EDUCATIONAL TECHNOLOGY AND ICT

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Week-03

Lecture-14

Module-14: Dale's Cone and Multi-Sensory Instructions

Hello dear learners, welcome to the SWAYAM- NPTEL course on Educational Technology and ICT. I am the course coordinator, Dr. Sarita Anand, from the Department of Education, Vinaya Bhavana, Visva-Bharati, Santiniketan, West Bengal, India. Today, we will talk about Module 14, based on Dale's Cone and Multisensory Instruction. This will be Lecture 14. Earlier, we covered concepts on the Systems Approach in the Indian Education Context, examples of the Systems Approach in practice today, comparisons of hardware and software technology in education, and we also discussed challenges to implementation.

Now, we will talk about today's topic on Dale's Cone and multisensory instruction. The psychological basis for using hardware and software technologies in education. Psychology is generally defined as the science of behavior. Through one of its applied aspects, known as educational psychology, it helps both the teacher and the learners in shaping the latter's behavior in accordance with the aims and objectives of education. Educational psychology is a science of education.

So, we use psychology in the educational perspective. Thus, it helps both teachers and learners to bring essential modifications in their teaching behavior or learning behavior for the effective realization of teaching-learning objectives. It suggests and paves the way for the application of hardware technologies to soften the process of teaching and learning, much to the benefit of both the teacher and the learner. For example, it may provide certain principles, maxims, and theories of teaching and learning or may put forward generalizations. For instance, 'Experience is the best teacher' or 'Senses are the gateway to knowledge.'

Such path showing statements and generalization supported within the sound psychological principles and the theories of teaching learning may in fact be credited to the provide a strong psychological base for the use and application of hardware. and software technologies in the field of education mentioned by Mangal and Mangal on their book in page number 32. Now, Dale's Cone of experience. This Dale's Cone of experience developed by Edgar Dale in 1946 and on his name, we know this cone as a Dale's Cone of experience. It is a visual model that categorizes type of learning experiences based on their level of abstraction.

It is often referred to as a cone because it illustrates how learning experiences transition from the most concrete direct hands-on experiences at the bottom to the most abstract verbal and symbolic representations at the top. This model is fundamental in understanding how learners process information and retain knowledge suggesting that the closer a learning experience is to real life. Direct engagement and the more effective it is more retention and understanding. Dale's cone of experience does not specify exact retention rate in its original version and it is often mis-presented with added percentages.

The genuine model serves as a visual metaphor to show the varying degree of abstraction in learning experiences rather than providing a scientifically qualified retention model. So, following is the visual representation of the Dale's cone of experience that illustrates these levels from the most concrete at the top and the most abstract at the top. Did I do something wrong? Will we do it again? Will we go back?

Following is the representation of Dale's Cone of Experience that illustrates these levels from the most concrete at the base to the most abstract at the top. This is Edgar Dale's Cone of Experience because its shape looks like a cone, which is why we call it Dale's Cone, where you can see the indirect abstract experiences and direct concrete experiences in this figure. Now we will discuss Dale's Cone one by one in its original concept. The first one is direct purposeful experiences, which is the base of the cone. This is the most concrete level of the cone.

It includes real-life experiences that involve direct engagement and interaction with the learning material. Examples include conducting experiments, practicing skills, or participating in real-world scenarios. This level allows learners to fully immerse themselves in learning through all their senses, promoting deep understanding and long-term retention. The second one is contrived experiences. At this level, learners engage in

simulated experiences or models that represent reality. These are designed to closely resemble real-life situations but occur in a controlled environment.

For example, it includes role-playing, simulations, or using mock-ups of real objects. Contrived experiences help learners build understanding when direct experiences are impractical or impossible. Dramatized experiences Dramatization involves learners actively participating in dramatized events or acting out scenarios to grasp concepts. For example, it includes skits, role-playing historical events, or performing reenactments.

This helps students connect emotionally with the subject, which can enhance comprehension and retention. The fourth one is demonstration. Demonstration involves showing learners how something is done. Examples include a teacher showing how to solve a math problem or conduct a science experiment, either in a physics, chemistry, or biology lab. Demonstration makes abstract concepts more tangible and provides a clear model of skills or procedures for students to emulate or understand.

The field trips Field trips offer real-life exposure to topics of study, such as visiting a museum, historical site, or a factory. These experiences provide concrete examples that relate classroom learning to the outside world, enriching students' understanding of abstract concepts. Exhibits Exhibits are static displays of items, models, or visuals that can be examined by the learners.

For example, it includes educational displays in the classroom, the museum, or exhibitions in educational institutions showcased by the students. They allow learners to observe and study objects related to their lessons, reinforcing conceptual understanding. Like in Visva-Bharati, we organize *Nandan Mela* and *Anand Mela*, which are exhibit opportunities for the students where they display their creative works, visuals, and models for others, benefiting both teachers and students. The next one is educational television and motion pictures. Audio-visual media, such as educational videos, documentaries, and educational films, provide a combination of sight and sound to convey information. They are especially useful for visualizing complex topics and are more engaging than text alone, but still lack the direct involvement of hands-on experiences.

Educational movie shows are part of our B.Ed. program where students can watch educational movies for their learning purposes and to understand concepts for upcoming classes in real-time situations. The eighth one is recording radio and still pictures. These include more static forms of media, such as photographs, audio recordings, and illustrations. While these materials can convey information and provide examples, they

lack the dynamic aspect of video and are a more abstract form of learning. We can also go for visual symbols.

Visual symbols, such as charts, diagrams, and graphs, are used to represent ideas and concepts in a simplified visual form. They are abstract and require some level of interpretation but can effectively summarize complex information in a visual manner. The tenth one is verbal symbols. Top of the cone. Verbal symbols are the most abstract form of learning.

They include words, either spoken or written, without any direct visual or physical context. This level of learning relies heavily on the learner's ability to interpret and imagine concepts, making it the least effective for retention and understanding compared to concrete experiences. Visual symbols (Stage 9) are widely used in teacher training programs where our trainee pupil teachers use charts, diagrams, and graphs during their internship programs. So, the significance of Dale's Cone of Experience suggests that concrete experiences are generally more effective for deeper understanding and retention compared to abstract ones. However, it is important to note that this model does not suggest a strict hierarchy or an absolute approach to learning.

This is just a suggestion. Each level has its place depending on the learner's needs, the complexity of the material, and the instructional goal. In practice, a combination of various levels in the cone can enhance learning. Starting with a concrete experience, such as a demonstration or simulation, can lay a solid foundation, while later using abstract representations like diagrams or verbal explanations can help deepen conceptual understanding. This blend of learning experiences encourages students to apply what they learn across different contexts and forms.

The psychological foundations for using hardware and software technologies in education are deeply linked to Dale's Cone of Experience, which highlights the effectiveness of learning experiences at varying levels of abstraction. Hardware and software technologies play a key role in supporting these experiences across Dale's Cone, from concrete hands-on learning to more abstract forms of understanding. Understanding these psychological foundations helps in effectively integrating these technologies into educational practices. Now, the psychological basis for hardware technology.

We will talk about hardware technology and software technology separately. Hardware technologies in education include devices like projectors, interactive whiteboards, tablets, virtual reality equipment, etc. which we have already discussed many times.

Psychologically, these tools support learning by enhancing sensory engagement, reinforcing cognitive processing, and increasing motivation through interactivity.

The first one is enhanced sensory engagement. This is the psychological base of hardware technology. According to Dale's cone, learning experiences at the bottom of the cone such as direct purposeful experiences involve real-world tangible interactions that are critical for sensory learning. Hardware technologies like virtual reality and interactive whiteboards allow students to participate in a simulated or augmented environment offering a hands-on experience even when actual field experiences are impractical.

Like if you want to go to the riverside or an ocean and you do not want to take it with the small kids, then we can utilize this virtual reality or you want to visit the NASA, then definitely you can use these VR headsets and visit the NASA in your educational institution itself. So, VR heads for example provide immersive 3D environment that simulate real life experiences bridging the gap between direct and contrived experiences on the cone. This sensory engagement supports cognitive development by engaging the brain activity and active learning facilitating memory formation and recall. The second is the psychological reinforcement and retention. Hardware tool support, demonstrations and field trips on desk cone by allowing instructors to bring distant or abstract concept into classroom.

For example, without going to the museum, without going to the Kutub Minar students are visiting the Kutub Minar. So, this field trip is helping the instructor. Demonstration via digital projectors or interactive screens help students visualize and understand the complex information activating cognitive reinforcement mechanisms. Studies in psychology suggest that visual learning aids stimulate the brain's recognition and retention pathways, making abstract concepts more concrete.

These align with Dale's Cone in promoting better retention through engaging visual and interactions, encouraging students to build connections and reinforce understanding. Motivation and engagement through active participation. Definitely, interactive hardware like tablets and digital whiteboards or interactive boards fosters active participation by allowing students to engage with the content directly. moving them up the cone from passive educational television to active demonstrations and dramatized experiences.

The psychological principle of active learning suggests that students who are directly engaged with the materials, like drawing on a tablet or interacting with a digital model, have higher motivation and are more likely to retain information as they are actively involved in the learning process rather than just passively observing. So, the psychological

basis now for the software technologies. Software technologies, we all know, in education encompass tools like educational apps, learning management systems, simulations, video conferencing platforms, and other content creation apps and platforms. So, these tools support abstract thinking and cognitive engagement, particularly with the middle to higher levels of Dale's cone, where learning shifts to symbolic and representational forms.

The first psychological basis for the software technologies is cognitive processing and symbolic understanding. Software tools allow for the visualization of abstract concepts through symbolic representations, such as graphs, diagrams, and simulations, etc. Dale's Cone suggests that moving up the cone, the visual symbols and the verbal symbols engage cognitive processes that allow learners to understand and analyze complex ideas. For instance, educational software like math simulators and data visualization tools supports the psychological concept of dual coding, where both verbal and visual information work together to reinforce understanding.

Such tools improve cognitive processing by allowing learners to conceptualize abstract relationships through interactive and visual models. The second point is scaffolding and conceptual learning. Software technologies, particularly those with adaptive learning algorithms, provide tailored scaffolding to learners, supporting them as they progress through abstract concepts. In terms of Dale's Cone, software allows students to start with guided experiences and gradually work up to independent symbolic learning, such as analysis of textual content or data. The psychological theory of constructivism highlights the importance of building knowledge through structured steps.

Software platforms like LMS and educational apps help students move from understanding concrete concepts through digital flashcards, interactive stories, or videos to more abstract forms like self-assessment quizzes or project-based tasks, supporting retention and conceptual learning. The third point is self-regulation and reflective learning. Software tools that incorporate self-paced learning and progress tracking, like Khan Academy or Google Classroom, support metacognitive skills, which align with the idea of advancing toward verbal symbols and other higher abstractions. Such software encourages students to reflect on their progress, reinforcing retention and deeper understanding.

The self-regulation-based aspect, based on cognitive psychology, helps students monitor their learning journey. A key aspect in moving up the cone and dealing with more abstract content, psychological studies show that students who actively self-regulate are more engaged and retain information longer, even with abstract materials. The fourth is

simulations and virtual environments. Software-based simulations and virtual environments replicate contrived and dramatized experiences for Dale's Cone.

Educational psychology emphasizes that these immersive experiments enhance memory and comprehension by creating meaningful and emotionally engaging scenarios. For example, language learning platforms with interactive dialogues, cultural simulation provide dramatized experiences that make learning memorable. This not only aligns with the Dale's principle but also taps into affective memory where emotion strengthens memory and recall. Now integration of hardware and software in modern pedagogy. We all know that pedagogy is art and science of teaching.

So, both hardware and software technologies support different levels on their school, creating a mixed environment where students can experience both concrete and abstract learning. When integrated effectively, they allow teachers to create comprehensive learning experiences that enhance sensory engagement encourage cognitive process and support symbolic understanding. Now, the practical applications in teacher education. Incorporating VR headsets and simulations, teacher educators can use virtual reality and interactive simulation to provide training to their trainee teachers with contrived experiences, enabling them to practice classroom management, or interact with the student avatars in risk-free environment.

Using LMS for reflection and assessment. Learning management system can be used to encourage self-regulation allowing trainees to move from demonstrations to reflective learning experiences. These supports metacognitive development and allows trainees teachers to manage and access their own progress. So, now we can say that the psychological foundations for hardware and software technologies when applied through the lens of Dale's cone reveals how these tools help bridge the gap between concrete experiences and abstract understanding. Now, another term which we are going to use in this lecture is, multisensory instruction.

Multisensory instruction is a teaching approach that engages multiple senses simultaneously to facilitate learning. It is based on the premise that engaging various senses such as sight, hearing, touch, and movement can improve memory, understanding, and retention, especially for diverse learners, including those with learning differences. Multisensory techniques often combine visual, auditory, kinesthetic, and tactile elements in instructional practices, creating an immersive and active learning environment. So, the definition of multisensory instruction according to Lindbergh Bell (2009) is that

multisensory instruction integrates visual, auditory, kinesthetic, and tactile pathways to enhance learning experiences, connecting brain functions and improving comprehension by stimulating memory through multiple sensory channels.

According to Moats and Farrell (2005) multisensory teaching is an approach that integrates sensory experiences to reinforce concepts, particularly beneficial in areas such as reading, where combining visual, auditory, and kinesthetic activities aids in decoding, comprehension, and memory. So, the major components of multisensory instruction are the visual components, the auditory components, and the kinesthetic components.

First, we will talk about the visual components. Visual aids such as images, diagrams, charts, and text help engage the sight pathway. For example, using graphic organizers or color-coded notes in a reading lesson aids comprehension by providing a visual structure to follow. The second one is auditory components. Auditory learning involves using spoken language, sound, and music to reinforce learning. For example, in a language lesson, listening to phonetic sounds or participating in reading aloud can strengthen word recognition and phonological skills.

The third one is the kinesthetic and tactile component. Tactile and kinesthetic activities involve hands-on, movement-based interaction with materials. This could include tracing the letters in sand, using manipulatives for math, or physically arranging the words into sentences. These components help learners who benefit from physical engagement in learning.

This is the diagram to explain multisensory or multimodal learning, where the three concepts auditory, visual, and kinesthetic together move ahead for deeper learning. I hear, I know (cognition); I see, I remember (memory); and I do, I understand (metacognition). If these all come together, they make deeper learning ahead. The theoretical foundation of multisensory Multisensory instruction draws on several psychological and educational theories, as below.

The first one is the dual coding theory by Paivio (1971). He suggested that combining verbal and nonverbal information helps create stronger mental connections, making it easier to retrieve information later. Through engaging multiple senses, multisensory instruction leverages both verbal and visual processing pathways. The second theory is the constructivist theory given by Piaget in 1954. It emphasizes that students construct knowledge actively.

Multisensory activities allow students to interact with materials, in meaningful ways, building their understanding through sensory engagement and active participation. The third theory is multimodal learning theory. This theory asserts that people learn better when multiple senses are involved.

Multisensory approaches align well with multimodal learning as they address learners' varied needs and strengths. making learning accessible and effective for diverse students. So, what is the importance of this multisensory instruction? The first one is it enhances memory and retention. Research indicates that information processed through multiple sensory channels is more likely to be retained.

Multisensory techniques activate multiple areas of the brain, increasing the likelihood that the learning material will be retained and recalled over time. The second one is it supports diverse learning needs. Multisensory instruction is particularly beneficial for students with learning differences such as dyslexia, ADHD, and other processing disorders. As it addresses diverse cognitive strengths by providing various ways to engage with the content.

Third one is encouraging active engagement. Multisensory instruction encourages the active engagement through the activities helps learners focus on feel more involved in the learning process. For example, a lesson combining visual aids and interactive whiteboard activities keep students attentive and invested into the lesson. The fourth one improves conceptual understanding.

By using the different senses, students can grasp concepts that may be challenging when presented in a single format. For instance, Mathematical concepts are often more understandable when students can see, touch and move and manipulative rather than just solving questions on a paper. So, the example of multi sensory instruction in practice, we will take the example of reading and language arts. A teacher may use letter tiles, audio recordings of sounds and writing practice to teach phonics enabling a student to see, hear and physically create words.

In mathematics, manipulative like blocks or counters combined with the visual representation on the board and the spoken explanations allow students to visualize mathematical operations while engaging physically with it. Science, hands on experiments that incorporate observing, measuring and moving like building a model or conducting a chemical reaction allow students to engage their senses and better understand the scientific concept. So, multi sensory instruction is a dynamic flexible approach that can adapt to diverse learning needs and enhance the comprehension by engaging various senses.

By combining visual, auditory, kinesthetic, and tactile elements, educators can create a robust and multidimensional learning environment that supports all learners, particularly those who benefit from concrete, hands-on experiences. In conclusion, we can say that by drawing upon psychological principles, particularly Dale's Cone of Experience, we can understand how hardware and software technologies effectively bridge the gap between concrete experiences and abstract concepts. This synergistic approach creates a dynamic learning environment aligned with key psychological principles. Such as sensory engagement, cognitive processing, motivation, and self-regulation, ultimately leading to deeper learning and improved retention across various educational settings. Whereas multi-sensory instruction is a versatile and adaptable approach that effectively caters to diverse learners' needs and enhances comprehension.

By incorporating visual, auditory, kinesthetic, and tactile Tactile elements, educators can create a rich and multi-dimensional learning environment that supports all learners, especially those who thrive on concrete and hands-on experiences. So, for your reference, here are a few references. You can go through them for further studies and try to better understand the concept.

Thank you.