

Details of Module and its structure

Module Detail	
Subject Name	Education
Paper Name	Perspectives, Issues and Research in Teacher Education
Module Name/Title	Learner Driven Pedagogy from Constructivism to Connectivism
Module Id	e-PGEDN 10.10
Pre-requisites	<ul style="list-style-type: none"> • Understanding of behaviourism, cognitivism, constructivism & Connectivism. • Knowledge of Learner Driven Pedagogy.
Objectives	<p>After going through the module the learners will be in a position to:</p> <ul style="list-style-type: none"> • discuss about behaviourism, cognitivism, constructivism & Connectivism. • discuss maxims of teaching. • discuss about Pedagogy. • explain neurotransmitters, neural networks and network topologies.
Keywords	learner, pedagogy, neuron, network, behaviorism, cognitivism, constructivism, connectivism

Development Team

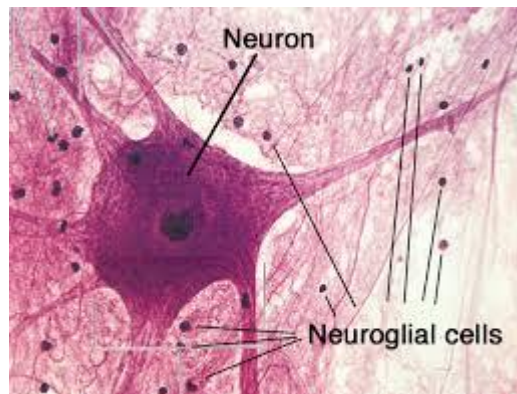
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1. Introduction

The focus of the present module is learner-driven pedagogy. It demands a shift from teacher driven pedagogy to learner driven pedagogy. The concern is realization of learner identity and transcendence from dependent to independent learning through constructivism and Connectivism. It examines the probability of the human brain to cognize the entire cosmos. It tries to find meaning with connectivism and realize the need for connectivism in education and teacher education. It focuses on Learner Driven Pedagogy (LDP) through constructivism and then the nodes and links for connectivism and explores the history & the methods of learning connectivism. Then it presents the importance of networks, foundations and principles of connectivism. A comparative view of cognitivism, behaviorism, constructivism & connectivism has also been presented. Skills of connectivism find expression followed by some illustrations on connectivism. Finally it concludes how connectivism provides the pathways for connecting dot to globe & point to morphology.

2. Human Brain Capacity

The human brain has more than one billion nerve cells which are capable of making 10^{800} interconnections as follows:



The emerging question is, can the human brain reconstruct & cognize the entire universe. There is no answer as such. Further what is reconstruction & storage mechanism? How are the schemas designed and stored? How is the connectivity amongst the whole of cosmos? How are the images formed & stored. It demands collective wisdom to connect with & cognize the universe. How are these bonds formed? What is connectivity? To what extent it has been realised in Education & Teacher Education?

3. Heart & Brain Entrainment

When a person feels content or calm, his brain-wave patterns entrain with his heart-rate variability patterns. A measurable synchronicity between the heart rate and brain waves occurs. The heart, not the brain, sets the pace. When a person becomes fearful, this synchronicity is broken off. The heart rate variability patterns become jagged and disordered, but more significantly, the brain wave patterns become unrelated to the heart rate patterns. When fearful or under stress, brain waves cease to be entrained with the heart-rate variability patterns. When the fear is over, the brain's wave patterns can again become entrained with the heart's wave patterns realizing Dopamine & Adrenaline equation.

4. Emerging Questions

- Can the human brain reconstruct & cognize the entire universe?
- What is reconstruction & storage mechanism?
- How are the schemas designed and stored?
- How is the connectivity amongst the whole of cosmos?
- How are the images formed & stored?
- How are the bonds formed?
- What is connectivity?
- To what extent it has been realised in Education & Teacher Education?

5. Constructivism

This universe becomes meaningful when we are in a position to realise interrelation and interdependence with its constituents it demands knowledge of the universe, which demands organised search that is research. This research is an infinite i.e. never-ending process, but more and more we know about the universe more and more ease we have in life and living. It has to be more of learner driven. The pedagogy may be teacher designed or learner designed, but for knowledge and learning it has to be essentially learner driven. Learner driven pedagogy demands experiential learning, in this process of conversing with the universe, there are both discovery and construction. Discovery involves recursive re-search, whereas construction demands germination of an idea, its incubation, creation and expression. Many approaches are on the fore for construction called constructivism. Many a models of constructivism have come up such as 5-E Model and 7-E Model, wherein the learners have

immersion into a particular domain called engagement, its exploration, explanation, elaboration and extension. Our existence becomes more meaningful when we do both, i.e. discovery and construction.

6. Some Illustrations of Constructivism

A. A Trainer Trains a Learner on Car Driving, particularly, on ABC, that is,

- Accelerator
- Brake &
- Clutch

Trainer driven and dependent pedagogy fails the learner, whereas, the learner driven pedagogy passes. Every learner has to experience accelerator, brake and clutch on ones own. Sooner the learner realizes independence better is the learning. Driving demands experiential learning.

B. Moving a static ball

A ball rolls and stops deep under a cot.

- A child hits the ball with another ball from outside.
- Both the balls roll out.

The learner driven pedagogy works very well, more so, because it has been designed, developed and implemented by the learner. There could be number of alternatives for solving the problem. But, the one where the learner has exercised discretion works very well.

C. Two beetles crossing a road rolling spherical seed

Two beetles were crossing a road breadth-wise rolling a spherical seed. They were having full hold of the seed. The Push, Pull, Momentum and Control, all, were marvelous. It was a highly fascinating stimulus for the passer by. The learners driven pedagogy worked very well.

D. Readymade Products: Learner Retardation

- Guides are readily available in the markets.
- Question banks with solutions are available.
- It has become customary to copy paste, without mental processing.

- Drill and Practice are negligible.

Experts driven pedagogy fails many a novice.

E. Programmed Learners

- Children are Programmed Round the Clock.
- Beauty of Childhood is Lost.
- Booming Energy of the Adolescents goes Stray.
- Vision of the Adults is Lost.
- There is rare Life in the Institutes of Education, but, added focus on life skills.

Where are we learners?

Dwindling Values and Institutions

- Degeneration of Values and Institutions
- Technological De-Schooling
- Mechanized Education

There is a felt need for Germination, Incubation, Innovation, Creation, Construction, and Connection.

Ways Out

- Technological De-Schooling
- Zero Lecture Program
- Participatory Approach of Problem Solving
- Activity Based learning
- Employing Models of Teaching
- Theory Building and Employing
- Employing Taxonomy of Educational Skills
- Constructivism and Connectivism
- Training Thinking
- Wholistic Learning

Features of Some of the Innovative Programs

- **Personalized Teacher Education (Devi Ahelya Viswa Vidyalaya)**
 - Choice of Volunteers
 - Learner Centered
 - Personalized Classroom Setting
 - Participatory Approach
 - ZLP
 - Freedom for what to study, how to study, when to study, where to study
 - Peer Teaching-Learning-Evaluation
 - Variety in the modes of presentation
 - Successive Discussions
 - Evaluation by Self, Peer & Teacher
 - Emergence of Humanistic & Professional Masters

- **Wholistic Teacher Education (Centre of Advanced Studies in Education)**
 - Subject Knowledge
 - Inter-disciplinarity
 - Environmental Attitude
 - Health development
 - Emotional development
 - Spiritual development
 - Integrated development
 - Universe Development Index (UDI)

- **Problem Solving through Participatory Approach (DAVV)**
 - The MCEd class, DAVV, Indore was very often given a problem to be solved through a computer program.
 - Number of different programmes would emerge from the entire class.
 - Each program was presented by one of the programmers to the rest of the class and rated by all the students on different criteria, namely, compactness of source code, fetch and execute cycle size, response time, memory used, programming discipline level and programme intelligibility.

- Also, the students developed programme to calculate Kendall's Coefficient of Concordance through 'C' language. They then computed Kendall's coefficient of concordance individual criterion wise and with respect to the comprehensive criteria.
 - There is a significant cognitive development through cognitively mapping the algorithms and solution to a problem. This approach cuts across students of varied profiles, simultaneously. Participatory approach may be introduced in various disciplines to enhance learning in all domains. It facilitates creative production and independent thinking. Also, it provides scope to experience and appreciate the cognitive maps of others.
- **Development of Creative Writing Ability Amongst Students Through Participatory Approach (CASE)**
 - Recitation of Model Poems by the Teacher in Class Situation
 - Appreciation of the poem by the class and identification of the various components of creative composition
 - Composition of a variety of poems by the students individually, and in groups
 - Recitation of the self composed poems by the classmates and appreciation by rest of the class
 - Participatory approach of creative writing facilitates expression of the latent creative faculties in terms of original production.

7. Learner-Driven Pedagogy with Constructivism

Here is a poem presenting learner driven pedagogy:

ABC of Learner Driven Pedagogy with Constructivism

Mere Trainer Driven Pedagogy Failed Me Grossly as a Learner Accelerator-Break-Clutch & Gear Was Full of Diffidence & Fear	Fully Learner Driven Pedagogy Passed Me Gracefully as a Learner Driving Easily in Any Direction With Confidence & Conviction
Driving demands knowledge of techniques Driving demands motor muscle skills Driving demands concept of space & time	Driving tunes with multivariate setting Driving rules with multiple controls Driving has its own methodology

Driving drives both body & mind	Driving has its own Science & Technology
Driving drives Self & Vehicle Driving derives concepts & principles Driving is full of arrays of Skills Slight Negligence Bumps Hurts & Kills	Driving demands a Taxonomy of Skills Compatible Drivers, Ways & Vehicles Whether driving Man or Machine Driving demands Wit Will & Skills
Pedals With or Against Currents Lift Thrust Ailerons & Rudder Pedals Let us Drive Hills-Valleys-Plains all the Ways Up-Down Back-Forth Left-Right All the Days	Replacement of SMPS Insertion of CMOS Fixing of RAM Fabrication of Chips Spring Tide Sun Moon Opposite Side Drive Universe with Wit Might & Delight
Clouds in the Sky Rains & Storms Dew Drops on Petals Sweat of the Workers	Salute to Thee for Thy Grace Resonating Drive Always All Ways Electrons in Orbits Ribosome in DNA All the Entities in Wonderful Constellation!

8. Connectivism

Connectivism is a hypothesis of learning which emphasizes the role of social and cultural context. Connectivism is often associated with and proposes a perspective similar to Vygotsky's 'zone of proximal development' (ZPD), an idea later transposed into Engeström's (2001) Activity Theory. The relationship between work experience, learning, and knowledge, as expressed in the concept of 'connectivity is central to connectivism, motivating the theory's name. It is somewhat similar to Bandura's Social Learning Theory that proposes that people learn through contact. The phrase "a learning theory for the digital age" indicates the emphasis that connectivism gives to technology's effect on how people live, communicate and learn. Those who struggle to create an adequate theory of learning must admit that the process is much like stumbling in the dark. So much of our thought structure is shaped by hidden assumptions evident in our existing learning and educational systems (Siemens, 2005).

Connectivism is a learning theory for the digital age. The theories of behaviourism, cognitivism, and constructivism provide an effect view of learning in many and related environments respectively. Connectivism basically postulates that learning occurs through connections within the networks. The Connectivism comprises of the networks with nodes and connections to define the learning. Constructivism highlighted on the construction of knowledge and meaning making activity and applying the known to the unknown. Here in Connectivism the generated knowledge gets networked with other new knowledge and the network develops and moves on. It is the Philosophy of learning where the Knowledge constructed consists of connections between entities in a network; also the learning consists of developing and traversing these networks. It asserts that knowledge and learning are of not completely the content but about the connections.

Behaviorism offers laws to govern behaviour that can inform a teacher's manipulation of the learning environment (including texts and activities) to promote learning, where knowledge is perceived as facts that can be transmitted from teacher to student. Cognitivism opens up the black box of the mind, regarding the learner as an information processor. Social constructivism in which it has an "ontology in which reality is subjective, a social product constructed and interpreted by learners. Hence social constructivism places a greater emphasis on the importance of social interactions in affecting the individual's generation of knowledge or facts about the world. The whole is greater than the sum of the parts, and knowledge becomes a cultural artefact, associated with groups within a specific context.

9. Nodes and links

The central aspect of Connectivism is the metaphor of a network with nodes and connections. In this metaphor, a node is anything that can be connected to another node such as an organization, information, data, feelings, and images. Connectivism sees learning as the process of creating connections and expanding or increasing network complexity. Not all connections are of equal strength. The idea of organisations as cognitive systems where knowledge is distributed across nodes originated from the Perceptron and is directly borrowed from Connectionism- a paradigm in cognitive sciences that sees mental or behavioral phenomena as the emergent processes of interconnected networks of simple units. The network metaphor allows a notion of "know-where" (the understanding of where to find the knowledge when it is needed) to supplement to the ones of "know-how" and "know-what"

that make the cornerstones of many theories of learning. As Downes states: "at its heart, connectivism is the thesis that knowledge is distributed across a network of connections, and therefore that learning consists of the ability to construct and traverse those networks".

10. History and Foundations of Connectivism

Connectivism was introduced in 2005 by two publications, Siemens' Connectivism: Learning as Network Creation and Downes' An Introduction to Connective Knowledge. Both works received significant attention in the blogosphere and an extended discourse has followed on the appropriateness of Connectivism as a learning theory for the digital age. In 2007 Kerr entered into a debate with a series of lectures and talks on the matter, as did Forster, both at the Online Connectivism Conference at the University of Manitoba. In 2008, in the context of digital and e-learning, Connectivism was reconsidered and its technological implications were discussed by Siemens' and Ally. Each and every idea has their own heritages; likewise the idea of the Connectivism too has the roots. Like language as a tool of learning in Social Constructivism of Lev Vygotsky, Social learning theory of Vygotsky, Bruner, Bandura's Self-efficacy, Network theories of Mathematics, Sociology and Physics.

11. Teaching Methods

Summarizing connectivist teaching and learning, Downes states: "to teach is to model and demonstrate, to learn is to practice and reflect." In 2008, Siemens and Downes delivered an online course called "Connectivism and Connective Knowledge". It covered Connectivism as content while attempting to implement some of their ideas. The course was free to anyone who wished to participate, and over 2000 people worldwide enrolled. The phrase "Massive Open Online Course " (MOOC) describes this model. All course content was available through RSS feeds, and learners could participate with their choice of tools: threaded discussions in Moodle, blog posts, Second Life and synchronous online meetings. The course was repeated in 2009 and in 2011.

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Connectivism is a learning theory for the digital age. Learning has transformed from the last several decades. The theories of behaviourism, cognitivism, and constructivism provide an effect view of learning in many and related environments respectively. Connectivism basically postulates that learning occurs through connections within the networks.

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12. Importance of Networks

According to Siemens, "considering technology and meaning-making as learning activities begins to move learning into the digital age" (2005). Inherent to this new viewpoint on learning is the idea that we can no longer personally experience everything there is to experience as we try to learn something new. We must create networks which, simply defined, are connections between entities. By using these networks - of people, of technology, of social structures, of systems, of power grids, etc. - learning communities can

share their ideas with others, thereby “cross-pollinating” the learning environment (Siemens, 2005).

Downes and Siemens have brought together their ideas on the use of networks in understanding learning on many levels in a theory called connectivism. Siemens sets a bold research agenda around the sharing of cognitive tasks between people and technology; coping with rapid change in the “information ecology”; and the impact of theories of networks, complexity, and chaos. He defines a network as connections between entities, which he calls nodes; the nodes can be individuals, groups, systems, fields, ideas, or communities. The networks are basically in two forms.

- Internally as neural networks (where knowledge is distributed across our brain, not held in its entirety in one location)
- Externally as networks we actively form (each node represents an element of specialization and the aggregate represent our ability to be aware of, learn, and adapt to the world around).

Downes draws the concept of Connectivism, as it has been used when applying ideas from biological models of the brain to neural networks in machine learning, treating the neural network as part of a whole. The overall view that a strongly interconnected neural network and its firing patterns must be considered as part of a whole became an important principle of orientation in the study of the nervous system; it is referred to under the name of connectivism (Gestzi, 1990).

Principles of Connectivism:

According to Siemen (2005)

- Knowledge and the learning rests in the diversity of opinions
- Learning is a process of connecting specialized nodes or information sources.
- Learning may reside in non-human appliances.
- Capacity to know more is more critical than what is currently known
- Nurturing and maintaining connections is needed to facilitate continual learning.
- Ability to see connections between fields, ideas, and concepts is a core skill.
- Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.

- Decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision.

A Comparison

Learning	Behaviourism	Cognitivism	Constructivism	Connectivism
How does learning occur	Observable behaviour main focus	Structured, computational	Social, meaning created by each learner	Distributed within a network, socially, technologically enhanced, recognising and interpreting patterns.
Factors influencing	Nature of Reward, Punishment, Stimuli	Existing Schema, Previous experience	Engagement, participation, social and cultural	Diversity of Network
Role of the memory	Memory is hardwiring of repeated experiences- where reward & punishment are most influential, Drill and practice, repeated experiences	Encoding, storage, Retrieval	Prior Knowledge remixed to current context	Adaptive patterns representative of current state, existing in networks
How does transfer occur	Stimulus Response	Duplicating Knowledge Constructs of “Knower”	Socialization	Connecting to other connections, adding nodes

Type of learning best explained	Task-based learning	Reasoning, Problem Solving	Socially Defined	Complex learning, diverse expansion of knowledge and knowledge sources.
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(Ireland, 2007)

Connectionist Skills

- Interpretation of units
- Activation of the network of units
- Learning Algorithm
- Recurrent Neural Networking
- Evolving continuous, dynamic systems approaches

Illustrations on Connectivism

- Learning Resources Management System
- Time-Space-Personnel Management System
- Consortium of Teacher Education
- Inter University Consortium (IUC)
- Global Educational Research Association (GERA)
- Indian Consortium of Research in Education (ICORE)
- Wholistic Education
- Taxonomy of Educational Skills
- Social Networking
- Management Information System Series
- Reflective dialoguing

13. Conclusion

In connectionism the starting point is always the individual learner (Siemens, 2005). The path to gaining knowledge comes through an individual, possibly with the assistance of others, establishing their own personal knowledge network of relevant information resources (e.g., valuable web sites, academic or professional journals, conferences, etc.) and information connections. These connections may consist of relationships with knowledgeable co-workers

or professional colleagues. Connectivism provides a new way of thinking about knowledge and learning in the context of emerging information technology and rapid change. Knowledge should no longer be considered a stable artifact to be passed from one person to another, but instead should be viewed as a process, always changing and growing. Connectivism provides the pathways for connecting dot to globe & point to morphology.