**Components of Educational Technology: Hardware and Software**

**Introduction**

Educational technology consists of two interrelated concepts namely education and technology. Here, education refers to the process of overall development of child and technology involves highly designed and sophisticated engineering of software and hardware that is meant for the systematic organization of knowledge for practical purposes. In order to serve educational purposes, there is need of educational technology which helps in improving the processes as well as products of education. It is also called as learning technology which comprise of the use of technology in teaching-learning process. The basic idea behind the educational technology is “ using all available resources (human and non-human) in a systematic manner to find viable solution to educational problems” (NCERT, 2006). With its first coinage, it referred to “technology in education ”, implying the use of a variety of educational audio-visual aids for teaching purposes. With further conceptual development of educational technology, the term “technology of education” came into vogue which looked at education in a wider sense, and included different aspects such as entry behavior of learners, objectives, contents, evaluation, etc. In addition, arrival of digital media added new dimension to educational technology (NCERT, 2006). The concept is not constant, but keeps on changing with changing time and scenario. Its scope and area is as wide as that of education itself.

“The universally accepted definition of educational technology involves processes, methods and techniques, products, resources and technologies, organized into workable system” (NCERT, 2006). In National Focus Group on Educational Technology, NCERT (2006), it is described as “the efficient organisation of any learning system adapting or adopting methods, processes, and products to serve identified educational goals. This involves systematic identification of the goals of education, recognition of the diversity of learner’s needs, the contexts in which learning will take place, and the range of provisions needed for each of these.”

Adding to it, educational technology is solely concerned with the task of identifying the most appropriate, relevant, suitable and developed technology, both hardware and software, for serving the educational needs and purposes of the students and the society at a particular time and place (Mangal&Mangal, 2017). According to G. O. M. Leith, “Educational technology is the systematic application of scientific knowledge about teaching-learning and conditions of learning to improve the efficiency of teaching and training.” On analysis of these definitions of educational technology, it can be said that it helps in bringing improvement in the processes and products of education through systematic organisation and application of knowledge.

**Components of Educational Technology**

In the field of education, educational technology has a wide range of scope and applicability. It helps in provision of necessary ways and means for brining improvement in the processes and products of teaching and learning. It makes practitioners search for new and innovatively effective ways of organizing teaching-learning processes. It has different aspects and forms such as teaching technology, instructional technology, behavioral technology and instructional design technology. Further, on the basis of the concepts of educational technology given in the introduction, it can be said that it is a “multi faceted concept” (Mangal&Mangal, 2017). This multi-faceted concept has different components which can be understood in terms of the approaches to educational technology. Humbsdaine (1964) has listed three distinct approaches to educational technology which are:

1. Educational Technology I or Hardware Approach
2. Educational Technology II or Software Approach
3. Educational Technology III or System Approach

Here, hardware and software components will be discussed elaborately.

**Hardware Approach**

Hardware approach to educational technology is originated from physical sciences and engineering. This component is based on the concept of service which can be called as using technology in education. It adopts product oriented approach where more concern is shown for production and utilization of audio-visual aid materials such as charts, models, slides, film strips, audio cassettes and sophisticated equipment such as radio, TV, films, projectors, tape recorders, video, teaching machine and computers (Mangal&Mangal, 2017). It strengthens the concept of utilizing these equipment and materials. It is also concerned with he advancement of mass media which contribute a lot to reach the educational benefits to masses with great ease and in more cost effective ways (Mangal&Mangal, 2017). This technology mechanizes the teaching-learning processes. According to Ruhela, “This part of educational technology refers to tools and hardware such as teaching machines, TV, tape recorder, etc. which are used in instructions. In fact, the selection and utilization of machines and hardware approaches in the field of learning is called hardware approach or educational technology I.” Silverman called it ‘relative technology’ which refers to borrowing and to applying technology, machines and devices in the process of teaching and learning. By using these devices, teachers can deal with larger group of students to have discourse on teaching-learning experiences. Further, it is added that it utilizes the products of Software Technology for its functioning. It has the potential to hand over the educational benefits to the masses with greater ease and economy.

**Software Approach**

Unlike the origin of the hardware approach, this software approach is originated from behavioral sciences and its applied aspects which are concerned with psychology of learning. It is also referred to as instructional technology, teaching technology and/or behavior technology. It denotes technology of education. It is a process- oriented approach to produce suitable teaching-learning material, strategies and techniques for the optimum results in the teaching-learning process on the basis of knowledge and principles of psychology of learning. It denotes the application of teaching learning principles towards directing and shaping behavior of learners as per desired by society. According to Silverman, it is called as “constructive educational technology”. It is mainly concentrated on the processes of analysis, selection and construction of necessary elements to meet the educational needs of the learners.

**Distinction between Hardware and Software Components**

These two approaches to educational technology are different in several areas which are described in the following manner:

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On the basis of these points, it can be said that both approaches are different in nature but are complementary to each other. One’s presence is necessary for functioning as well as for proper and judicious utilization of another one to make educational practices and teaching learning processes effective and productive.

**Role of the Components of Educational Technology in Educational Practices**

Technology, as the systematic organisation of knowledge for practical purposes, is used for bringing effectiveness in the process of teaching and learning. This educational technology improves the educational processes through its components such as software and hardware technologies. The role of these components in educational practices are briefly presented in the given points:

* It helps in providing individualisation of instruction and personalised learning according to the needs, interests, pace and abilities of the individual learner.
* It uses multi media and multi sensory approach to teaching and learning which are based on the principles of psychology of learning.
* It helps in management of the affairs of educational practices in an efficient and productive way through proper planning, systematic organisation, efficient leading and proper control of teaching and learning processes.
* It helps in providing effective and proper input in the form instructional materials, equipment and appliances and involved processes in the form methods, strategies and devices for the best possible outcomes or products which move towards realisation of learning objectives in efficient and cost-effective ways.
* It fulfills the expectations of distance and correspondence education in order to make learning accessible to all learners irrespective of where they are situated.
* It makes teaching and learning tasks more interesting, productive, meaningful and purposeful.

**Conclusion**

To conclude, it can be stated that education and technology are interrelatedly complementary to each other. The effective and efficient use of technology in the field of education helps in bringing improvement in the process of education and in realising its goals. Educational technology, as a multi faceted concept, uses all the available resources in a systematic and organized manner to solve the educational problems. It has hardware as well as software components. The former denotes technology in education and the latter technology of education. The software component makes hardware function properly and software components are redundant without appropriate hardware. These components help in individualization of instruction, multi media and multi sensory approach to teaching and learning, management of the affairs of educational practices, providing effective and proper input and processes for the best possible products, fulfilling the expectations of distance and correspondence education and making teaching and learning tasks more interesting, productive, meaningful and purposeful.

**Objectives**

The main objectives of this module are to acquaint the students about the:

1. meaning and concept of educational technology;
2. components of educational technology;
3. hardware and software approaches to educational technology;
4. differences between hardware and software approaches to educational technology; and
5. role of the components of educational technology in the field of educational practices.

**Glossary**

1. **Education:** Education refers to the all round development of children.
2. **Technology:** Technology means the systematic organisation of knowledge for practical purposes. It involves highly designed and sophisticated engineering of software and hardware components.
3. **Educational Technology**: Educational technology denotes the usage of all available resources in a systematic and organised manner to find viable solution to educational problems. It is as wide as the area of education itself. According to G O M Leith, “Educational technology is the systematic application of scientific knowledge about teaching-learning and conditions of learning to improve the efficiency of teaching and training.”
4. **Technology in Education**: Technology in education implies the use of a variety of audio-visual aids for teaching purposes. Hardware approach to educational technology is based on this concept of technology in education.
5. **Technology of Education:** Technology of education looks at education in a wider sense by including various aspects such as entry behavior of learners, objectives, content analysis, evaluation, etc. It signifies a technological approach to the problems of education. Software approach to educational technology is based on the concept of technology of education.
6. **Hardware Approach**: Hardware approach is originated from physical sciences and engineering. It is based on the concept of technology in education. It adopts product oriented approach where more concern is shown for production and utilisation of audio-visual aid materials such as charts, models, slides, film strips, audio cassettes and sophisticated equipment such as radio, TV, films, projectors, tape recorders, video, teaching machine and computers.
7. **Relative Technology**: Silverman called hardware approach as relative technology which refers to borrowing and applying technology, machines and devices in the process of teaching and learning.
8. **Software Approach:** Software approach is originated from behavioural sciences and its applied aspects which are concerned with psychology of learning. It is also referred to as instructional technology, teaching technology and/or behaviour technology. It denotes technology of education. It is a process-oriented approach to produce suitable teaching-learning material, strategies and techniques for the optimum results in the teaching-learning process on the basis of knowledge and principles of psychology of learning.
9. **Constructive Educational Technology:** According to Silverman, software approach is called as “constructive educational technology” which is mainly concentrated on the processes of analysis, selection and construction of necessary elements to meet the educational needs of the learners.

**Frequently Asked Questions (FAQs)**

**1. What is the meaning of technology?**

Ans: Technology means the systematic organisation of knowledge for practical purposes. It involves highly designed and sophisticated engineering of software and hardware components.

**2. What is the Educational Technology?**

Ans: Educational technology denotes the usage of all available resources in a systematic and organized manner to find viable solution to educational problems. It is as wide as the area of education itself. According to G O M Leith, “Educational technology is the systematic application of scientific knowledge about teaching-learning and conditions of learning to improve the efficiency of teaching and training.”

**3. What is the difference between technology in education and technology of education?**

Ans: Technology in education implies the use of a variety of audio-visual aids for teaching purposes. Whereas technology of education looks at education in a wider sense by including various aspects such as entry behaviour of learners, objectives, content analysis, evaluation, etc. Technology of education cannot limit itself to the role of services as confined in technology in education.

**4. What are the approaches to educational technology?**

Ans: Humbsdaine (1964) has listed three distinct approaches to educational technology which are:

1. Educational Technology I or Hardware Approach
2. Educational Technology II or Software Approach
3. Educational Technology III or System Approach

**5.What is hardware approach to educational technology?**

Ans: Hardware approach is originated from physical sciences and engineering. It is based on the concept of technology in education. It adopts product oriented approach where more concern is shown for production and utilisation of audio-visual aid materials such as charts, models, slides, film strips, audio cassettes and sophisticated equipment such as radio, TV, films, projectors, tape recorders, video, teaching machine and computers.

**6.Explain software approach.**

Ans: Software approach is originated from behavioral sciences and its applied aspects which are concerned with psychology of learning. It is also referred to as instructional technology, teaching technology and/or behaviour technology. It denotes technology of education. It is a process-oriented approach to produce suitable teaching-learning material, strategies and techniques for the optimum results in the teaching-learning process on the basis of knowledge and principles of psychology of learning.

**7.What is the difference between software and hardware approaches to educational technology?**

Ans: Hardware has its origin in physical sciences and applied engineering. Whereas software from behavioral sciences and their applied aspects concerning psychology of learning. Hardware is concerned with the production and utilisation of audio-visual material, instruments and mass media for helping the teacher and learners in their tasks.

Software is concerned with the usage of psychology of learning for production and utilisation of software techniques and materials for smoothening the teaching learning tasks. Hardware adopts product-oriented approach. Software approach adopts process-oriented approach for production of materials. Hardware stands for technology in education. Software components do not provide direct services to its users. It stands for technology of education. Examples of hardware are radio, TV, tape recorder, video, slides and film projectors, computers, machines, etc. Examples of software are programmed learning materials, strategies, devices, etc.

**8. How are these two approaches complementary to each other?**

Ans: Both approaches are complementary to each other. One’s presence is necessary for functioning as well as for proper utilisation of another one to make educational practices and teaching learning processes effective and productive. Hardware technology needs the services of software technology for its use and functioning. Software technology proves most useful when assisted and made into use by hardware appliances and materials.

**9. What are the roles of these components of educational technology in educational practices?**

Ans: These components help in providing individualised instruction, multimedia and multi sensory approach to teaching and learning, management of the affairs of educational practices, providing proper input and processes for the best possible outcomes, fulfilling the expectations of distance and correspondence education and making teaching-learning tasks more interesting, meaningful and purposeful.

**References**

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**LINKS**

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