**EDUCATIONAL TECHNOLOGY AND ICT**

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**Week-03**

**Lecture-15**

### Module-15: Hardware and Software Instructional Aids

Hello dear learners, welcome to SWAYAM and NPTEL course on Educational Technology and ICT. I am the course coordinator Dr. Sarita Anand from Department of Education, Vinaya Bhavana, Visva-Bharati, Santiniketan, West Bengal, India. Today we will talk about the Hardware and Software Instructional Aids. This is the module 15 and the lecture 15. In earlier classes, in the lecture, we have covered the concepts of Dell's cone and multisensory instructions, the psychological basis for using hardware and software technologies, major levels of Dell's cone experiences based on Dell's original concept, significance of Dell's cone of experience and multisensory instructional concept and its theoretical foundations.

Now we will talk about the hardware and software instructional aids. First, we have to understand what are these instructional aids. Instructional aids or the teaching aids are being utilized in the classroom at the time of teaching learning process. In the modern educational scenario, the use of instructional aids has become indispensable. In creating effective and engaging learning experiences.

These aids broadly classified into hardware and software provide teachers with the innovative ways to deliver content, explain complex concepts and foster active in student participation. By integrating technology into the teaching learning process, educators can enhance both the delivery and assimilation of the knowledge. Hardware and software instructional aids are the teaching aids commonly used in modern educational settings.

These aids facilitate diverse teaching strategies, foster students' engagement, and support a wide range of learning styles and needs. Hardware instructional aids Hardware instructional aids refer to the tangible physical tools and devices used in the teaching-learning process. These include devices which we have already discussed: projectors,

smart boards, audiovisual equipment, and computers. They act as enablers of presenting educational content in an interactive and visually appealing manner.

Hardware aids allow educators to create a dynamic classroom environment where abstract ideas can be illustrated through visual demonstrations and hands-on activities. So, following is the list of hardware instructional aids which can be used in your classes as a teacher or as a teacher trainee. The list is as follows: projectors, interactive whiteboards or smart boards, computers and laptops, tablets and e-readers, document cameras, overhead projectors, audio systems, speakers and microphones, virtual reality headsets, 3D printers, scientific and graphic calculators, digital cameras and camcorders, laboratory equipment, clickers or student response systems, printers and scanners, television, radio, CCTV, and mobile phones or smartphones.

These days, the mobile phone and smartphone are number one because without these, we cannot go ahead, whether we are teachers or students. So now, hardware instructional aids and their educational uses, because this is the course where we have to explain what the concept of hardware is and where we utilize it for our educational purposes. So, the projector is the first one. Projectors display digital content such as presentations, videos, or interactive software onto a larger screen or wall, and the educational use

The projectors are ideal for visualizing complex concepts for entire class. They make it easier to display multimedia content like diagram, video and interactive exercises, PPTs and YouTube videos. Whatever you want to project, you can use the projector to projecting that content. Projectors also support collaborative learning by enabling teachers to present content on a large audience simultaneously.

The second one is interactive whiteboard or smart boards: Interactive whiteboards often referred to as a smart board are large screens that allow users to interact directly with the display content via touch. These function similarly like you use your mobile screen or the tablet screen. The educational use, these boards support interactive lessons by allowing the teachers and students to write, draw, interact with the digital content directly on the screen. They beneficial for subjects like mathematics and science where visual demonstrations and the problem-solving activities can be interactively performed.

 The third one is computers and the laptops: The computers and the laptops are the versatile digital tools that facilitates various educational activities from research and writing to coding and multimedia creation. Educational use, laptop and computers are essential for assessing the online resources, creating assignments and conducting research. The

SWAYAM course you are pursuing, the laptop or the computers or the mobiles are essential to access those contents from the Swayam course. In modern classroom, they are used for individual and group projects, digital learning activities and running specialized educational software.

The fourth one is tablet or e-readers: Tablets are portable touchscreen devices that allows access to a wide range of digital resources. While e-readers are specialized devices for reading digital books. Especially our VI visual impaired students are using these e-readers or screen readers for their learning. The educational use tablets are highly flexible and supporting interactive learning allowing students to access digital textbooks, educational apps and multimedia content. They are particularly beneficial in blended learning environments and for students with special needs offering interactive and accessible educational materials.

The fifth one is document camera: Document camera are digital cameras mounted on a stand projecting images of document or objects onto a screen. Earlier in initial ages, when I was a student, there was OHP, overhead projector and this document camera works the similar. The document camera helps display physical materials like book pages, worksheet or science specimens to the entire class in real time. They are valuable for subjects that require step-by-step demonstrations such as math, science and experiment and arts.

The overhead projectors: Overhead projectors are used to project transparent sheets onto a screen or wall. These educational uses though somewhat of outdated yes, I already mentioned they are still used in the classroom for display written content or illustrations particularly when digital projectors are unavailable or there is no electricity then they definitely you can use it. the overhead projectors, they are also useful for direct hands-on note taking during the lectures.

Audio systems: Speakers and microphones, audio systems include speakers and microphones which amplify sound within a classroom or auditorium. These audio systems support auditory learning, improve lesson accessibility and ensure that all student can hear the instructions clearly, especially in larger classrooms for students with hearing impairment or challenges and also where the teacher's sound is not loud and clear then auditory or audio systems are very much useful for the learners.

The eighth point is Virtual Reality headsets:  VR headsets offer immersive 3D experiences by stimulating virtual environment. these vr headsets is used in education to provide virtual field trips lab simulation and immersive environment for subjects like history science and

art it enhances the experiment learning by enabling students to explore places and concepts that might otherwise be inaccessible like I had earlier mentioned that nasa visit if you want to do and go to space then use the VR set and fill the space at your institution.

The ninth one is 3D printers: 3D printers are created physical objects from digital designs layered by layer. Educational use of these 3D printers are, particularly valuable in STEM education, allowing the students to design and create prototypes, models and physical objects They enhance spatial understanding and problem-solving skills in subjects such as engineering, math and art. The tenth point is scientific and graphic calculator.

These hardwares are the calculators provide advanced mathematical functions suitable for higher level math and science courses. The educational use of these scientific and graphical Calculators are essential for subjects like calculus, algebra and physics. Allowing the students to visualize complex functions and solve equations that go beyond basic arithmetic. The eleventh hardware is digital cameras and camcorders.

Digital cameras and camcorders allow for capturing photos and videos, which can be uploaded and edited on computers. Educational use of these cameras. Digital cameras are helpful in subjects like art, journalism, and science. Students can document projects, experiments, or events using the visual materials for presentations and analysis. The twelfth hardware is laboratory equipment.

These are essentials in schools. These include scientific tools and apparatus such as microscopes, lab kits, digital thermometers, prisms, and other required equipment in your physics, chemistry, or biology labs, etc. The educational use of this laboratory equipment is essential for hands-on learning in science subjects like biology, chemistry, and physics, enabling students to conduct experiments and engage in the scientific method. The 13th one is a clicker or student response system. Clickers are handheld devices that allow students to respond to multiple-choice questions or polls during class.

We know that not all classes have these clickers, but they have educational uses. Clickers make lectures interactive and provide instant feedback, allowing teachers to gauge students' understanding in real time. They are also useful for formative assessment, fostering student engagement and participation in the classroom teaching-learning process. The fourteenth one is printers and scanners. Printers and scanners allow for the physical creation of digital documents and the digitization of physical ones.

The educational use of printers: are used for printing assignments obviously, worksheets and study materials while scanners digitize the documents for sharing or uploading to learning management systems making resources accessible for online classes. These days our mobile phones are having the scanners and we do not need the separate scanners but the offices are having these come scanners and three in one printer and scanner etc. The fifteenth one is the television. Television is a widely used medium for broadcasting and visual audio content to a large audience and it has the immense educational use like the programs can present documentaries, lectures, news segments and educational shows made for the different age groups and subjects.

TV can bring real world events, cultural experiences, experts discussion into the classroom. Like right now Mahakumbh is going on and you can go for the real-world experiences by watching the television and you can feel the effect of Mahakumbh in the Prayagraj. So, this is the benefit of educational use of television if you are using it in your classroom. In distance education, television has been especially valuable delivering educational programming to students who might not have direct access to traditional classrooms.

The channels dedicated to educational contents such as Do Darshan, Gyan Darshan in India focus on academic subjects and vocational skills. The educational televisions like run by the educational satellites are utilized here for the educational purposes in schools via using the television.

The sixteenth hardware is radio. Radio broadcast audio programs that can be transmitted across large areas reaching wide audiences at low cost. Educational use Radio is an effective tool for distance learning. Educational radio programs cover a range of subjects including literacy, science, history, language learning and agriculture. In many countries, radio has been used to supplement traditional education, particularly in rural areas. Educational institutions can also be used community radio to broadcast school or college specific information and lesson reaching students in remote areas.

The seventeenth one is closed circuit television, the CCTV. CCTV uses video cameras to transit signals through specific monitors or recording devices within a closed network, typically for surveillance or controlled broadcasting. So, what is the educational use of this CCTV in the education purpose? CCTV is used in education primarily for monitoring and security purpose.

So, the surveillance is the main goal of the CCTV. It helps ensure a safe learning environment by monitoring classrooms, hallways and school grounds. Additionally, in

some educational context, CCTV is used for broadcasting lessons or assemblies to multiple classrooms for recording lectures that can be reviewed later by students especially when you are using multimedia CCTV cameras in teacher training CCTV can be utilized for observation and feedback where students' teachers can review footage to improve the instructional materials and also CCTVs are utilized in educational institution for maintaining the disciplinary issues.

The last one is mobile phone: Actually, this is the first one, but I kept it here in last because you all know the uses of this mobile phone. So mobile phone especially smartphone are versatile portable devices capable of assessing the internet applications and the multimedia. The educational use need not to say that the mobile phone has revolutionized education by making learning materials accessible anytime anywhere.

They support various functions such as educational apps, online research, communication and collaboration. In classroom teachers use mobile phones, even we told our students that yes labs are moving in your pocket, because ICT lab is the concept which was earlier that there will be hall and having the computers and the lab will be there but now this smartphone made the lab in your pocket, ICT lab in your pocket. In classroom, teachers use mobile phone for interactive polling, quizzes, real-time feedback, etc.

 Mobile phones are also essential in remote learning environments, allowing students to participate in virtual classrooms, access e-books and engaging with the digital assignments. At the time of SWAYAM courses dissemination the information, we tell our students that bring out your mobile and go and login the course and see the lecture and all because these mobiles are utilized anytime anywhere. With the features like cameras, GPS and various sensors, mobile phones also support field research, virtual labs and multimedia projects.

So, these were the hardware instructional aids for the course. Now, the software instructional aid. The software instructional aid on the other hand encompasses the digital tools and applications that operate on hardware devices. These include educational softwares like simulation, multimedia presentations, learning management system and subject specific apps etc. Software aids empower teachers to design personalized lessons, conduct virtual assessment and provide immediate feedback thereby enriching the overall learning experiences.

So, these are the list of the software instructional aids. starting from the LMS, presentation softwares, educational games and simulation, interactive whiteboard, video conferencing apps, quizzes and polling tools, digital content creation tools, assessment and feedback,

virtual reality and augmented reality, productivity software, collaborative e-books and digital libraries and lastly the subject specific educational software. The list is enormous, but I have mentioned only three here for your course. The software instructional aids and their educational use I have mentioned.

The LMS: LMS you already know that the learning management systems like Moodle, Blackboard, Canvas organize, deliver and track online courses and learning activities. And the uses, it supports the course management, content sharing, assessment, grading, communication between the teacher and the learners or the students. They are essential for online and blended learning. Providing a centralized platform for the learning of all the resources. Presentation software such as Microsoft PowerPoint, Google Slides, Prezi allows users to create and display slide presentations.

The list of presentation software is enormous but I have mentioned few. The presentation software is used to create visually engaging lectures and interactive presentations that help students grasp complex concepts through visuals, animations and multimedia elements. The third one is educational games and simulations. Programs like Kahoot, Minecraft Education Edition and SimCity Edu provides game-based learning experiences and simulations. The educational use these tools make learning interactive and enjoyable.

By incorporating game mechanics, real-world scenario which can enhance problem solving skills, critical thinking, and engagement particularly in STEM education. The fourth one is interactive whiteboard software. Softwares like smart notebook and Microsoft whiteboard enables digital drawing and interaction on a virtual whiteboard. These softwares allow for dynamic teaching by enabling teachers and students to write, draw and interact with content during lessons, which is especially helpful in subjects like math and science where visual demonstrations are important.

The fifth one is video conferencing and virtual classroom software. Tools such as Zoom, Microsoft Teams, Google Meet allow real-time video communication and online classes and sessions. The educational use Video conferencing software facilitates virtual classrooms allowing for live lectures, discussions, and collaborative activities.

Features like screen sharing, breakout rooms in Zoom, and recording enhance the online learning experiences. Educational uses were more seen at the time of COVID-19 when people organize the video conferences in large scale. Now, the sixth one is quiz and polling tools. Tools like Kahoot! Quizizz, Mentimeter offer platform for quizzes, polls and real time assessments. Quiz and polling software enables formative assessment, instant

feedback, and active participation, these tools are valuable for checking students' understanding in real time and promoting active learning.

It also checks the interest of the learners: whether they are taking interest in the class or not. The seventh one is digital content creation tools. Tools like Canva, Adobe Spark, and WeVideo allow users to create multimedia content, including infographics. Videos and presentations. Canva is the most used by me because it is very user-friendly. Students and teachers use these tools to create visually appealing projects, presentations, and digital stories, fostering activity and helping students learn through hands-on digital content creation. Especially in teacher education and teacher training, we need to create content, and apps like Canva are very helpful for teachers like us.

The eighth one is assessment and feedback tools. Software like Google Forms, Quizlet, and Socrative allows creating and administering tests and quizzes. These tools simplify grading, provide analytics on student performance, and facilitate feedback, making assessment more efficient and allowing teachers to track learning outcomes easily. The ninth one is virtual and augmented reality applications—the apps. Applications like Google Expeditions, CoSpaces Edu, and AR Flashcards provide immersive and interactive experiences.

The ePathshala AR by the Government of India is also on this list. VR and AR bring learning to life by allowing students to explore virtual experiments, conduct experiments, or visualize complex subjects like anatomy and architecture, enhancing experiential learning. The tenth one is productivity software, like word processing and spreadsheets, etc. Software like Microsoft Office, Google Workspace, and OpenOffice provides tools for writing, data analysis, and organization.

Educational uses, productivity software is essential for creating assignments, analyzing data and managing information. Word processors, spreadsheets and presentation tools are the fundamental in education for research, reporting and organizing learning materials. The eleventh one is collaborative tool like Google Workplace and Microsoft Teams. These tools enable real-time collaboration on documents, spreadsheets and representations. Like in Google Workplace, we can work, 2-3 teachers can work together in a real-time at sitting different places.

Educational use, collaborative tools support group works enabling students to work on projects together, share resources and communicate seamlessly which builds network and organizational skills. The twelfth one is e-book and digital library software. Platforms like

Kindle, Overdrive and Google Books offer digital access to the books and educational resources. And by the government of India, National Digital Library is also in this list. E-books and digital libraries provide access to a wide range of reading materials that students can use for research, reading assignments and self-study, making learning resources more accessible and convenient and the last one is subject specific educational software.

A specialized software for different subjects such as GeoGebra or Math or Labsters for science and Duolingo for languages are very useful for the education. These tools focus on the specific skills or the subjects offering interactive exercises, simulations and tutorials made to teach discipline allowing students to practice and deepen subject specific skills.

In conclusion, we can say that each hardware instructional tool offers unique benefits in enhancing educational practices. By carefully selecting and integrating these tools, educators can create an interactive, multimodal, and student-centered learning environment, encouraging engagement, improving understanding, and supporting diverse learning styles. Software instructional aids enhance learning by supporting various educational processes, from content creation and presentation to assessment and collaboration.

With a combination of these tools, educators can create a dynamic and inclusive learning environment that caters to diverse learning styles and needs, ensuring effective engagement and knowledge retention in both in-person and virtual classrooms. These are a few references for your study purpose; you can go through these references for further reading and enhance your learning.

Thank you.