



# TAMIL NADU OPEN UNIVERSITY

## School of Education

### CERTIFICATE PROGRAMME ON BRAIN BASED LEARNING TECHNIQUES

This certificate programme aims to prepare people in all age groups, teachers, students and other professionals, equipped with the knowledge and skills for organising teaching and training with the help of appropriate technologies.

#### Programme Objectives

While studying the Certificate Programme, the student shall be able to:

- Knowledge and understanding the nature, structure of the Brain and its function;
- promote an awareness about the information processing in brain;
- develop the skills needed for making ideal use of concept formation and concept mapping
- enhance the theoretical backgrounds on cognition and metacognition

#### Programme Outcomes

After completion of the Certificate Programme, the student will be able to:

- practice appropriate "Brain Based Learning techniques"
- handle the curriculum with ease using BBL techniques;
- equip themselves to various information for learning;
- educate students with diverse needs and abilities effectively by using adaptive techniques;
- Inculcate the usage of BBL techniques to enhance learning.

**Eligibility** : Graduate in any discipline

**Medium of Instruction** : English.

**Duration** : Minimum 6 months and Maximum 1 year

**Fee Structure** : Rs. 1500 /-

#### Programme Details

COURSE CODE	COURSE TITLE	CREDITS
CBBL - 01	Structure and function of Brain	3
CBBL - 02	Information Processing in Brain	3
CBBL - 03	Theories of Learning and Cognitive strategies	3
<b>Total Credits</b>		<b>9</b>

**Examination System:** Theory Examinations will be conducted by the University in the Identified Centres. The assignment for each course should be submitted to the respective Learning Support Centres, which will be evaluated by the evaluators appointed by the University.

**Assignment for each Course**

**Assignment 1:**

Answer any one of the questions not exceeding 1000 words	Max – 15 Marks
Question 1	
Question 2	
Question 3	

**Assignment 2:**

Answer any one of the questions not exceeding 1000 words	Max – 15 Marks
Question 1	
Question 2	
Question 3	

**Theory Examination:** Students shall normally be allowed to appear for theory examination by completing Assignment. The Term-End Examination shall carry Sections: A, B and C.

Section-A	Very Short-Answer Questions [Each 3- Marks] Three out of Five Questions	3 x 3 = 9 Marks
Section-B	Short-Answer Questions [Each 7 - Marks] Three out of Five Questions	3 x 7 = 21 Marks
Section-C	Long-Answer Questions [Each 10- Marks] Four out of Seven Questions	4 x 7 = 40 Marks
<b>Total</b>		<b>70 Marks</b>

**Awarding Continuous Internal Assessment (Maximum 30 marks):**

Submission and Evaluation of Assignments:	<b>15 Marks (Compulsory)</b>
Attending in Academic Counselling Classes at LSCs/SCs	<b>15 Marks</b>

(50% of Attendance may be considered for maximum marks)	
<b>Total</b>	<b>30 Marks</b>

### **Scheme of Evaluation**

Continuous Internal Assessment	<b>30 Marks</b>
Theory Examinations	<b>70 Marks</b>
<b>Total</b>	<b>100 Marks</b>

**Passing Minimum:** The passing minimum is 25marks out off 70 marks in the external (Theory) Examination and minimum 10 marks out off 30 marks in the Continuous Internal Assessment (CIA), overall 40 percent for successful completion of each course.

**Classification of Successful Candidate:** Candidates who pass all the Courses and who secure 60 percent and above in the aggregate of marks will be placed in the first class. Those securing 50 percent and above but below 60 percent in the aggregate will be placed in the second class. Those securing 40 percent and above but below 50 percent in the aggregate will be placed in the third class.

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**Tamil Nadu Open University**  
**School of Education**  
**Chennai – 15**

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**COURSE TITLE** : **STRUCTURE AND FUNCTION OF BRAIN**

**COURSE CODE** : **CBBL - 01**

**COURSE CREDIT** : **3**

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**COURSE OBJECTIVES**

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While studying Brain Based Learning Techniques, the student shall be able to:

- develop the scope of BBL and its applications in learning;
  - Maximize the learning potential of a person
  - Improve the productivity of students and teachers through BBL and concept mapping techniques and information processing
  - to creating a classroom atmosphere that is capable of stimulating the student's ability to learn Morphology and Physiology of Brain.
  - to bring students in an environment that are pleasant enough;
  - create an atmosphere of active and meaningful for students with Long term and short term memory
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**COURSE OUTCOMES**

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After completion of Brain Based Learning Techniques, the student will be able to:

- enrich the theories and findings about brain development from an evolutionary perspective and the subdivision of the nervous system based on a skeleton map of the brain,
  - be able to locate important parts of the brain and function
  - promote Psychology of Learning, Long term and short term memory
  - know the knowledge about Hemisphericity and Memory
  - educate the Right and Left Brain : hemisphericity, Memory and Learning and Coding and Decoding
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**BLOCK 1**      **STRUCTURE AND FUNCTION OF BRAIN**

**UNIT – 1 –Brain – An Introduction**

Definitions of Brain - History of Brain - structure of brain - fact about Human-Brain - Nervous system - anatomy of Human Brain – parts of Human Brain - the architecture of brain – the Geography of thought and Brain Conditions.

## **UNIT – 2 – Morphology and Physiology of Brain**

Principle regions of brain: the cerebrum, the cerebellum, the pons and the Medulla – the layers of the brain and four lobes of the brain and function – functional area of the brain - lobes of the brain: Frontal lobe, parietal lobe occipital lobe – temporal lobe -Blood supply to Brain – Development of the Brain -

## **UNIT – 3 – Function of Brain**

Hearing ability – Memory acquisition – visual perception Categorization of Objects – co-ordination of voluntary movement, Balance and equilibrium and memory reflex motor - Location for visual attention -Location for touch perception - Goal directed voluntary movementsIntegration of different senses that allows for understanding a single concept

## **BLOCK 2 STRUCTURES AND FUNCTION OF NERVOUS SYSTEM**

### **UNIT – 4 – Introduction to Neurons**

Structure of neurons - The human nervous system - The Central Nervous System (CNS) – Peripheral Nervous System (PNS) - Classes of neurons : Sensory neurons, Motor neurons and Interneurons. The cellular foundations the nerve function: Types of nerve cells- functions- the Four lobes and their Functions.

### **UNIT – 5 – Structure and Function of Neurons**

Neuroanatomy: the nervous system, surrounding structures (skull, blood vessels, meninges, ventricles)-spinal cord, brainstem, cerebellum, midbrain, thalamus, basal ganglia, cortex. Part of neuron : axon dendrites – function of neuron chemical synopsis – electrical synopsis Types of neuron – sensory neuron-motor neuron - interneurons

### **UNIT – 6 – Neural networking and neurotransmitters**

Function of neuron - Basic morphological features of neurons - Resting potentials - Action potentials - Synaptic potentials and synaptic integration -Neuronal Networks - Micro network

## **BLOCK 3 INTRODUCTION TO BRAIN BASED LEARNING**

### **UNIT – 7 – Introduction to Brain Based Learning**

Brain based learning definitions – meaning - principles of brain based learning – instructional techniques associated with brain based learning - Orchestrated immersion - Relaxed alertness -

Active processing

### **UNIT – 8 – Psychology of Learning**

Meaning and Definition of learning – nature of learning – scope of learning - psychology of learning introduction – learning -behaviourism - classical conditioning – Operant conditioning - observational learning – influential people.

### **UNIT – 9 – Educational Implications of Brain based learning**

Principles of brain based learning - Functions of learning -why brain based learning – brain based instruction – how brain learn - what happened to the brain when brain learning takes place – benefits of brain based learning.

## **BLOCK 4 HEMISPHERICITY AND MEMORY**

### **UNIT – 10 – Right and Left Brain : Hemisphericity**

Right and Left brain – structure of Brain – role of Right and left brain – difference of right and left brain character of right and left brain – function of right and left brain – effect of learning in hemisphericity

### **UNIT – 11 – Memory and Learning**

Definition and meaning of memory and learning – sensory – short term memory – long term memory – different types of long term memory - role of memory in learning - theories of memory.

### **UNIT – 12 – Coding and Decoding**

Definition of coding and decoding – learning concepts - encoding – storing – retrieving – factors influencing coding: content factor, environmental factor and subjective factor.

## **BLOCK 5 THE BRAIN AND LEARNING**

### **UNIT – 13 – Introduction of Learning**

Definition of Learning - The Learning Process – What Is Learning - Types of Learning - Classical Conditioning - Operant Conditioning - Learning and Connotations - Learning with Cultural and Social Contexts - Teacher and Learning- learning and its Process of Organizing Knowledge, Information and Activities – learning and its Process in brain

### **UNIT – 14 – Long term and short-term memory**

Introduction to Long term and short-term memory – components of memory – conscious memory (also called **explicit or declarative memory**),

and Unconscious memory (also called **implicit or procedural memory**) –  
Single-store memory model - Dual-store memory model.

### **UNIT – 15 – Psychology of brain**

Introduction of brain science and cognitive psychology – application of brain  
science and cognitive psychology – consciousness and thinking – neuroplasticity -  
Brain control: thought feelings and behaviour – neuroplasticity.

#### **Suggesting Reading**

- **David Eagleman March 7, 2017** The Brain: The Story of You Paperback
- **Brown, A.L. (1997)**. Transforming schools into communities of thinking and learning about serious matters. American Psychologist, 52(4),399-413.
- **Jensen, E.P. 2008** Brain-Based Learning: The New Paradigm of Teaching, 2nd Edition. San Diego, CA: Corwin Press. ISBN: 9781412962568 4.
- **Sousa, D. 1998-2011** How the Brain learns (with learning manual). Thousand Oaks, CA: Corwin Press Incorporated.
- **Ozden, M., and M. Gultekin. 2008**. "The Effects of Brain-based Learning." Electronic Journal of Science Education 12 (1). Pickering,
- [www.elementarymatters.com/.../ten-brain-based-learning-strategies.html](http://www.elementarymatters.com/.../ten-brain-based-learning-strategies.html)
- [www.funderstanding.com](http://www.funderstanding.com)

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**COURSE TITLE** : **INFORMATION PROCESSING IN BRAIN**  
**COURSE CODE** : **CBBL-02**  
**COURSE CREDIT** : **3**

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**COURSE OBJECTIVES**

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While studying Brain Based Learning Techniques, the student shall be able to:

- develop the scope of BBL and its applications in learning;
- Maximize the learning potential of a person
- Minimize learning losses and wasted effort
- to creating a classroom atmosphere that is capable of stimulating the student's ability to think;
- to bring students in an environment that are pleasant enough;
- create an atmosphere of active and meaningful for students

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**COURSE OUTCOMES**

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After completion of Brain Based Learning Techniques, the student, will be able to:

- enrich his/her knowledge on role of BBL Techniques and its applications in teaching and learning;
- Learning engages the entire physiology.
- To understand the brain processes parts and wholes simultaneously.
- Retrieve and remember best when facts and skills are embedded in natural, spatial memory.
- Realise each brain is unique and its information processing.
- practice the ways and means of concept formation, mapping and theories
- educate the children with learning applications of BBL techniques through online and offline
- Promote the process of using the application BBL techniques for teaching & learning process, memory, retrieve and remember based on how information stored in the brain.

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**BLOCK 1 INTRODUCTION OF INFORMATION PROCESSING**  
**UNIT – 1 –Introduction of Information Processing**

Definition of information processing – stages of information process: attending, encoding, storing and retrieving - stages of memory: sensory short-term and long-term - information processing theory – creating memories by using different stimuli – role of short-term (working ) memory – encoding information in to long-term memory – limitations and benefits of Information processing.

### **UNIT – 2 – The introduction of brain-based learning**

Brain based learning definition - principles of brain-based learning - reactive brain : Teaching strategies that promote optimal functioning - reflective brain: Teaching strategies that support executive functioning – role of cerebral cortex and leaning – brain-based education and neuroscience - Plasticity in the brain and Pruning.

### **UNIT – 3 – The types information processing in brain**

Vertical/ horizontal information processing - centralised/ decentralised information processing - Computation - structure of neocortex - computing in retina – optical image of brain – information processing in brain - connectome – learning in cortex.

## **BLOCK 2 INFORMATION PROCESSING IN BRAIN**

### **UNIT – 4 – various activation functions in neural networks**

Definitions of neural networking – use of activation function - Types of activation functions in neural network: sigmoid, TanH and Rectified Linear Unit (ReLU) - Linear Activation Function - Non-linear Activation Functions – activation function in deep learning - activation function in neural networks- activation functions and layers.

### **UNIT – 5 – Perception and Concept of Single Neuron**

Definition of perception – perception, learning and memory – mapping the brain - neural networking – sense and single neuron: the physiology of perception – neuronal potentials- single neuron correlation of conscious perception – perception and recognition -physiological approach – brain: ‘The mind’s computer’ – neurons and receptive field.

### **UNIT – 6 – Input, Storage Output of information in brain**

brain network system - electric impulses: dendrites, axon and synapse – brain function: Input, out put, storage, processor and programme – analysing brain

network system – the structural connectivity of the brain – the functional connectivity of the brain - effective connectivity of the brain – the different type of brain network system.

### **BLOCK 3 BRAIN BASED LEARNING PROCESS**

#### **UNIT – 7 – Theories of Learning and information process**

Theories of learning -Information Processing - Information Processing Theory - Information Processing Model - Cognitive Psychology - Cognitive Theory - Cognitive Information Processing

#### **UNIT – 8 – Brain based learning theories and process**

What is brain based learning – BBL goal and outcome –Construal Level spectrum (CL) -Sensory integration - The Transfer effect: Priming, Fun, Engagement, Curiosity, and Positive moods – BBL strategies: Mental Models, Models, and Metaphors -Meta-cognition, language, and inquiry

BBL theory :Behaviorism, Cognitivism, Constructivism, Humanism and Connectivism.

#### **UNIT – 9 - Introduction of Cognition, Metacognition and Neurocognition**

Definition of cognition, metacognition and neurocognition - history of cognition – cognitive neuro psychology - Psychological processes- Emergence of different approaches to cognitive psychology information procession- connectionism & ecological perspective.

### **BLOCK 4 MEMORY AND LEARNING**

#### **UNIT – 10 – the various memory systems and how they influence learning.**

Role Of Memory In Learning: encoding , storing and retrieving - Learning factors : Content factors, Environmental factors and Subjective factors – enhancing memory

#### **UNIT – 11 – perception of learning rules**

Learning Rules - Perceptron Architecture - Single-Neuron Perceptron - Multiple-Neuron Perceptron - Perceptron Learning Rule - Constructing Learning Rules - Unified Learning Rule - Multiple-Neuron Perceptron

#### **UNIT – 12 – encoding strategies to facilitate storage and retrieval**

The Stages of the Learning/Memory Process – stages of memory – encoding, storage and retrieval – memory encoding types: Visual (picture), Acoustic (sound), elaborative, Semantic (meaning) and other - memory storage - memory retrieval – long term potentiation: mapping activity – molecular perspective : synaptic plasticity, encoding process and encoding and genetics.

## **BLOCK 5      BRAIN ORGANIZATION AND FUNCTION**

### **UNIT – 13 – Hemispheric dominance and its impact on teaching and learning**

Definition of Hemispheric dominance - Left versus Right Brain Thinking. Left and Right Hemisphere Information Processing – role of right brain – role of left brain – the left/right brain theory – left/right brain dominance

### **UNIT – 14 – Concept formation and process**

Cognition Categories and Concepts Natural and Artificial Concepts Schemata – neuron communication- plasticity and adaptability – biology of learning and through processing –Defining concepts -construction of concepts -concept map - concept formation- promoting conceptual change.

### **UNIT – 15 – Concept mapping and mind mapping**

Definition of concept mapping -concept map in science education – kinds of concept maps—purpose of concept mapping – construction of concept mapping - importance of concept mapping—cognitive map - mind mapping – application and need of concept mapping.

## **Suggesting Reading**

- **Armstrong, T.2009.** Multiple Intelligences in the Classroom. 3rd ed. Alexandria, Va.: Association for Supervision and Curriculum Development.
- **Caine, R., et.al.. 2009.** 12 Brain/Mind Learning Principles in Action: Developing Executive Functions of the Human Brain. Thousands Oaks, Calif.: Corwin Press.
- **Gunzelmann, B. 2009.** "New Administration/New Possibilities: Research-based Education for Equality and Excellence." Educational Horizons (Fall).
- **Rogers, et.al. (1999).** "Using information-processing theory to understand planning/Performance relationships in the context of strategy". Strategic Management Journal. **20** (6): 567–577.
- **Miller, George A. (2003).** "The cognitive revolution: A historical perspective". Trends in Cognitive Sciences. **7** (3): 141–144.

- **Miller, F. Et.al. 2010.** Executive functions: Psychology, neuroscience, brain, attention, cognitive neuropsychology, nonverbal learning disorder, working memory, frontal lobe.
- **Degen, R. J. 2011.** Review of the current knowledge of brain- /mind-based learning to present the optimum climate for, and the guided experience approach to teaching.

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**COURSE TITLE** : **THEORIES OF LEARNING AND COGNITIVE STRATEGIES**  
**COURSE CODE** : **CBBL-03**  
**COURSE CREDIT** : **3**

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**COURSE OBJECTIVES**

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While studying Brain Based Learning Techniques, the student shall be able to:

- develop the scope of BBL and its applications in learning;
- Maximize the learning potential of a person
- Minimize learning losses and wasted effort
- Improve the productivity of students and teachers through BBL and concept mapping techniques and theories
- to bring students in an environment that are pleasant enough;
- create an atmosphere of active and meaningful for students

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**COURSE OUTCOMES**

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After completion of Brain Based Learning Techniques, the student will be able to:

- enrich his/her knowledge on role of BBL Techniques and its applications in teaching and learning;
- Learning engages the learning theories.
- Know the knowledge on cognitive theories and Cognitive strategies
- Retrieve and remember best when facts and skills are embedded in natural, spatial memory.

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**BLOCK 1 THE BRAIN BASED LEARNING THEORIES**

**UNIT – 1 – Theories of learning**

Definition of learning – nature of learning – learning theories: jean Piaget  
learning theory – Jerome s. Bruner theory of learning

**UNIT – 2 – Brain based learning theory**

Ausubel's reception theory – Bernard Weiner attribution theory – schema theory  
- Edward Tolman cognitive learning - Guthrie's theories of learning by cognition.

**UNIT – 3 – Brain based learning strategy**

Construal Level spectrum (CL): Real-time monitoring of changes ( movement, mental awareness, sensory inputs) - Outcome-based feedback –Introspective feedback - Sensory integration-The Transfer effect.

## **BLOCK 2 INFORMATION PROCESSING THEORIES**

### **UNIT – 4- Information processing theory**

George Armitage Miller - Atkinson and Shiffrin Model - Sensory Memory - Short-Term Memory - Long Term Memory - Baddeley and Hitch Model of Working Memory: Central Executive, Phonological Loop, Visuospatial Sketch Pad and Episodic Buffer.

### **UNIT – 5-Applications of Information Processing in Learning**

Brain biology – human memory - information processing stages – assimilation and absorption – function of information processing: sensory, working and long-term memory - application of information processing.

### **UNIT – 6 - Information Processing Model**

The information processing models assume serial processing of stimulus inputs - Human cognition and computer functioning – theories/ models of attention - information in cognition -level of processing Craik and Lockhart (1972), Dual Coding Theory Clark et.al. and schema theory Rumelhart.

## **BLOCK 3 NEURAL NETWORKS**

### **UNIT– 7 - Introduction to Neural networks**

Definition of neural networks – deep learning - artificial neural networks – deep neural networks – application of neural networks: speech recognition, image recognition, visual art processing, natural language processing etc.

### **UNIT – 8- Cognition and Psychology**

Definition of cognition and psychology cognition: meaning, categorize and concepts, and concepts and photo types – cognitive process – attention – memory – perception – language and metacognition.

### **UNIT – 9- The Impact of Cognitive Psychology**

Social Cognition: Thinking and Learning about Others - Social Affect: Feelings about Ourselves and Others - Social Behavior: Interacting with Others

## **BLOCK 4 CONCEPT MAPPING AND LEARNING**

### **UNIT – 10-Importance of Memories and Retrieval**

Memory Retrieval Basics : Recall, Recollection, Recognition and Relearning - Problems With Memory Retrieval - Sensory memory - Short-term memory-3Long-term memory-Multi-store model-Working memory – types of memory : information, declarative, temporal direction, free recall, cued recall and serial recall – neuro anatomy – factor that affect recall: attention, motivation and interference etc.

### **UNIT – 11- Concept mapping strategies**

Definition of concept mapping – purpose of concept mapping constructivism -use of concept mapping – significance of concept mapping – procedure and variation of concept mapping.

### **UNIT – 12- Encoding and decoding strategies and theories.**

Application of model - Three positions upon decoding messages - Dominant/hegemonic position - Negotiated position - Oppositional position - The encoding/decoding model critique

## **BLOCK 5 COGNITIVE AND METACOGNITIVE THEORIES IN LEARNING**

### **UNIT – 13- Theories of Cognition In Learning**

Piaget: cognitive development theory – Vygotsky: cognitive development theory- Bandura: socio cognitive theory- Anderson's ACT theory and schema theory.

### **UNIT – 14-Theories of Metacognition in learning**

Flavell : metacognitive knowledge -Ann Leslie Brown: metacognitive theories - Michael Pressley meta cognitive theories.

### **UNIT – 15-Theories of Neurocognition in learning**

Neurocognitive Learning Theory (Roger Anderson O, 2009) Brandoni and Anderson Neurocognitive Model for Assessing Divergent Thinking. Contextual-Label-Pointer" (CLP) by Anderson and middle-ground Neuro educational theory

### **Suggesting Reading**

- **Illeris, Knud (2004).** The three dimensions of learning. Malabar, Fla: Krieger Pub. Co.
- **Ormrod, Jeanne (2012).** Human learning (6th ed.). Boston: Pearson. ISBN 9780132595186.

- **Dearden, R. F. (2012).** Theory and Practice in Education (RLE Edu K). Oxon: Routledge. p. 71. ISBN 978-0-415-69722-4.
- **Smith, M.K.** "Learning Theory, the encyclopedia of informal education". theencyclopedia of informal education. Retrieved 6 July 2011.
- **Yang, L., Hanneke, S., & Carbonell, J.** A Theory of Transfer Learning with Applications to Active Learning. Carnegie Mellon University.
- **Perkins, D. (1992).** Transfer of Learning. International Encyclopedia of Education, 2. Retrieved March 23, 2015
- **Armstrong, T. 2009.** Multiple Intelligences in the Classroom. 3rd ed. Alexandria, Va.: Association for Supervision and Curriculum Development.
- **Caine, R., et.al.. 2009.** 12 Brain/Mind Learning Principles in Action: Developing Executive Functions of the Human Brain. Thousands Oaks, Calif.: Corwin Press.
- **Rastelli, S (2018)**Neurolinguistics and second language teaching: A view from the crossroads. 103–123. education 12 (1). Pickering,
- **Jensen, E.P. 2008** Brain-Based Learning: The New Paradigm of Teaching, 2nd Edition. San Diego, CA: Corwin Press. ISBN: 9781412962568 4.
- **Sousa, D. 1998-2011** How the Brain Learns (with learning manual). Thousand Oaks, CA: Corwin Press Incorporated.

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