

Educational Technology: Historical Developments

UNIT

2

▪ Santosh Panda

- Emergence, borrowing and convergence
- Media and technology developments
- The 1990s
- Educational technology in India
- Future scenario and directions

Introduction

By now, you may have developed a fair understanding of the field of educational technology – its concept and diversified applications. As you have already noticed, educational technology as a field encompasses design-development-application-evaluation of education and training systems and processes at all levels of education and training, and in formal (classroom), non-formal, adult, continuing, and lifelong education. Simultaneously, it has encompassed a wide variety of media and technology developments – starting from the traditional audio-visual aids to the current semantic web and web 3.0, including open source software and social networking tools. Based on the discussion on its concept and scope, we extend the discussion further in this Unit to trace its historical developments in forms of its emergence, borrowings from other fields, and convergence with other disciplines and systems. While doing so, we relate this to the developments in the field of media and technology (and note that while these developments have blurred the concept, they have extended the scope of educational technology); draw a parallel with the development of the field in India; and based on all these, reflect on the future of educational technology in its applications in teaching and learning and training, and its professional development. We shall draw in the contents of Units 1 and 2 to explain its applications in teaching, learning and evaluation and training in Unit 3.



Learning outcomes

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

- trace the historical developments in the field of educational technology;
- relate them to individualized learning, group learning, and training vis-à-vis tremendous technological developments;
- relate those developments to the Indian context; and
- reflect on the future directions that this field is moving to.

Emergence, borrowing and convergence

During the various stages of the development of educational technology, there are phases of its emergence, its borrowings from other fields, and its contribution to or convergence with other fields of study. Before we take up these three aspects, it is important to note that in the early sixties, ET emerged as an occupational category with specialized jobs or field of work; and that is the phase when ET was formally recognized by many. As you would have seen in Unit 1, the emergence of educational technology can be traced to ‘audio-visual aids’ and ‘programmed learning’. Therefore, it is not surprising that many educational technologists owe their origin to these two fields. The audio-visual movement facilitated student learning within classrooms by enhancing motivation, attention and other stimuli, and also outside classrooms through mass media such as, television. On the other hand, the programmed learning movement facilitated ‘individualized learning’ which has so far been the major domain of distance education and other computer-mediated learning (Panda, 1990). In the following discussion, let’s focus on the four developments within ET: i) audiovisual aids, ii) instructional technology, iii) individualized learning, and iv) the systems approach. Following this discussion, we shall expand these four aspects and include many other developments with in a historical perspective.

i) Audiovisual aids

The beginning of the development of educational technology was the use of various audiovisual (AV) aids to enhance the quantity and quality of communication so as to facilitate teacher presentation and student learning. This was intended to increase the accuracy and variety in the presentation of information. The audiovisual approach emerged in 1928 which later on led to the use of optical and electronic equipments. This approach combined both hardware and software:

- Hardware: Equipments such as tape recorder, overhead projector (OHP), microcomputer.
- Software: Learning materials, audio programmes, overhead transparencies, computer programmes.

Though many educators do not consider this aspect to be included at all within educational technology, many educational technologists argue that the beginning of this field is the audiovisual aids. The merit of AV aids was that it exemplified both the verbal communication and abstract learning experiences so that learning experience became more concrete. The demerit was that teachers used to lay more stress on the audiovisual materials than their usefulness in teaching-learning. The AV approach may be referred to as ‘technology in education’ (as you have seen in Unit-1 of this block). During the 1950s, there were developments of communication theories which were applied to the AV approach to teaching-learning. While earlier the emphasis was on the product, this new development focused on the process of communication. This resulted in effective communication through educational television, and later through computer programming. Therefore, both radio (and audio) and television (and video) had to have principles of design for learning (or instruction) which differed from the way verbal classroom communication (or teaching) took place. Subsequent to this, both audiovisual aids and communication processes, combined with the developments in learning theories, led to the development of the area of instructional technology and instructional design as discussed here.

ii) Instructional technology

There were gradual developments in various learning theories, starting with ‘behaviourism’ which applied laboratory experiments to human learning (and teaching-learning). ‘Technology of education’ (as you have seen in Unit 1) was the result of the combined contribution of instructional scientific research, learning theories, and educational research. Instead of stressing the use of audiovisual aids, this approach (called ‘instructional technology’) emphasized the intangible aspects of learning (i.e. the underware aspects) and the techniques of teaching-learning. The technology of education included hardware, software, courseware, and instructional strategy. Self-instructional strategies such as programmed learning were developed; and teaching or instruction was designed based on definite principles of learning theories.

Following the application of physical sciences and engineering technology ‘instructional devices’ were developed; and the application of learning theories led to developments in ‘technology of learning’. Considerable research took place in the area of the science of human learning, and their application to the design of teaching-learning strategies (and various media to facilitate them) – this precisely led to the development of the field of ‘instructional technology’. Later on, cognitive and constructivist psychologists contributed to this. Cognitivism contributed to the design for remembering, problem solving, thinking, reasoning; and major contributions came from Piaget, Glaser (1976), Reigeluth (1979), Merrill (1983). Their research led to serious design for instruction, instructional strategies, and development of instructional systems/instructional systems design. The later developments in constructivism (Jonassen, 1991) led to the design on the individual construction of knowledge and group negotiation of meaning. The developments in Web 2.0 and social technologies (as we shall see later in this Unit) have significantly contributed to the constructivist view of learning and enrichment of the quality of individualized learning.

A simple form or process of instructional design is presented in Figure 2.1 in which you will find that the design of instruction or teaching-learning proceeds with the setting of learning objectives, development of instructional materials and procedures (i.e. actual teaching-learning), and assessment and evaluation at the end (on which feedback is provided to further revise learning objectives) based on the learner’s style and pace of learning and the teaching-learning processes, and also an in built mechanism for revisiting also on revise the teaching-learning process itself.

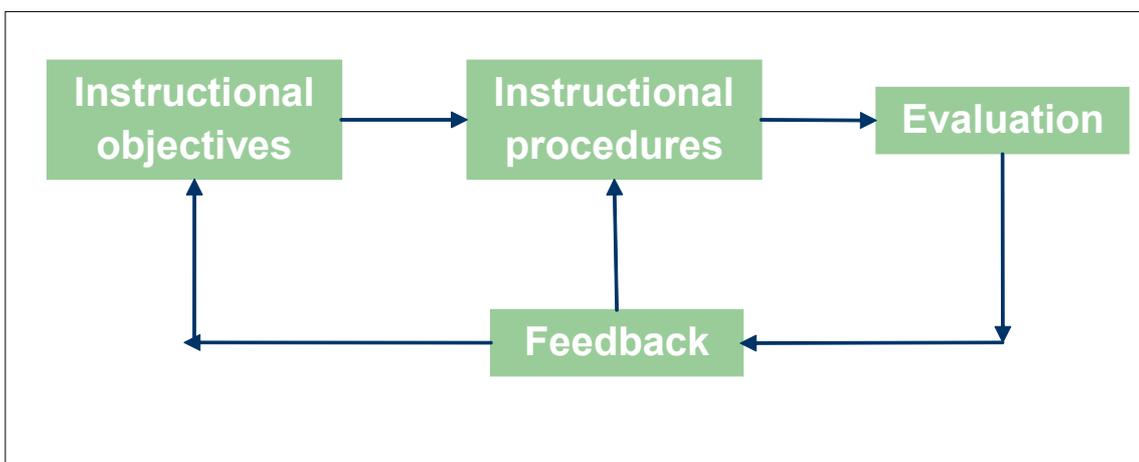


Figure 2.1: Instructional Systems Design

In a scholarly work on describing the historical development of instructional technology, Shrock (1991) has recorded the following chronological developments which will give you a general idea as to how this field has evolved (especially from the American perspective):

- Pre-1920s: The earlier works of psychologists like E.L. Thorndike provided the base to how human beings learn and how teaching-learning should be organized, and how assessment and evaluation (through measurement) should take place.
- 1920s: This was the decade of the development of learning objectives, i.e. design of instruction or teaching-learning based on pre-stipulated learning outcomes. The Dalton plan was developed, and instructional development was associated with individualized instruction and mastery learning, and development of self-learning materials.
- 1930s: Grounded on the work of R. W. Tyler, there were further refinements in writing of instructional objectives based on students' behaviour (which were later termed as behavioural objectives); the development of alternative curricula and alternative learning resources; and the emergence of the concept of formative evaluation.
- 1940s: In this decade following World War II, there was significant development in instructional media and technology – especially films and other such instructional materials. Though the focus/emphasis was more on instructional media (rather than instructional technology), there was the emergence of the concept of mediated instruction and also the breed of instructional technologists who were to facilitate the subject-matter experts. This may be related, for instance, to the need for the trio (subject-matter expert, instructional designer/ technologist, and the producer) in the production of educational video/television programmes at BBC-Open University Production Centre in UK and/or the Countrywide Classroom of the University Grants Commission (UGC) in India.
- 1950s: This was the decade of programmed instruction based on the work of B.F. Skinner relating to operant conditioning. The following steps were clearly devised and categorically followed in programmed learning: learning objectives, content presented in smaller chunks, self-pacing and individualized progress in learning, self-assessment questions with active learner response and immediate feedback, and further improvement in the process. The programmed learning movement contributed to: well designed learning materials, self-pacing in learning, and mastery learning; and later to task analysis and content analysis. This was the period when Benjamin Bloom developed the taxonomy of educational objectives which is being used even today in the context of online learning as well.
- 1960s: This was the decade of instructional systems development, especially Robert Glaser's instructional system, and Robert Gagne's conditions of learning. There were further developments in norm-referenced and criterion-referenced testing. Instructional developers gained further legitimacy, though their defined profession was contested by media specialists who claimed to be educational technologists too.
- 1970s: This decade was the decade of the recognition of 'instructional design and development' as a profession. Cognitive psychologists contributed immensely to instruction design and development to this.
- 1980s: the 80s saw the advent of microcomputers and rigorous process of instructional systems development. Due to the emphasis lay on training (especially corporate training),

there was greater focus on performance technology which took into consideration both instructional and non-instructional aspects to achieve the desired level of performance.

iii) Individualized learning

The area of individualized learning developed from programmed learning onwards, especially, following the works of B.F. Skinner (1954). This further led to the development of individualized learning packages, systems of individualized instruction, and system-based instructional models. Subsequent to these, further research led to developments in mastery learning, Keller's personalized system of instruction, modular instruction, individually guided instruction, Knowles' (1975) learning contracts, audio-tutorial systems, among others. With the developments and refinements in computers (especially, personal computers), computer-assisted learning (CAL) has assumed a significant place in teaching-learning today. The advent of the web, social software (like Wiki) and social networking (like Facebook) has contributed significantly to computer-mediated communication (CMC) in the virtual world.

ACTIVITY 2.1



At this stage, take a pause, and reflect on the relationship between audiovisual aids and instructional development on the one hand, and individualized instruction/learning on the other. That is, in what way the former have contributed to the quality of the latter (i.e. self learning). You may write about 150 words in the space given below.

iv) Systems approach

The developments in the management sciences contributed to further developments in educational technology in the mid sixties that resulted in educational systems design and analysis (or, systems approach to education and training). The systems approach combined audiovisual education, communications theory, learning theories, developments in media and technology, learning styles, and teaching-learning contexts. The approach follows an input-process-output model, and various sub-elements within these. The work of Romiszowski (1974) contributed significantly to this, and further design and applications of instructional media and instructional systems. For example, the design of instruction for teaching any topic or concept in any subject area includes: target population, needs assessment, entry behaviour, learning objectives, course content and instructional

strategies, learning experience, assessment evaluation, and feedback – all these form part of a continuum and move in a cycle towards continuous improvement and change from time to time so that the teacher’s teaching becomes more effective and student’s learning becomes more enriching and qualitative. This involves application of systems models which clearly and precisely record various stages (and activities included in these stages) of analysis, design, development, implementation, and evaluation of instruction. Various scholars have contributed to the components of instructional design and development: Rossett for needs assessment, goal analysis by Mager, task analysis by Merrill, instructional systems design by Romiszowski, media production and utilization by Heinich, instructional delivery by Clark, and formative and summative evaluation by Bloom. The present day reforms in curriculum development and instructional design are contributions from the earlier developments in the systems approach to education and training. The developmental continuum of the above aspects of educational technology, known as the Elton Model (given by Lewis Elton in 1977), has been described by Ellington et al (2005) which is diagrammatically presented in Figure 2.2 and subsequently described.

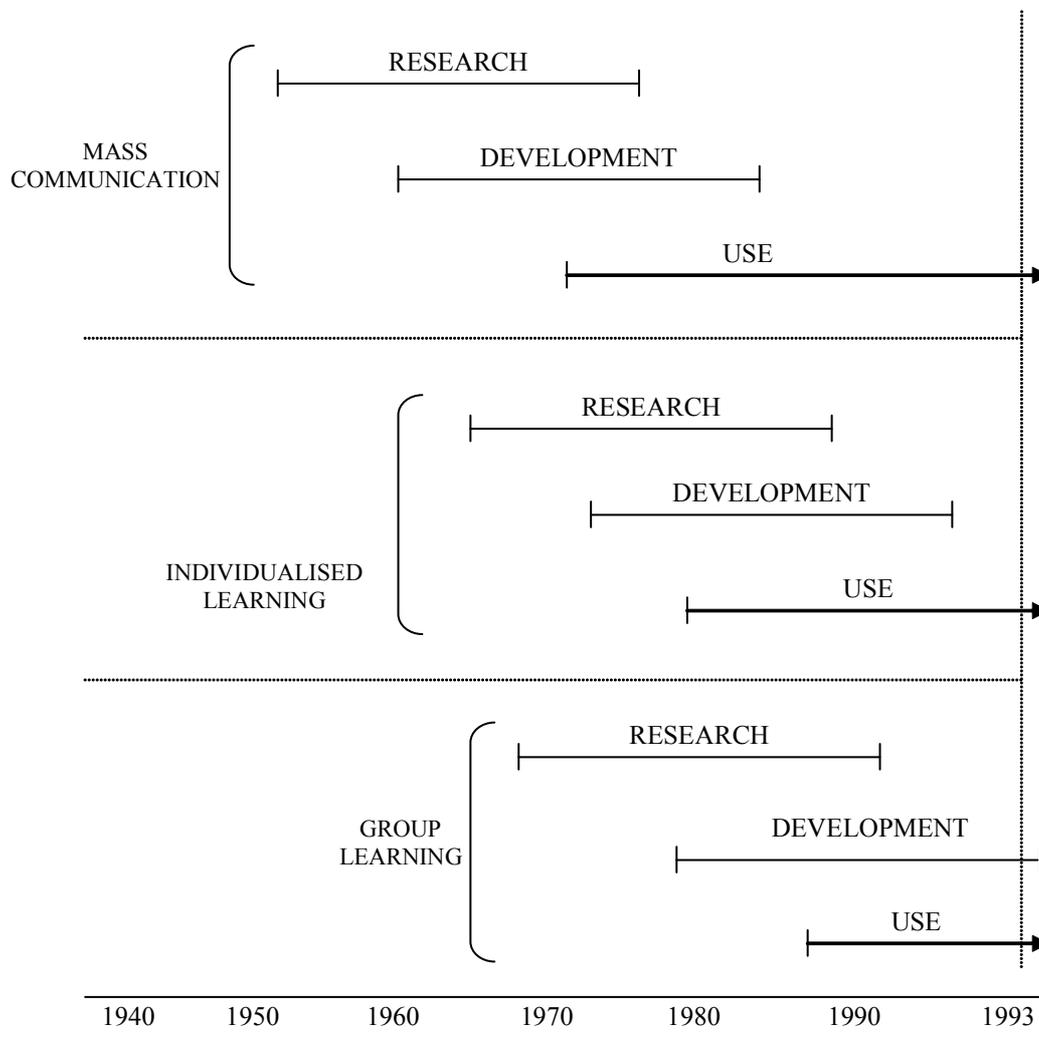


Figure 2.2: Elton Model – Main Concerns of Educational Technology (Historical Development)

(Source: Ellington et al, 2005)

As given in Figure 2.2, Elton believed that the development of educational technology can be organized under three broad areas – mass instruction/communication, individualized instruction/learning, and group learning. Each of these areas has gone through three stages of research, development, and use. And, this continuum or the cycle continues forever – i.e. in each area R&D (research and development) is still being conducted which is leading to its improved application in education and training, and teaching and learning.

Mass instruction is as old as lecture itself, though this was limited to groups of students. Developments in audiovisual aids (and related hardware and software) during the post-World War II period led to emergence of television (and also radio which was much before this) as mass communication and mass instruction technique. The major objective was to reach as many as possible and also to achieve economy of scale (i.e. less cost per unit or per person). However, communication based on this technology was one-way, without any possibility of interaction between the sender and the receivers. Later, the allied development of audio and video technology and associated programmes facilitated interaction in groups since the control of stop-and-start facility rested with the teacher. Another development of mass instruction was close circuit television (CCTV) which facilitated: i) teaching by one teacher and distributed to other classrooms, and ii) teaching by more than one teacher from different locations to address only one group of students in one classroom. Another example is cable television network for teaching-learning. The limitation in this technology was that students remained passive, and also that higher order educational objectives could not be addressed by this. In spite of these limitations, mass instruction has expanded further in forms of ‘*open and distance learning*’ and ‘*virtual education*’. In case of the former (which is basically offline), there is increasing use of industrialized system of education in which there is mass production of learning resources and mass distribution with continuous learner support at study centres. This facilitated greater access and equity in education (though it has been argued that ODL has been more oriented to behaviourism and/or instructional industrialism). On the other hand, virtual education (which is online and is carried out in the World Wide Web) facilitates large scale/mass education and training, and at the same time provides for greater interaction among the learning resources, the teacher and the students. If designed properly, there is every possibility of addressing constructivist learning in online contexts. During the past few years, this has led to a new strategy of ‘*blended learning*’ in which online, face-to-face, and individual self-learning are blended to achieve the highest quality of student learning experiences.

Individualized learning got a boost only after B.F. Skinner’s contribution to programmed learning through behaviourism, even if independent study through correspondence education existed earlier to this. Unlike mass instruction which stressed on access and equity, the focus of individualized instruction was to facilitate self-learning. The behaviourist psychology put forward the theory of stimulus-response and feedback in the process of learning, and the conditions that are very favourable to learning to take place. These conditions were extended by Robert Gagne in his famous steps of learning. Learning takes place through a chain of stimulus-response situations. Reinforcement in the form of feedback is provided for learning to happen and to be retained (if it is positive reinforcement) or to be discarded (if it is negative reinforcement). The small steps of stimulus-response and concomitant reinforcement resulted in shaping of human behaviour which was to overtly expressed and assessed to make sure learning has taken place.

Skinner introduced *linear programming* in which the content is provided in small chunks (i.e. stimulus), there is interaction with content (i.e. response), and there is always immediate feedback in form of right or wrong answer to self-assessment questions. This slow process as also the recognition of individual differences in learning led to the development of *branching programmed learning* in the 1960s. Instead of proceeding in a linear process of interacting with content, this was provided through various alternative pathways of contents for students to proceed as per their learning style and pace of learning. There was remedial loop which facilitated correction of learning misconceptions. This branching programmed learning with multiple or alternative pathways of learning facilitated computer-based learning in the 1970s. Later developments in self-learning provided more flexible pathways to study, the use of various access devices, more engaging activities, and constant interaction with the learning materials, teacher, and fellow students.

With more stress gradually given to the development of self-learning resources in print, audio and video, a variety of models was developed to facilitate individualized learning at a distance, and online. The most famous and used theory of learning at a distance was developed by Michael Moore in 1972 in the name of independent study which is presented in Figure 2.3 below.

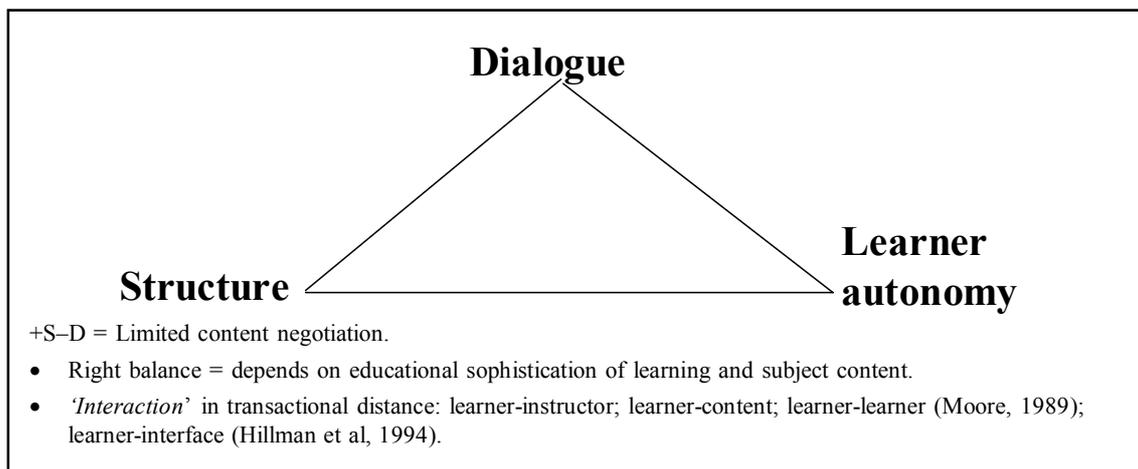


Figure 2.3: *Transactional distance*
(Michael Moore: 1977, 1989, 1990)

The theory clearly states that in independent study through distance learning, the learning resources and instructional strategies should be less structured to allow for accommodation of diversified learning styles and pace of learning; that there should be constant dialogue with the materials and human beings (teachers and peers) involved in distance teaching-learning; and given the above two, these will ensure more learner autonomy or independent study. You will see more on this aspect in Unit 3 when we discuss the contribution of educational technology to learning. Right now, if you extend this concept of independent study at a distance to the context of computer-mediated communication (CMC) and online learning, you will realize that the virtual platform on the web provides for more interactive content, more audio/video/ multimedia content, more interaction with the teacher/peers/other learning resources on the web. The semantic web along with the later developments in open source software and technologies led to the design and application of personalized learning space online (as you will see in Figure 2.7).

Following the emergence of the phase of mass education, individualized learning continued (and

even continues) to dominate teaching-learning and training strategies. The developments in interactive multimedia (CD-ROM) boosted independent learning within the classroom (teacher-guided) and at home (self-learning). In the case of out-of-campus distance learning, independent study or self-learning assumes considerable significance. The same is the case with online learning though there is ample opportunity for interaction. In the case of the latest developments in blended learning through a mix of technologies and delivery modes, there is a flexible mix of independent learning and interactive learning. However, there was a perceived need for interaction to develop skills of interaction and leadership as also balanced attitude. Both humanistic psychology (of Carl Rogers – interaction and learning from each other) and constructivism (i.e. negotiation of meaning in groups and in-context) significantly contributed to *group learning* and shaping of group dynamics in both the face-to-face and the virtual learning contexts. Group learning techniques such as buzz sessions, seminars, tutorials, simulation and role plays, group projects, self-help groups lays were emphasis on the approach or the technique rather than technology per se. Even in the context of online learning, the technological configuration and design facilitate the techniques of interaction and negotiation.

ACTIVITY 2.2



Based on what you have reflected in Activity 2.1, in this activity you need to extend the relationship between AV aids and instructional design with individualized instruction to the context of non-classroom based instruction and learning, especially in the context of offline distance learning and computer-mediated communication online (i.e. online learning). You may write down your response within 100 words in the space given below.

The developments of various media and technology have also contributed significantly contributed to the evolution and application of educational technology.

Media and technology developments

Starting with the developments in audiovisual aids, the evolution of media and technology has taken place through various stages, especially in reaching the stages of computer-mediated communication and virtual learning through the semantic web. Let's first distinguish between media and technology.

- *Media*: Technologies carry the media (like text, audio, video, graphics, animation) – the latter are devices to create and communicate content. For instance, while audio cassette is a technology, audio programme falls under the category of media.

- *Technology*: It refers to tools and systems in a systematic process towards knowledge creation, dissemination and application. In the case of education and training, technology shall refer to tools and systems that also address software, rules and procedures and other systems like LMS. Therefore, audio, video, computer, telecommunications, communication networks are all technologies which carry the message through one or a combination of media.

Tony Bates has authentically reported developments in technologies used for teaching and learning (as given in Table 2.1 for 1500 BC to 1990 AD; and in Table 2.2 for 1990 AD to 2011 AD). (For a detailed discussion, see his website at <http://www.tonybates.com>). As you will see, he has noted teachers as the earliest form of technology through lecturing, which may be termed as face-to-face media. Starting from print technology, there have been developments in radio and television, computer, conferencing, and smart board till 1990. Following the 1990s, the developments led to internet, mobile phones, social software, and cloud computing.

Table 2.1: Technologies for teaching (1500 BC – 1990 AD)

Development	Year in general use
Teachers	1500 BC (at least)
Printed book	1450
Postal service	1850
Blackboards (Chalk)	1850
Telephone	1890
Radio	1920
Film	1920
Broadcast television	1950
Cable TV	1950
Audio-cassettes	1965
Computer-based instruction	1970
Satellite TV	1975
Laser video discs	1975
Audio-conferencing	1975
Personal computers	1980
Audio-graphics	1980
Viewdata/Teletext	1980
Computer conferencing (CMC)	1980
Compact discs (CDs)	1985
E-mail	1985
Video-conferencing	1990
Projectors	1990
Smart Board	1990

As noted earlier, activities on the Net (the Web) increased and diversified following the creation of the semantic web by Sir Bernard Lee and colleague. As noted in Table 2.2, the general use of the internet along can be stated to have started in 1990, the World Wide Web (WWW) with simulation and games. Development of web browsers, wireless networks and mobile technology was put to use in the mid-nineties; followed by e-portfolio (electronic portfolio development and use) and YouTube (for live storage and play of recorded videos) in mid-2000s. The actual use of electronic books (including kindle), 3G technology, and cloud computing (and cloud learning) is a more recent phenomenon.

Table 2.2: Technologies for teaching (1990 onwards)

Development	Year in general use
Internet	1990
World Wide Web	1990
Simulations and games	1990
Learning management systems	1995
Browsers/web portals	1995
Wireless networks	1995
Mobile phones	1995
Learning objects/OERs	1995
Fibre optic cables	2000
DVDs	2000
Search engines	2000
Social software	2002
Virtual reality	2003
e-Portfolios	2005
Clickers	2005
You Tube	2005
Lecture capture	2008
e-books	2009
Cloud computing	2010
Learning analytics	2011

As you can see from Table 2.2, the last decade saw technological developments reach the pinnacle with significant progress in areas of social technologies, social software, and social networking. Such developments like YouTube, Flickr, Facebook and Twitter transformed the way people generally communicate, collaborate, network, and socialize/professionalize. The emergence of cloud computing, data centres, and cloud learning transformed the traditional bounded learning either within the classroom, or through a network of study centres, or even through the traditional computer-mediated communication.

Web 1.0	Web 2.0
Publishing (Britannica Online)	Participation (Wikipedia)
Personal websites	Blogging
Content management	Wikis
Directories (taxonomy)	Tagging (folksonomy)
Stickiness	Syndication (RSS)
Downloading	Uploading
Consumer	Prosumer (consumer + producer)

Figure 2.4: Comparative Developments in Web

Figure 2.4 depicts the principal changes that have taken place over Web 1.0 when Web 2.0 emerged on the semantic web. Web 1.0 facilitated online publishing, the creation of personal websites, managing online, downloading multi-media resources, in a way that enabled us to interact as a consumer on the Web. Web 2.0 was much ahead of its earlier *avatar* in that it facilitated collaborative content/knowledge creation, creation of own blogs (for reflective discourse) in place of websites, wikis for collaborative creation of anything (in place of managing content), and the user became both consumer and producer (i.e. prosumer) in place of the earlier role as simply consumer. Just like that ‘citation’ today is more important than refereed journal publishing, similarly saying something authentic and reflective through Blogs is more important than just displaying on the website.

Social Networking	Technologies
Distributed, participatory, collaborative, open, student-centred, constructivist, social learning	Blogs, moblogs, wikis, podcasts, vodcasts, RSS feeds, search engines, mobile learning, intelligent publishing, etc.
Social software, open software, open education resource, social networking	Communication over Internet Protocol (CIP) <u>Text + Voice + Video</u> Internet Cellphone PDA's Computers

Figure 2.5: Social Networking and Social Technologies

The discussion above with reference to Figure 2.4 may be further extended with reference to Figure 2.5 which specifies various technologies, the social networking, and the reality that the internet can connect to the mobile phone, the PDAs, and the personal computers. Most of the social software which support community practice are generally open source (i.e. at least, free of cost), and social software support social networking and the current movement towards open

education resource (OER) – resources which are collaboratively created and used by all under the Creative Commons License (the legal mechanism to support the copyright/intellectual property rights).

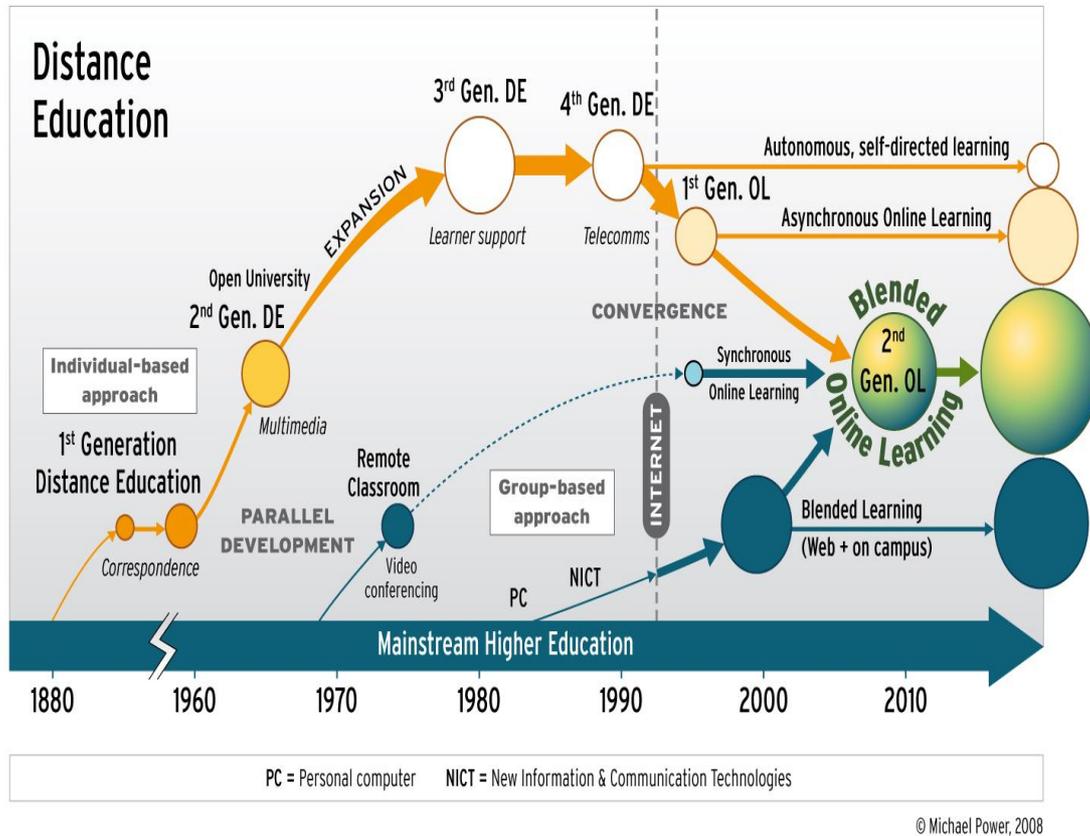
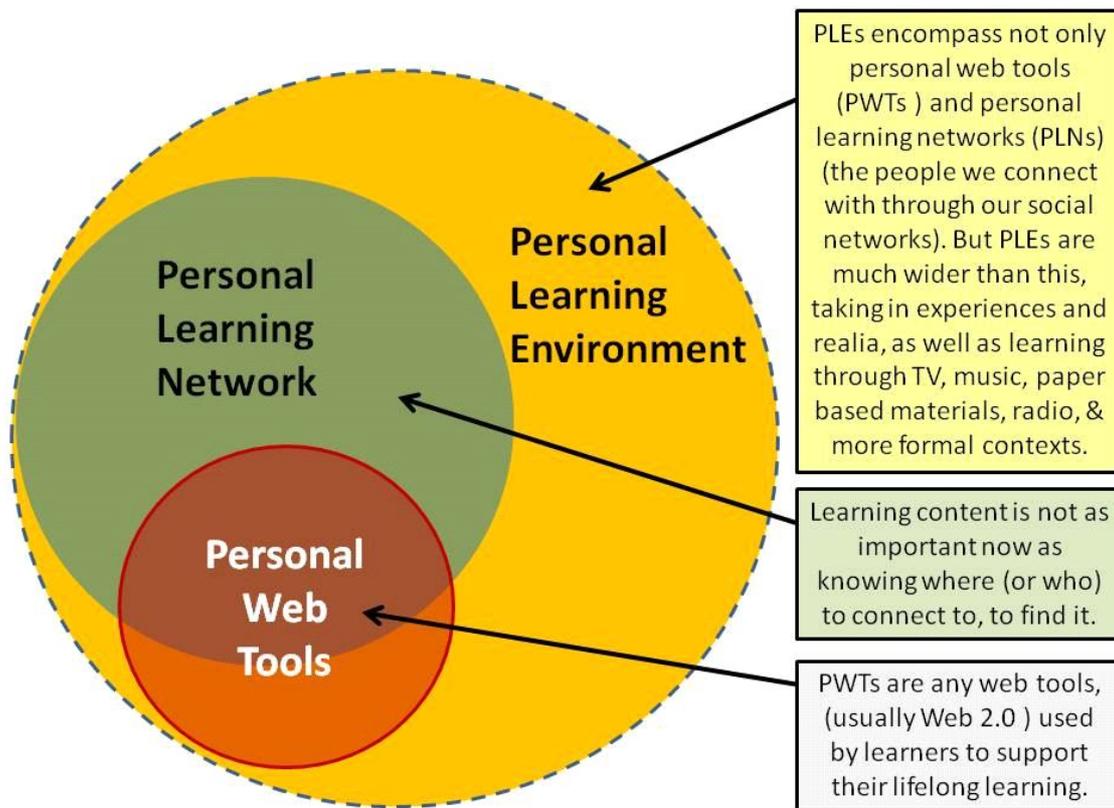


Figure 2.6: Evolution of Distance Education Technologies

These above developments in software, technology and resources (i.e. teaching-learning resources) have been largely utilized by the current developments in open and distance learning, vis-à-vis online learning, and in its current formulation of what is called ‘blended learning’ as shown in Figure 2.6 above in the previous page (please check during formatting and preparation of CRC). The first generation of distance education started with correspondence courses in the late 19th century, which has passed through several stages; the second generation of multimedia and open university; the third generation of conferencing, group learning and learner support; the fourth generation of developments in telecommunications and convergence of technologies (broadcasting, telecommunication, and computing), and the beginning of the first generation of online learning; and the second generation of blended learning (web, on-campus, synchronous and asynchronous, social technologies, open source software, open education resources). All through these developments, we can still find the existence of each generation in one or the other country or institution today. Due to the tremendous R&D efforts during the current generation, the web has facilitated the provision of personal learning spaces that is crucial for individualized learning styles within the learning community the web (Figure 2.7).



Steve Wheeler, 2011

Figure 2.7: Personalized Learning on the Web

While the well-designed learning space or LMS on the web can specify personal learning space for each student in the learning community, it can also contain personal learning network and personal web tools to draw upon and use the network and the environment for quality learning. The recent developments in cloud computing provides for cloud learning environment; and if the PLE, the PLN and the PWTs operate within the cloud learning environment, the student can dynamically use these 24/7 with ease and customize the learning resources as per his/her own need and style. This is how constructivist learning is highly facilitated by this kind of personalized learning on the web.

ACTIVITY 2.3



By now you have a fair understanding of media and technology developments used for teaching-learning and training. At this stage, reflect on those media and technologies that you are using regularly or occasionally, and examine the combinations that you will like to use for teaching the subject of your choice. Also, justify your choice of media and their combination, and examine the purpose each media will address. Write in about 200 words using the space given below.

Before we proceed to examine the development of educational technology in India and subsequently the direction in which it is moving (or, poised to move), let's examine the trends of the 1990s.

The 1990s

Donald Ely, an authority from the United States on educational technology, its literature, and research and development, analyzed the trends in the beginning of the 1990s (Ely, 1991). He underlined 11 trends then which had the possibility of continuing in the future the advent of Web 2.0 and social technologies. These are briefly outlined below; and you may reflect on them and see how far these trends still continue to operate in recent times.

Trend 1: Design and development of instructional products and procedures.

Educational technologists continued to work in areas of need assessment, learner characteristics, task and content analysis, content design and development, and strategies to motivate learners. In other words, instructional design and development was a significant trend which continues to dominate the work of educational technologists even today, though through the process, a lot of emphasis is laid on technology design, and use of software.

Trend 2: Evaluation as integral to instructional design and development.

Evaluation of instructional strategies and technologies in the form of process evaluation, formative evaluation, effectiveness and impact continues to dominate instructional development. This is also extended to programme evaluation covering entire programme design, development and delivery.

Trend 3: Use of R&D to solve teaching-learning problems.

Research and development joined together to facilitate effective process and product design; and this also included meta-analysis of research studies and case studies across the globe.

Trend 4: Increasing use of computers.

There was increasing use of personal computers by two extreme groups – school students and lifelong learners. The advent of the semantic web (Panda, 2009) provided immense space to the users of PCs to instantly access the web and get access to emerging storehouse of literature and content/knowledge. This was also the time when there was tremendous development in the production and use of CD-ROMs (multimedia) in education and training.

Trend 5: Developments in, but not use of, interactive video.

Though there was significant investment in the development of interactive video, its use in education and training was very much limited. However, with the later developments in distance learning and distance training, there was significant use of interactive video though it was expensive to produce and run.

Trend 6: Establishment of distance education as a major mode of education and training.

This period witnessed global upscaling of open and distance learning courses and programmes within formal education institutions, in business and training establishments, and in single-mode open universities. Curriculum design, instructional design and development were streamlined further, especially with the emergence and recognition of the constructivist philosophy of learning and interactive technologies (satellite and computer conferencing, and web-based learning). While training at-a-distance (without physical displacement) took place in business and industry in a large scale, the dual-model and single-mode distance teaching institutions could focus more on continuing education and lifelong learning, with courses and programmes that were not available in conventional campus-based institutions. Further, instructional design and development got a vast canvas for practical application, and media and technology got the required platform for design and deployment.

Trend 7: Professional education received wider attention and preoccupation.

While professional education got further impetus to expand, professionals within the field of educational technology got active with a variety of inter-institutional and inter-national activities to reclaim the professional position and status of educational technology. Part of the exercise was design and offer of professional courses and programmes (certification) in the field of educational technology.

Trend 8: Educational technologists' interest in the impact on society.

Educational technologists became more concerned and active with their research and evaluation especially on the impact of media and technology on society, culture, etc., and more specifically the impact of, say for instance, television on children.

Trend 9: Increasing use of telecommunications in education.

Developments in telecommunications technology facilitated teleconferencing through satellite, computer conferencing, cable TV for education, and interactive distance learning.

Trend 10: Gap between research and application of educational technology.

Though there was significant research on educational technology (instructional design and development), most ET applications were devoid of research back-up, and most research did not translate into practical applications or that they did not contain definite guidelines for practice.

Trend 11: Educational technologists' concern for curriculum support.

Organization and management of educational programmes in schools and colleges drew the attention of educational technologists in the sense that ET alone could not reform teaching-learning unless the entire organization of education at institutional and national/regional level was taken into consideration. Therefore, curriculum support, instructional technology, media centre and school organization were seen in an integrated framework so as to derive maximum and sustainable productivity, application and reform in educational practices.

ACTIVITY 2.4

Based on the above trends of the 1990s which were basically American, what trends do you see in educational technology in the national contexts in your own country? You may look into at any level of education or the education system as a whole. Write in about 150 words in the space given below.

Educational technology in India

Like any other country, the educational technology movement in India started with audiovisual aids, and teacher training institutions significantly stressed on effective use of even chalk and blackboard and later the overhead projector (OHP; see Kumar, 1996; Kulkarni, 1986). Even the beginning of the Centre for Educational Technology (renamed as the Central Institute of Educational Technology (CIET) of NCERT started as the audiovisual department of the government. So much so, the NCERT 2006 position paper of its National Focus Group (NCERT, 2006) even underlined that the stress on individualized learning in the old *gurukul* system can be considered as a feature of educational technology. It also notes that alternative educational technologies/instructional strategies were adopted by innovative schooling projects in the voluntary sectors such as projects on early childhood education by Badheka and Modak, Tilonia programme in Rajasthan, Kishore Bharti/Eklavya project in Hosangabad (M.P.), Gram Mangal in Maharashtra, Bhandup and Avehi-Abacus projects of Mumbai municipal schools, among others.

The shift from the audiovisual movement to the programmed learning movement (and, therefore, development of programmed learning materials – which later on led to development of training resources and self-learning materials in various sectors including distance learning) was led by Basu and Kulkarni at NCERT. That was a significant development since the audiovisual (and later the media and technology) movement needed to be balanced with the development and use of learning resources, and planning for teaching-learning guided by learning/educational objectives and mastery learning (you may like to refer to the minimum levels of learning – MLL – of NCERT).

Television came to India in 1959 as a pilot project financially supported by the Ford Foundation, and the Delhi School Television programme was initiated on October 24, 1961. However, the Satellite Instructional Television Experiment (SITE) in 1975-76 was the first interactive TV

experiment which combined education with community participation and development. In 1974, the union government created an ET unit in the Education Ministry, the Centre for Educational Technology (CET) at NCERT, and ET cells in six state states. In 1980, when INSAT (Indian National Satellite) was launched, the government *Doordarshan* (national television) took over production and especially telecast of educational television programmes. The CIET of NCERT later started educational television programmes for school children and for primary teachers in the eighties. The GoI in collaboration with UNDP and UNESCO started INSAT for Education project; simultaneously an ET Division was established at the Ministry; the CET of NCERT was merged with its Department of Teaching Aids to be renamed as CIET; and many ET cells of state governments were also renamed as State Institutes of Educational Technology. Classroom 2000+ experiment on interactive conferencing was conducted by CIET the results of which though could not be implemented widely thereafter. However, concurrently, the GoI undertook a scheme of distributing radio-cum-cassette players (about 228,118) and colour TV sets (about 31,129) and using those in various schools in the country, though, the scheme also failed to integrate media and technology with classroom teaching-learning (Mukhopadhyay, et. al. 1993).

In so far as the computer is concerned, its experiment and use in classrooms dates back to 1984 when the CLASS (computer literature and studies) project was started as a joint venture of the Department of Electronics (DoE), GoI and NCERT. Microcomputers provided by the BBC were supplied to 2582 schools and 42 resource centres. The experiment concluded not-so-effective use of microcomputers in teaching due largely to the gap between teacher orientation and actual use, installation and other problems, and lack of sufficient training. Attitude to technology was also another factor. The revised CLASS was revived during 1993-2004 with new PCs, followed by CLASS 2000 in which the government had to introduce computer literacy in 10,000 schools, and computer based learning in 100 smart schools. The experience of NCERT showed that IT was not integrated into teaching-learning, rather was used as add on; and also that lack of significant policy and committed practice led to its negligence by the teachers. Subsequently, there have been a few experiments like IIT (D)-NIIT experiment on 'Hole in the Wall' computer literacy project, 1-month summer course for Class V students by TeNet group of IIT (Madras), among others. A large number of urban schools today use a number of interactive multimedia CD-ROMs in the classroom, along with ETV and web resources. The use of interactive multimedia CD-ROMs on hard spots and computers was enhanced under the Computer Based Elementary Education (CBEE) of Sarva Shiksha Abhiyan (SSA) in schools in various states under a Public-Private-Partnership (PPP) model in collaboration with private IT companies, government organization, and NGOs.

In the case of higher education, after the successful launch of INSAT-1B, the UGC initiated the UGC-INSAT Television Project (known as Countrywide Classroom-CWCR) on August 15, 1984, to produce and broadcast enrichment programmes on week days for one hour to undergraduate college students, coordinated by the Mass Communicating Cell (now Consortium for Educational Communication) of UGC, and produced by four Educational Media Research Centres and two Audio Visual Research Centres in Universities. The Mass Communication Research Centre of Jamia Millia Islamia (now a central university) was to conduct R&D besides also producing television programmes to the related undergraduate curriculum (Panda, 1995). Later the enrichment programmes were replaced by curriculum-based video lectures which were broadcast as are also available at a price in the market. The UGC provided television sets and

VCRs to (selected) colleges under various Five-Year Plans. Many universities today both teachers and students have access to internet and web resources, online journals and books, access to the literature base of INFLIBNET, and the digital curriculum-based printed modules under the Sakshat project of MHRD, GoI and the online video repository in engineering and technology of NPTEL (of IITs). Almost all IITs, the IIMs, the IISc, Jadavpur University, among others have developed online learning management systems (LMS) for online teaching-learning as also multimedia-based interaction through institutional network. Some also do web casting of their teleconferencing lectures.

The use of media and technology got a wider platform after the initiation of correspondence education both at the school level and in higher education. Besides audio and video, and radio (Gyan Vani) and television (Gyan Darshan), the distance teaching institutions including the open universities and open schools also use teleconferencing, web casting, and online platforms, IGNOU, besides all these, uses interactive radio counseling (IRC) through its FM radio stations, mobile technology for learner support, online lecturing/presentation through Adobe Connect, and online resource repository of digital print modules, audio and video programmes (as Open Education Resource) through its eGyankosh. The Open School system, especially the National Institute of Open Schooling, uses audio and video, radio and television, teleconferencing for teaching-learning. Besides, there is online admission, and on-demand online examination. Parallel to these media and technology deployment and use in all levels of open and distance learning, there is constant updating and diversification in course design and development models, and different styles of self-learning materials in print, audio-video, multimedia, and online LMS.

Future scenario and directions

ACTIVITY 2.5



Based on what you have read so far and also based on the fact that media and technology developments shall continue to upscale in future, reflect on and categorically specify what you think could be the future developments in educational technology internationally and in your own country. Use the space given below to write your views.

The views that you have jotted down above may have covered areas such as instructional system development, curriculum design and development, instructional design/development, course design and development, media and technology especially social technologies and social networking, mobile technology, bases of learning especially the constructivist perspective, management of databases and networks, dynamic platforms like cloud computing and cloud learning, open educational resources, among others. To consolidate some of the future developments in educational

technology through some broad parameters, go through the following points and see if you thought of these and also if you agree to these or have altogether different views.

- While the use of audio, radio, video and television in teaching-learning will continue, the use of CD-ROM (multimedia) is reducing; teleconferencing and video conferencing especially through web casting and through the 3G mobile technology (mobile phone) will increase; schools and colleges will opt for more computer-mediated communication, network/LAN based resource storage and use, use of online resource repositories, and some form of blended learning. Since there is/will be an increasing convergence of broadcasting, telecommunications, and computing, converged technologies and blended learning will continue to dominate the educational media and technology scenario in the future. In case of open learning and self learning materials (or learning resources), authentic proprietary materials will be still of value, though authentic and appropriate open education resources will be the issue to deal with along with its instructional design, repurposing and copyright.
- With increasing R&D and expansion in social software, social technologies, and social networking technologies, there shall be greater need for these technologies to be systematically designed within instructional design and blended learning frameworks to address diversified educational and training requirements at especially tertiary education and in cases of continuing education, lifelong learning, training, and adult education. Open software and open source social technologies will capture the mainstream, and mobile (with converged) technology will assume greater significance. Further, there shall be increasing use of ICT in adult basic education, continuing education, and lifelong learning.
- Since constructivist approaches to learning have (and shall continue to) come to the forefront of educational design and organization of teaching-learning, the future will see more of instructional systems design, instructional design, learning resources development, interaction and knowledge construction and negotiation being influenced by this. This will possibly be more in the case of online learning and training.
- Due to these development, curriculum design and selection and use of learning resources may happen in a cloud learning environment which shall provide for dynamic, 24×7, and customized learning design to meet the needs of individual learners. Also, there shall more resource generation and sharing on the web through Web 2.0 and social technologies, though there shall be further questions raised about authentic resources and authentic learning, especially in the context of open education resources.

Summary

You have seen in this unit that the initiation of educational technology movement started with audiovisual aids (within ‘technology in education’) and behaviourism and programmed learning (within ‘technology of education’). In the process educational technology/ instructional technology systems got developed, learning was more personalized (i.e. oriented to one’s own ability, need and style), and group ‘interaction’ was frequent and enriched. The later developments in distance education largely used the educational technology developments so much so that today both constructivist learning and personalized learning environment on the web can combine together to offer customized and enriched learning experiences. We shall look at the application of educational technology to teaching, learning and training more closely in Unit 3

Describing the future scenario of education and educational technology research for the next 25 years, Facer and Sandford (2010) point out that the stress in the future shall shift from pedagogy to curriculum (for networked learning); from school to cover the community, home and workplace; and beyond social sciences to relate to the fields of medical and bio-ethics.

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Questions for critical reflection

1. While tracing the historical developments in educational technology especially in your country, critical reflects on the trends which the teachers of all the generations have found useful and effective in their own teaching and in facilitating student learning. Write in about 600 words.
2. Based on the media and technology developments on the one hand, and the developments in theories explaining how human beings learn, contemplate on and describe the design of a learning environment which can best facilitate students' learning (of any subject or subject of your choice). Write in about 600 words.