus creating new communities of learning.

Internet brought a change in the teaching-learning process. The students control the content and the process of their learning. The new paradigm places learning with the students. The earlier paradigm was that teacher must use technology to teach students. The paradigm involves students using technology to learn. The students go beyond the experiences of teachers, beyond books in the library. They may find conference papers as yet unpublished, press releases and news items from any part of the world (Jenkins, 1998). The latest information/content in the area of their interest can be downloaded and used as and when required. Thus use of Internet places the focus on the student. This in turn focuses on aspects such as student's prior knowledge and experience, readiness and motivation to learn.

Through e-mail the students can have easy access to information resources which contribute to updating and greater learning. It has the capacity to present to the student many kinds of information sources. Moreover, e-mail can remove time and space barriers of the conventional classroom teaching, Sitting at home the teacher can respond to students' problems concerning assignments, projects or readings. It also provides one-to-one communication between the student and the teacher. Thus, it can offer more individualised attention to the students with specific learning needs. (IGNOU, 2009). Due to web.2 technologies, both teachers and students can interact among themselves through several social networking tools like WhatsApp, Facebook, twitter, discussion forums, blogs, etc.

Check Your Progress 3

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

b) Compare your answers with those given at the end of this unit.

7) What are the steps of collaborative learning?

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8) Give three advantages of simulation in education.

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9) Name any three modes of Computer Assisted Learning.

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3.11 LET US SUM UP

In this Unit, we focussed on the implications of different theories of learning on technology mediated teaching-learning activities. We explained that the learning experiences provided by a teacher through different types of technology constitute technology mediated learning experiences. We explained how behaviourist, cognitivist and constructivist theories of learning have several implications for technology mediated teaching-learning. According to behaviourists learning is a mechanical process of responding to a stimulus that leads to change in the overt behaviour of the learner. Behaviourist pedagogies, therefore, seek behavioural changes like the ability to explain, narrate, differentiate, develop, create, analyze, and so on, that can be assessed. For introducing these changes, information transmission is the commonly used pedagogy. Hence, if the approach to teaching and learning remains behaviouristic, even when ICT is used, it is used for supporting a lecture based pedagogy. For instance, the power point slides made

using a computer are usually only the carriers of text, illustrations and so on and at best serve as an alternate channel of communication that can very well be substituted by a chart paper. Such pedagogies do not utilize the potential of ICT for supporting active, collaborative and reflective learning. However, can we altogether abandon behaviouristic approaches? The use of signs and symbols is common even for advanced machinery and we learn to respond to these stimuli. Hence, an online course or a multimedia CD we develop may use symbols for pause, start, going back, forward, next, audio, notice board, assessment results and so on. Similarly, we may develop computer assisted instructions for drill for supporting learning that may not require meaning making but only rote like, names of state capitals, names of geographical features, colours, designs of national flags, national animals, and other such things.

Cognitivists consider learning to be an insightful activity that involves thought process and meaning making. ICT use for presenting advance organisers, linkages to concepts learnt earlier and other relevant concepts, content map and other scaffolding devices is in accordance with this approach. Constructivism too holds that knowledge is not meant for being transmitted but has to be constructed by learners within a social setting. This explains the use of web 2.0 technologies like wikis, blogs, podcasts that include the space and mechanism for discussions with peers and experts and even collaborative creation of artefacts; virtual worlds; simulated learning situations, and the like. Therefore, evolving ICT has the potential to support pedagogies based on constructivist approaches, and as schools are supposed to reform educational practices by introducing pedagogies based on constructivist learning theories, ICT use for teaching and learning at schools needs to be directed to this end (UNESCO, 2002). Therefore, ICT needs to be used for imparting pedagogically sound instructions that enhance learners' activities like communication with content, peers and teachers; collaboration with peers; participation in activities for learning by doing in real and simulated environments; analysis of data; synthesis for drawing inferences, making decisions and the like. We discussed how technology can be used to facilitate collaborative and situated learning. In the end, we touched upon the generations of computer technology and the role of computer technology in pedagogy.

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3.13 ANSWERS TO CHECK YOUR PROGRESS

1. Yes, we need to design instructional content taking into consideration the 'readiness; of our learners; provide pleasing learning experiences, include scope for practice, use symbols intelligently for communicating meanings.

2. It should include logically sequenced, small meaningful segments (frames) that are followed by scope for assessment of learning and feedback thereon.

3. Links to earlier learning, means for drawing attention like underlining, bullets etc,. scaffoldings like a concept map, advance organizers, illustrations, examples and so on, relevant questions, cases, etc. For example, a scaffolding technique has been used in the design of an interactive simulation framework for developing a participatory simulation game for collaborative in-context learning, and the scaffolding provided initially is gradually phasing out like the scaffolds of children's bicycles (Yin, Ogata & Yano, 2009).).

4. It can be useful for reminding the teacher to cover the points she wants to teach, project illustrations, highlight the main points. Therefore, it serves more as a tool that supports teaching than learning, and has limited role in encouraging learners' activity, thought process and knowledge construction.

5. ICT is used for learning rather than teaching and engaging learners in tasks like carrying out collaborative activities involving search for information, organising content, making meaning through discussions and negotiations, creating learning resources, playing educational games, engaging in simulation.

6. Web 2.0 technologies like wikis and social media allow learners to interact, negotiate meaning and develop content collaboratively.

7. i) Selecting the topics, ii) Forming groups, iii) Introducing the activity, iv) Teaching students how to work in groups, v) Providing guidance, and vi) Evaluation

8. i) It avoids the difficulties and complexities of real by using idealised conditions.e.g. changing demands and supplies of commodities to see its effect on the market economy.

   ii) It overcomes the prohibitive costs of laboratory field-work based experiments. e.g. providing a variety of acids with different densities in a lab for one single experiment.

   iii) The time normally demanded by an experiment can be foreshortened.

9. Drill and practice, Simulation and Gaming