



LEARNING THEORIES, NEUROPHYSIOLOGICAL FOUNDATIONS AND STRATEGY-BASED SUPPORT FOR LEARNERS WITH LEARNING DIFFICULTIES: A LITERATURE REVIEW

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Abstract:

Learning is a lifelong, experience-driven process that transforms knowledge and behavior and reflects adaptation to environmental regularities. Learning may occur without immediately observable behavioral change, making conceptual clarity essential for research. The review synthesizes major learning theories: behaviorism (reinforcement/contiguity), connectionism (stimulus–response bonds via trial and error), and classical conditioning; cognitive and constructivist accounts emphasizing perception, memory and active knowledge construction (Piaget, Vygotsky, Bruner); social learning through observation and intrinsic reinforcement; sociocultural views of learning as participation in communities of knowledge; and humanistic perspectives highlighting learner agency and the teacher as facilitator. It also contrasts teacher-centered and learner-centered instructional models, noting the contemporary shift toward learner-centered practice to address individual differences in aptitude, motivation, and prior experience. Finally, it refers to neurophysiological foundations, memory processes and age-related changes, mnemonic strategies, and implications for supporting learners with learning difficulties through individualized and adaptive instruction to improve memorization and educational outcomes.

Keywords: learning theories, cognitive psychology, sociocultural theory, instructional models, mnemonic strategies, learning difficulties, literature review

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1. Introduction

Every stage in an individual's life is being moulded to bring multiple modifications in knowledge and behavior through the continuous transforming process of learning. Learning is about a change brought about either by developing a new skill or by understanding a notion, and even by changing an attitude (LeCun *et al.*, 2015). Changes in behavior and knowledge are initiated by experiences gained through the individual's interaction with the surrounding environment and its people (Behrens *et al.*, 2018).

Learning has been a central topic in both educational and psychological research and is one of the most intensely studied areas. Learning has been functionally defined as the outcome of multiple changes that result from experience. It is an ontogenetic adaptation that derives from regularities observed in the environment surrounding an individual. A variety of mental mechanisms mediate learning and therefore learning is seen as a function that maps experience onto behavior (Friston *et al.*, 2016).

Learning occurring in any developmental stage is an act towards obtaining experiences, skills, values and knowledge in order to conceptualize and synthesize different types of information. Identifying a person's needs is a main fundamental step during the process of learning and may enable the evaluation of the learning process. Therefore, understanding of an individual's perceptions involves multiple educational and psychological methods in an attempt to cover affective, cognitive and conative domains of human knowledge and behavior (Garbacz *et al.*, 2014). Motivation, aspiration and aptitude among different learners may also differ, leading to multiple distinctive results of the learning process. It is undeniable that learning is most effective when these differences are taken into account (Behrens *et al.*, 2018).

Educators should apply pertinent techniques and must employ applicable methods of teaching, such as learner-centered or teacher-centered strategies, in order to enable learners to meet their educational needs (Lerikkanen *et al.*, 2016). It is the passion of the teachers that can strongly motivate the developmental needs of the learners and will help them to overcome obstacles which appear during the process of achieving the aims of learning (Klein *et al.*, 2010). Evidence also suggests that the effectiveness of teaching is strengthened when instructional practices are grounded in scientifically validated interventions and adapted to the educational needs of different groups of learners (Tsesmeli & Skarmoutsou, 2023). Within this context, instructional adaptations that take into account students' cognitive characteristics have been associated with improved conceptual understanding among both typically developing students and students with autism spectrum disorder (Kaliampou *et al.*, 2021). Moreover, inquiry-based approaches, such as the Inquiry-Based Science Education (IBSE) framework, offer a pedagogical basis for planning inclusive science instruction that promotes active participation and supports learning among autistic students (Kaliampou *et al.*, 2025).

Against this background, the present article aims to provide an overview of the principal theoretical perspectives and educational frameworks that have informed the development of interventions for students with learning disabilities. Drawing on

evidence from educational and psychological research, it seeks to highlight the key principles underlying the planning and implementation of effective educational practices that address the diverse learning needs of these students. Given the scope of the article, the discussion necessarily relies on a degree of conceptual simplification. While this approach facilitates a concise synthesis of broad and multifaceted fields of knowledge, it inevitably entails a selective and schematic presentation of theoretical perspectives and research findings.

2. Methodological Approach

The literature review was based on the analysis of texts and foundational theoretical works presenting research on learning processes, cognitive psychology, neurophysiological mechanisms, and educational interventions for learners with difficulties. The synthesis was carried out by reviewing major theoretical perspectives (behavioral, cognitive, sociocultural, humanistic) as well as empirical studies on instructional models, memory, mnemonic strategies, and neurophysiological functions. The literature was categorized and analyzed based on the main focus of each theoretical framework and its implications for individualized and adaptive instruction.

3. Literature Review

The findings of the literature review are presented at three distinct levels: first, the foundational theoretical perspectives on learning and instructional models; second, the neurophysiological foundations and environmental modulators; and third, memory functions, learning strategies, and intervention approaches for learners with learning difficulties.

3.1. Major Theoretical Perspectives on Learning and Instructional Models

The mechanisms of behavior involved in the process of learning can be analyzed and explained through various formulated Theories of Learning (Iwamoto *et al.*, 2017).

3.1.1. Behaviorism, Connectionism, and Classical Conditioning

According to the behaviorist perspective, three main assumptions emerge regarding the learning procedure. Learning is considered to be mostly a process focused on a distinctively observed change of behavior and less on an internal modification. Therefore, an external change in behavior has to be detected to imply that learning has occurred. Additionally, the environment is presented as the major element of modification rather than individual characteristics. Central to this view are the principles of reinforcement and contiguity (Rimm-Kaufman *et al.*, 2009). Connectionism, founded by E.L. Thorndike, proposes that learning associates sense to personal impressions through trial and error, establishing bonds between stimuli and responses without necessary mediation by thinking or reasoning (Iwamoto *et al.*, 2017; Tohidi & Jabbari, 2012). Furthermore, I.

Pavlov proposed classical conditioning, where connections are created between neutral stimuli and natural responses (Lovibond & Shanks, 2002).

3.1.2. Cognitive, Constructivist, Social, and Humanistic Perspectives

Cognitive psychology differentiates strongly from behaviorism by proposing that learning is based on perception, thoughts, and memory (Bjorklund, 2018). Constructivist theory posits that learners actively construct new ideas based on pre-existing knowledge (Fernando & Marikar, 2017). Bruner's discovery learning emphasizes active inquiry where educational content is structured to match the learner's abilities (Dorgu, 2015). Piaget described learning as a dynamic process of successive stages of perceiving reality, driven by equilibration through assimilation and accommodation (Bjorklund, 2018; Lourenço, 2016). Social learning theory introduces the concept that knowledge acquisition occurs via observation of others and intrinsic reinforcement (Cook & Artino, 2016), whereas Vygotsky's sociocultural view emphasizes social interaction and integration into a knowledge community (Vygotsky, 2004). Finally, humanistic perspectives highlight the learner's natural desire to learn and maintain control over the process, positioning the teacher as a facilitator (Gawronski & Bodenhausen, 2006; Perry *et al.*, 2002).

3.1.3. Instructional Models in Education

Two major instructional models dominate the educational field: the teacher-centered model and the learner-centered model (McLeskey & Waldron, 2004). In the traditional teacher-centered approach, the teacher acts as the primary source of information (Dorgu, 2015). Contemporary practice has shifted toward learner-centered models, where learners play an active role in knowledge acquisition through active interaction, building upon their prior experiences (Lerkkanen *et al.*, 2016; Tohidi & Jabbari, 2012).

3.2. Neurophysiological Foundations and Modulators of Learning

Learning involves the neurophysiological establishment of stable connections (synapses) between neurons within the specialized structures of the brain, such as the frontal lobe, which coordinates thinking, decision-making, planning, problem-solving, and speech (Friston *et al.*, 2016). However, neural activity is heavily modulated by psychological and environmental factors (Ryan & Deci, 2000). Cognitive structures, experiences, and awareness differ among individual learners, underscoring the critical need for personalized teaching that accounts for learner diversity (Garbacz *et al.*, 2014).

3.3. Memory Processes, Strategies, and Support for Learning Difficulties

Learning strategies aim to optimize learners' cognitive behavior and problem-solving capacity during instruction (Broström *et al.*, 2014). Rather than remaining locked within teacher resources, strategies should be passed to learners to foster self-regulation, strategy evaluation, and self-confidence (Iwamoto *et al.*, 2017; Lerkkanen *et al.*, 2016).

3.4. Memory and Mnemonic Strategies

Mnemonic strategies are systematic procedures designed to enhance encoding and facilitate information retrieval (McGrath & Hughes, 2017). Memory processes vary across age groups; age-related decreases in processing speed can lead to deficits caused by altered processing pathways in memory networks (Hedden *et al.*, 2005; Nyberg *et al.*, 2012). In severe cases, memory deficiencies present as complex syndromes affecting attention to detail, alertness, organization, and specific detail recall (Boyle *et al.*, 2015).

3.5. Implications for Intervention in Learners with Learning Difficulties

Students with learning difficulties integrated into regular classrooms often face challenges in memorization and require specialized materials and strategy instruction (Crockett *et al.*, 2012). Memory capacity is enhanced through practice, repetition, and sustained motivation (Plasman & Gottfried, 2016). Teachers play an essential role in maintaining focus and motivation, helping students overcome learning barriers (Durkin *et al.*, 2014). Because learning is self-regulated and depends on individual characteristics, personalizing instructional strategies, applying empathy, and making dynamic adjustments based on teacher-learner interactions are crucial for improving educational outcomes (Ehsan *et al.*, 2018; Gupta & Sharma, 2017; Sormunen *et al.*, 2020; Spektor-Levy & Yifrach, 2017).

4. Discussion

Drawing from relevant literature, this synthesis captures the theoretical frameworks, neurophysiological bases, and pedagogical strategies surrounding human learning and learning difficulties. Learning is a multifactorial and dynamic process encompassing cognitive, affective, and sociocultural mechanisms. The review shows that no single theoretical framework is sufficient to explain the total complexity of learning. Instead, a shift toward learner-centered practices, supported by neurophysiological insights, allows educators to address individual differences in aptitude, prior experience, and memory functioning. Mnemonic strategies and individualized instruction emerge as vital tools to foster self-regulation and support information processing, particularly for learners with learning difficulties. Pedagogical differentiation, personalized learning environments, and sustained teacher-learner interactions represent essential conditions for meaningful educational support and improved learning outcomes.

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Conflict of Interest Statement

The authors declare no conflicts of interest.

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