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Chapter

Cognitive Learning Theory and Development: Higher Education Case Study

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Abstract

Cognitive skills facilitate thinking, reading, and learning, as well as retaining information, reasoning, and responding. Theories of cognitive development attempt to explain how humans develop and change from infancy to old age. Cognitive control suppresses inappropriate habitual actions simultaneously by choosing thoughts, emotions, and behaviors to meet task demands. This chapter is a compilation of major theories on cognitive development, both earlier and contemporary. A longitudinal study was conducted at Mazoon College, Sultanate of Oman. Six different sections of the authors' own classes were chosen as subjects of study to include 176 students (mixed ability learners) who were taking preparatory English language courses for bachelor's degrees. Over three semesters, 14 months of data were collected. During reading and writing exercises, learners were required to abstract, think, hypothesize, and draw conclusions. Experimental and control groups were compared in this study. The results of the research found that it is beneficial for learners to take courses that link to their cognitive abilities, as this will help them to develop more positively. Study results confirm that studying provides opportunities to develop new skills and broaden one's knowledge base. Student thoughts on learning and achievement are evoked by English as a second language.

Keywords: control functions, cognitive development, longitudinal study, cognitive development in higher education

1. Introduction

1.1 Cognitive control functions

Cognitive skills facilitate thinking, reading, learning, retaining information, reasoning, and paying attention as core functions of the brain. Collectively, they work to take incoming information and add it to the bank of knowledge that they use every day at school, work, and in everyday life. Cognitive skills are used in problem-solving, remembering information, and making decisions. In cognitive control, thoughts, emotions, and behaviors are intentionally chosen based on task demands,

circumstances, and social context to suppress inappropriate habitual actions simultaneously [1]. Three key areas have been identified in the study of cognitive control functions: working memory, inhibitory control, and cognitive flexibility to accomplish certain tasks.

Working memory is the ability to retain information, and one must be able to recall information from working memory to complete academic tasks. As an example, consider a student who is reading a narrative text. If that student is unable to grasp the gist of the story as it unfolds, they will not be able to read it successfully, and they will not enjoy the reading experience. There is a possibility that they might end up losing the thread of the story altogether. This is because they have to return to the beginning of a sentence, paragraph, or page quite frequently. They must develop reading fluency to become effective readers, and in order to achieve this goal, they must have a well-functioning working memory. Conversations should be conducted in the same manner. Learners are likely to experience confusion or even a breakdown in communication if a question is asked, and then the answer is not remembered. This is because of the effort necessary to understand the response.

According to Tiego et al. [2], inhibitory control involves the suppression of stimuli and behaviors that are irrelevant to the goal's attainment. Attention, especially in the face of distractions, and control over one's emotional and behavioral responses to diverse stimuli are very important to accomplishing a task or achieving a goal. Consider a situation in which a student is engaged in a writing task when he or she is interrupted in their work by another student, noise, or some other disturbance from around them. Inhibitory control skills are important to deal with the irritation successfully and continue with their work by ignoring the interruptions rather than losing track of their work. Developing inhibitory control skills is essential for dealing with irritation effectively. To be able to continue working quickly, they need to be able to ignore interruptions rather than lose track of their task.

The third aspect of the cognitive control function is cognitive flexibility, which refers to the ability to solve problems effectively. This is a multifaceted approach that enables students to think outside the box, think creatively, and adapt to changing environments. To think creatively without cognitive flexibility is impossible. To effectively communicate, students must be able to use language in accordance with the circumstances of the environment instead of exchanging prefabricated phrases. They will have to create sentences that they have never heard or seen before. In responding to the conversation of another person, they will need to react flexibly, creatively, and spontaneously. Therefore, they need to use repair strategies to support the process of communication to eliminate any misunderstanding, especially if they or their converser have difficulties comprehending. They need to be able to ask their interlocutor to repeat in order to paraphrase what has been said. Therefore, one must be able to change the course of the dialog flexibly to avoid being stuck.

According to Dawson and Guare [3], cognitive control is a function developed in the brain of the learner. Under the influence of others and the environment, cognitive and linguistic skills develop over time. Therefore, the learning environment and teaching play a crucial role in the development of these skills. Unlike motor control functions, cognitive control functions appear to be interrelated rather than used in isolation. There is often a correlation between working memory and inhibitory control (teachers usually notice that students who are proficient at concentrating and do not easily get distracted tend to also have better working memory).

Best and Miller [4] argue that working memory skills and the ability to control inhibitions are significant skills in cognitive flexibility.

2. Development of cognitive control

It is only through thinking, exploring, and solving problems that learners can acquire knowledge. By thinking about and understanding their surroundings, students develop knowledge, skills, problem-solving abilities, and dispositions. From a neurological perspective, brain development is part of cognitive development. Learning novel concepts and making connections between them is facilitated by building upon previous knowledge and ideas. Students can approach coursework with enthusiasm and confidence when they have a thorough understanding of topics and strong learning skills. Learning in college requires students to be able to read, understand, remember, write, think, analyze, and solve problems. To function effectively, these cognitive skills must be combined. Cognitive skills contribute to the enhancement of academic performance. Through three transactions, students gain an increasing ability to overcome habits. At first, they develop cognitive control in response to environmental stimuli. Later, cognitive control is applied both reactively and proactively. Lastly, learners become more self-directed rather than dependent on environmental cues to engage in cognitive control. The following factors, however, influence the development of cognitive control.

3. Influence of language learning

A study by Morales et al. [5] compared the performance of monolingual children and bilingual children on working memory tests. The results indicated that bilingual children performed better than monolingual children in these tasks. Bilingual children are more likely to perform these tasks successfully due to their ability to deal with “other executive function demands.” It appears that bilingual children outperformed monolingual children on these tasks. Bilingual children are more likely to perform these tasks successfully due to their ability to deal with “other executive function demands.” In the development of bilingualism, cognitive control may play a role in proficiency outcomes. It is because what we think becomes what we communicate, and what we communicate can lead to creative ideas. An immersive approach appears to improve functions, such as attention and mental alertness, in individuals who are learning a new language.

4. The influence of stress and anxiety

Stress makes students more likely to fail, make mistakes, and perform poorly on tests, especially if they fear failure and mistakes. Students may find stress to be one of the most powerful deterrents to learning, regardless of the source of the stress. Students’ self-talk while performing a task is often dominated by worries, which leads to less achievement. This is because students are involved in a process that reduces their working memory capacity and their ability to solve problems [6]. It is like what happens when students have unrealistically high expectations of themselves and strive to achieve perfection—their working memory is occupied with self-worry, limiting their ability to process information. The working memory of students in both situations is occupied either with negative self-talk or worries about possibly not being able to meet their high standards.

5. The influence of emotional engagement

Whether training in cognitive control functions will or will not be successful depends on the degree of emotional engagement. A learner's strong belief in their own engagement, their feelings of excitement, their sense of challenge, and their sense of achievement, as well as their sense that a particular activity is meaningful to them, are essential aspects of essentials. Emotional investment is essential to ensuring that a learner feels committed to an activity. They devote a significant amount of time and effort to this endeavor. Learning activities in the classroom are exciting and fulfilling, which contribute to the development of cognitive control. An activity's method of execution is crucial to this critical act. Therefore, the attitude of teachers is essential in making activities meaningful and engaging while allowing their students to make progress.

6. Theoretical perspective of cognitive learning

Thinking and reasoning abilities are developed through cognitive development. An understanding of human learning, socialization, and behavior is based on cognitive theory, which examines the internal workings of the brain. Information processing is an incredibly relevant topic for cognitive theorists. As children develop cognitively, they become capable of thinking about the world around them. Cognitive development can be influenced by everyday experiences. Cognitive development is initially considered through Piaget's stages, which correspond to certain ages. The Vygotsky theory is another significant contribution. His focus was on factors affecting cognitive development. This theory emphasizes that the social environment contributes significantly to cognitive development.

7. Jean Piaget's theory

Learning processes throughout the world has been profoundly impacted by Jean Piaget's theory of cognitive development. According to Jean Piaget's theory (1919), as cited by Miller [7], *"children's intelligence undergoes changes as they grow."* and *"Cognitive development in children is not only related to acquiring knowledge; children also need to build or develop a mental model of their surrounding world."* Hence, cognitive abilities are continually developed, with later abilities building on earlier ones. Children engage in different types of thinking in their formative years. According to Piaget, learning occurs because of the integration of new experiences with prior knowledge and newly acquired knowledge with previous experiences. Consequently, these two processes combine to create not only short-term learning but long-term developmental changes as well. Piaget's cognitive theory focuses primarily on long-term developments. From the time of birth through the end of adolescence, cognition develops according to distinct stages. The four key features of his "stages" are:

1. There is always a set order for the stages.
2. There is never a skip in a stage.

3. At each stage, the stage before it undergoes a significant transformation.

It is the later stages that incorporate the earlier stages.

8. The road map of cognitive development

Learning about the world requires children to be able to anticipate how objects and people will interact with one another. Human perception and comprehension of the environment are influenced by social interaction patterns. Iterative perception leads to an increase in one's world knowledge. A development link is the assimilation process, followed by the accommodation process. Based on Piaget's (1936) argument, learning is related to "equilibration objects and people will interact with one another". Human perception and comprehension of the environment are influenced by social interaction patterns. Iterative perception leads to an increase in one's world knowledge. A development link is the assimilation process, followed by the accommodation process.

Assimilation: Children familiarize themselves with new experiences by connecting them to previous ones (i.e., schemes). They may incorporate rattles into their grasping strategy because of previous interactions with sticks or rattles. In accordance with this, when they interpret objects, they have expectations based on their past experiences with sticks.

Accommodation: Both children and adults are subject to this process of accommodation. Because every first-time experience varies, youngsters will be able to adapt to these differences and expand their knowledge. The acquisition of updated information and experiences will alter one's existing views of the world (schemas).

9. A cognitive development model based on Piaget's four stages

The development process follows a "staircase" pattern. According to Piaget, there are four major stages of cognitive development: (1) sensorimotor intelligence, (2) preoperational thinking, (3) concrete operational thinking, and (4) formal operational thinking. Childhood aging periods and stages are generally correlated with each stage. During these stages, ideas are generated.

9.1 The sensorimotor stage

Object permanence is visible at this stage (from birth to age 2). Based on Piaget's theory, infants begin to "think" by using their senses and motor actions during the sensorimotor stage. Infants are constantly touching, manipulating, looking, listening, and even biting and chewing objects, as every new parent can attest. According to Piaget, the infant's actions represent objects and events and children acquire knowledge about the world through these actions.

9.2 The preoperational stage

This is a period (from ages 2 to 7) of symbolic thoughts. As children progress through this stage, they make use of their newly acquired ability to represent objects. It is important to note that, at the present time, they do not do so in an organized or

logical manner. Preschoolers, for example, engage in dramatic play or improvised pretend play as a form of cognition. Children engaged in imaginative play are thinking on two levels simultaneously: fantasy and reality. Dramatic play exemplifies metacognition, or reflecting on and monitoring the process of thinking, due to this dual processing of experience.

9.3 The concrete operational stage

This is a period (from ages 7 to 11) of logical thoughts. At this stage, children become more logical and flexible in presenting ideas and events at the elementary school level. They still act and operate unconsciously. A systematic approach to problem-solving improves children's academic performance. The child may be following a rule unconsciously. As well as performing certain arithmetic tasks and science experiments in class, they also perform certain scientific experiments. The mind of a child focuses on concrete events. He or she tries to use logic, but objects and events cannot yet be thought of or presented systematically.

9.4 The formal operational stage

This is a stage (age 11 and beyond) of scientific reasoning. At this stage, reasoning about abstract or hypothetical objects becomes possible for the children. As they represent ideas and events in elementary school, they become logical and flexible. Still, they operate and act unconsciously. Students succeed academically when they solve problems systematically. Additionally, they perform certain arithmetic tasks and science experiments in class. Children focus on concrete events. Although they try to use logic, they are unable to describe objects or events systematically.

10. Vygotsky theory

Based on this theory, scaffolding was introduced, which is defined as "social collaboration conducive to cognitive development." According to Vygotsky, four "elementary mental functions" are with us from birth: attention, sensation, perception, and memory. Utilization of these elementary skills enables us to acquire higher mental functions within our social and cultural environment. According to this theory, social conciliation is a process of knowledge construction, and infants are said to learn new interpersonal and cognitive skills through interactions with older people. Therefore, cognitive functions are developed because of the interaction between humans. Through collaborative dialogs with more knowledgeable members of society, children acquire their cultural values, beliefs, and problem-solving strategies.

In terms of child development, Vygotsky's approach is a form of social constructivism. Consequently, this theory has led to the development of more interactive and collaborative instructional and learning organizations. In these organizations, students and teachers are encouraged to interact socially. As Vygotsky believed, higher-order functions of the brain are shaped by parents, caregivers, peers, and the individual's culture. According to Vygotsky, there can be differences in human development between cultures. Vygotsky's theory discusses concepts, such as the zone of proximal development, culture-specific tools, and private speech. In the process of creating meaning, the community plays an essential role.

According to Vygotsky, social interaction plays a crucial role in cognitive development. Learning is a necessary, universal aspect of culturally organized psychological function. Unlike Piaget's view, social learning generally precedes development, according to Vygotsky [8]. Therefore, according to this theory, constructed cognitive abilities are argued to be socially guided. Learning, memory, attention, and problem-solving abilities are formed through cultural mediation. By means of Vygotsky's theory, teaching and learning have become interactive and collaborative. This type of organization encourages students to learn by interacting with peers and teachers.

11. Contemporary theoretical perspective

The Piaget theory has been criticized for using a small sample with rigid stage limits. Vygotsky's work demonstrates the development of Neo-Piagetian thinking, which integrates context (family, culture, history, language, and play). Piaget's descriptions of accommodation processes are complemented by Vygotsky's emphasis on environmental factors. According to modern theory, children's cognitive development follows specific principles. These principles shift and shift as a child interacts with the environment.

Many cognitive abilities are developed among children at a very early stage. Children have natural information outwardly world, and their learning is fast. Piaget was off-base about knowledge. As far as article lastingness, it was noticed that newborn children look for objects sooner than Piaget proposed. Besides, newborn children younger than one have the mental capacity to comprehend that secret items are not stowed away from sight.

Piaget and strategic issues as far as the standards of formative science, Piaget's hypothesis has a few issues. Right off the bat, with respect to the determination of members, Piaget did not choose an extraordinary assortment of members to give a dependable outcome; for the most part, he just inspected his own youngsters. Moreover, one of the main parts of the exploration strategy is diminishing the impact of testing predisposition by choosing members cautiously. Consequently, summing up his plans for kids from various societies or nations all over the planet is absurd.

Besides, Piaget frequently used the clinical technique to gather information. This technique is more adaptable, so members are probably going to pose various inquiries. Notwithstanding, uniform materials, questions, bearings, and procedures to assess mental factors are the spine of exploratory brain research. Current analysts have been disappointed by Piaget's reports of his investigation. Piaget did not make sense of the social-financial foundation of the kids, the quantity of members, or the member's race or nationality, and he did not give more than adequate insight concerning his testing measures.

It is challenging to tell whether Piaget is depicting kids speculatively or testing them. Besides, as per Piaget, "clinicians over-summed up their techniques and showed up at magnificent details, especially when a multitude of researchers made an interpretation of their outcomes into numerical terms." Besides, "intense perception, especially when made by [a great observer], beats all insights" (1936/1952, p. 72, referred to in Mill operator, 2012, 85-86). This implies that Piaget did not give factual outlines of his revelations, and he gave extensive example conventions deciphered by Piaget, from which peruses regularly do not figure out the topics.

Though Piaget has informed us about the four mental developmental stage but late examination has shown that not all teenagers arrive at the formal functional stage. Since the instructive cycle in certain social orders does not stress decisive reasoning, which is basic for arriving at the formal functional stage. Because of an absence of instructive foundation, concentrates on show that the main portion of people in certain social orders arrives at the formal functional stage. Moreover, people can show formal functional expertise in only one field; for instance, a generally excellent designer can ponder this particular region but is probably going to experience issues contemplating verse.

Modern cognitive development theory evolves as evidence is gathered and suggestions are made. Currently, researchers are studying factors affecting cognitive development. According to Taylor [9], these factors include both internal (such as sexual orientation) and external (such as the community). Kellermann et al. [10] discuss epilepsy's effects on cognitive development.

Dadvand et al. [11] demonstrate that exposure to green and open spaces benefits cognition. A similar study by Barac et al. [12] demonstrated various effects of bilingualism on cognitive development as an internal factor conditioned by the environment. Sun & Esposito [13] indicate the specificity principle plays a role in children's language development. As a result of extensive research, more specific factors are now being examined to provide more details and enhance our understanding of human cognitive development. Future views of this theory may result in a comprehensive understanding of human development due to the diversity of modern views. However, more research and more evidence are required before that can be achieved.

12. Cognitive development and educators as pedagogical leaders

Theories related to early development, sociocultural context, and contemporary context provide educators with theoretical scaffolding. By utilizing contemporary theories, such as Piaget's cognitive theory for observing children's play stages, Vygotsky's concept of cultural tools, and ZPD in early childhood education, educators scaffold children's play and learning. Zones of proximal development (ZPD) are key in scaffolding, allowing children to accomplish as much on their own as possible while tutoring fills in what they are unable to accomplish. Contemporary theorists point out other influences and realities educators need to be aware of. Therefore, they develop a self-understanding of how much they must be open to change and take into account children's perspectives when employing their pedagogical approach to enhance the learning of students in the total scheme of teaching and learning.

Education as a profession requires educators to have a strong reliance on verbal cues, such as providing suggestions and instructions for children to construct their own understandings of the world. A pedagogical leader builds students' social, academic, and intellectual capital, as well as teachers' intellectual and professional capital. The notion of "pedagogical leadership" refers to bringing a pedagogical framework to all aspects of teaching and focusing on dialog with the learners. Children learn more when they are in an environment in which the family is engaged, the organization's curricular philosophy is followed, data are used to measure program effectiveness, and standards are established to maximize learning. An understanding of pedagogy is rooted in a solid theoretical and practical foundation. Therefore, cultural and social values influence learning, teaching, and development.

With the modern educational system's national priorities, teachers must develop students with the skills and knowledge necessary not only for lifelong learning but also for the knowledge economy. In the knowledge-based economy, individuals and institutions actively interact with each other to learn from one another. As a result, teachers play a crucial role in promoting student learning in a pedagogical context. Organizing lessons, facilitating interaction, and solving classroom challenges require a teacher who is capable of handling content and student learning.

To be effective in the context of the modern era, developmental theories work well when combined with contemporary approaches, such as sociocultural theory and post-structural theory. Those theories really help to question universal norms; they help to think about what it is we see in terms of children's holistic development and not just whether they can do this or that by themselves. Sociocultural theories emphasize "the central role that families and cultural groups play in children's learning and the importance of respectful relationships" and "provide insights into the social and cultural contexts of learning and development." It emphasizes that cognitive development is essentially a social process. This is of great importance to educators who have to plan how to teach children with diverse social and cultural backgrounds. Post-structural theory inspires educators to "challenge traditional ways of seeing children, teaching, and learning." It offers insights into issues of power, equity, and social justice in early childhood settings.

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Considering theoretical understandings, educators may consider how different theories can assist them in looking holistically at children's capacities to participate at different ages. Because it is impossible to separate children from their interactions with others around them, educators must use more than one theory to observe learning. To establish a framework of what is acceptable and fair for students, educators should consider contemporary theories along with earlier theories of cognitive development. Learning takes place within the context of a learner's cognitive processes. To promote social, emotional, and cognitive development in children, educators should provide them with interesting and stimulating materials to use in their environments. Five types of educational approaches (constructivist, collaborative, integrative, reflective, and inquiry-based) are incorporated into a cognitive development theory. Classroom environmental, mental, and cultural realities are integrated into these pedagogical and cognitive approaches.

Thus, theoretical and pedagogical orientations support the distinction of cognitive strategies from metacognitive strategies (learning organization) and social/affective strategies (interaction base). In language teaching, educators utilize strategies, such as repetition, organizing new language, summarizing meaning, guessing meaning based

on context, and using imagery for memorization. The purpose of these strategies is to improve learning by deliberately manipulating language.

13. Criticism on cognitive psychology

Cognitive psychology focuses on interior data cycles, such as discernment, consideration, language, and memory. The psychology profession is concerned with these interior cycles and their impact on our behavior and feelings. As a result of cognitive psychology research, new speculations have been developed, and more insight into how the mind works has been gained. Researchers have found that cognitive development is difficult to identify. According to another interpretation of this methodology, it ignores other factors besides cognitive ones that can influence behavior. The social and cognitive environments are two factors that may influence a person's behavior. There are some limitations to this approach.

Psychology researchers usually carry out their studies in false environments or ignore the current situation. For instance, participants in a memory study could feel pressure to perform well in a study hall setting, resulting in worse memory performance than if they were evaluated at home. Since the focus lacks natural legitimacy, its effects are less applicable to daily life and may even be irrelevant outside the review environment. In many cases, students feel confident and well-prepared before an exam, but when they enter the exam hall, everything vanishes. A lack of cognitive development can be caused by nervousness or hypertension.

In most instances, Piaget's four stages of cognitive development respond to misconceptions or insignificant details that do not contradict the central principles of his theory. Some people have complained that his tests were too difficult for children. A variety of skills can be tested by altering the process so that younger students can pass the tests. In other studies, the ages associated with the stages have been examined, and the diversity of children has been highlighted. Rather than focusing on the age at which a child reaches a particular milestone, Piaget emphasized succession.

When it comes to specific errands, children use various types of reasoning and are conflictual at every stage. In another study, it was found that children use specific types of reasoning when solving specific errands and that they are conflictual throughout the process, indicating that they will use functional reasoning. That is, "level decal age" refers to the fact that a child may not always use concrete functional reasoning on such errands. Although it was acknowledged that this went against Piaget's hypothesis, it does so assuming that children are believed to be in a phase. Piaget predicted this outcome based on a thorough understanding of his hypothesis.

Looking closer at his hypothesis, it appears that children develop different types of reasoning based on their experiences. The degree to which a child is involved with the project materials will determine how well they use concrete and functional reasoning.

Furthermore, Piaget's conception of cognitive progression has been criticized for misinterpreting social factors. In some instances, he departs from Vygotsky's belief that social connections are so important. Anyhow, it surprised Vygotsky when he reviewed Piaget's original work and found it to be too dependent on friendly variables! According to Piaget, social elements are clearly significant and important, but they do not fully explain progress on their own. According to him, equilibrium is also a constant, ever-changing interaction. A key foundation for current research on the formative brain remains Piaget's hypothesis of cognitive development. The primary point of his argument is affirmed rather than challenged by subsequent revelations.

On the other hand, “reductionism” is a term only used to describe theories that alter how people behave. Many brain science research approaches fail to take into account all of the different factors that affect the human psyche and how we behave. Instead, they focus on just one aspect of understanding how the brain works. Individual differences are typically ignored in cognitive psychology, where it is assumed that all inner processing is consistent across individuals. This is reductionist because it ignores the influences of nature, the environment, or genetics on cognitive capacity.

Cognitive psychology studies cognitive cycles with a restricted focus. Because of the PC analogy, data handling specialists tend to focus primarily on the coherent components of information handling. They also tend to focus less on the deeper, innovative, and social facets that can also influence thinking. The field of cognitive psychology has often relied on correlations between the functioning of computers and the functioning of the human mind. Does the cerebrum function in this manner? In comparison to the most advanced computer, the human mind is infinitely more remarkable and adaptable.

Criticizing the cognitive approach, Burrhus Frederic Skinner [14] argues that only external stimulus-response behavior can be measured scientifically. Due to their inability to be observed and measured, mediation processes between stimulus and response cannot be observed. The mediation processes between stimulus and response cannot be observed or measured because they do not exist. He continues to explore problems with cognitive exploration techniques, especially thoughtfulness, due to its abstract and informal nature.

Behaviorists believe that children’s brains are like a blank slate (*tabula rasa*) and are born without cognitive functions, such as schemas, memories, or perceptions. In determining behavior, the cognitive approach often overlooks physical (biological psychology) and environmental (behaviorism) factors. In addition to cognitive psychology, cognitive neuroscience and artificial intelligence (AI) have been influenced by and integrated with cognitive psychology.

14. Cognitive development of students in higher education

In higher education institutions (HEIs), stakeholders perceive cognitive development in relation to intellectual capital (IC) and sustainable development (SD). In HEIs, two constructs (IC and SD) are related, especially through relational capital and structural capital [15]. Therefore, intellectual growth is influenced by the study environment, which is conducive to the development of intellectual ability.

Cognitive development is correlated with student learning approaches, but learners may develop cognitively differently in different environments. According to Zhang & Watkins [16], there was a reported difference in cognitive development among American and Chinese students. The study also demonstrated that extracurricular activities were positively related to cognitive development for both American and Chinese students. A stimulating learning environment and a focus on cognitive abilities result in improved academic performance. Among other factors, academic achievement is influenced by a student’s ability to process information quickly, function in a visual-spatial environment, and calculate.

A key goal of education is to engage students with educational plans and encourage them to work intellectually. Engagement in cognitive activities involves working beyond the minimum requirements by putting thoughtful energy into the comprehension of complex ideas. In it, psychological investment is focused on

learning, understanding, and mastering knowledge. An engaged student is capable of exceeding expectations and prefers challenges over requirements. Through this, students can expand their knowledge frontiers and develop meaningful and enduring academic commitments. Students' social and cognitive development is enhanced by engagement in the classroom. A student's engagement in higher education requires consideration of their potential to grow and motivation for development as distinctive characteristics. The development process is driven by the potential of an individual as a motivating value. To achieve creativity, a learner must develop, grow continuously, and engage in motivational-creative activities [17]. According to the five-dimensional model [18], five areas must be considered: (1) academic engagement, (2) cognitive engagement, (3) social engagement with peers, (4) social engagement with teachers, and (5) effective engagement. All these dimensions have high consistency. An undergraduate degree in pedagogical education has three components: (1) a value-based motivation component, (2) a cognitive component, and (3) a practical component. Therefore, by working on cognitive development through these engagements, a sufficient level of knowledge and skills can be developed in students of higher education institutions. A bachelor's degree is generally associated with competitiveness. This belief holds that knowledge (cognition) is the only competitive advantage that remains over time. For cognitive learning to take place, students' creativity must be developed. The perception of difficulty increases with the level of subjective memory dysfunction [19]. Further, speed and perceived difficulty correlate when a task is perceived as difficult. An individual's task and metacognition must be considered to examine the integrity of their information processing speed.

Besides other factors, students' cognitive development is also affected by dimensions of teaching effectiveness in higher education institutions [20]. There are two fundamental perceptions of students regarding instructors: clarity and organization. A combination of both aspects of learning is associated with enhanced outcomes. These outcomes include students' critical thinking skills, their propensity for lifelong learning, their academic motivation, their likelihood of completing their bachelor's degree, and their use of deep learning techniques [21]. From a pedagogical perspective, student-directed learning [22, 23] involves students in the processes of collaboration, testing, creation, and directing their own learning. Students engage in active learning by writing, reading, discussing, evaluating, and creating. Therefore, students develop skills in cooperation and communication with peers in addition to participating in content development and knowledge building. The most efficient way to provide students with opportunities for cognitive development is through a student-directed learning strategy. Student-centered learning refers to the efforts of teachers to facilitate and design the learning process to engage students in their learning. Student-centered education focuses on developing problem-solving skills using complex and open-ended problems. Unlike traditional learning, problem-based learning involves students presenting their knowledge based on their understanding of course content and class participation.

15. Glossary

15.1 Assimilation

Assimilation is the process by which a learner relates newly acquired information to older cognitive structures. Thus, assimilation occurs when a learner encounters a novel idea and must "fit" it into what they already know.

15.2 Accommodation

Accommodation is a substantial process that requires the learner to reshape existing knowledge due to the acquisition of recent information. An adaptation occurs when preexisting knowledge is altered to accommodate newly learned information. Thus, accommodation involves creating new schemas.

15.3 Cognitive learning

Cognitive learning emphasizes helping learners learn how to use their brains to their full potential, where experience leads to changes in knowledge. The formation of insights and latent learning are both components of cognitive learning. The cognitive theory asserts that emotions and behavior are largely influenced by thoughts. Several factors influence learning, such as problem-solving skills, memory retention, thinking skills, and the perception of what is learned.

15.4 Cognitive development

An individual's cognitive development is the development of his or her ability to reason and think. Cognitive information development includes four stages: reasoning, intelligence, language, and memory. Through cognitive development, children learn to think critically about the world around them. The cognitive development of a child is influenced by everyday experiences.

15.5 Cognitive skills

Cognitive skills are brain-based skills necessary for acquiring knowledge, manipulating information, and reasoning. Cognitive skills refer to cognitive capacities. These skills include thinking, reading, learning, remembering, reasoning, and paying attention. Learners organize newly acquired information into the repository of knowledge they use every day in class, at work, and in their personal lives.

15.6 Jean Piaget's theory

According to Jean Piaget, children's intelligence changes throughout their growth. Children need to develop a mental model of the world around them as part of their cognitive development. Children pass through stages in their development of intelligence in terms of their formal thought processes.

15.7 Problem-solving strategies

Learners can find the most appropriate solution to their problems by looking beyond the obvious answers and using problem-solving strategies. Learners develop problem-solving skills by identifying problems, analyzing them, generating alternative solutions, and evaluating them. Common problem-solving techniques used in education are computing, simplifying, illustrating, and summarizing information and ideas.

15.8 Vygotsky's theory

Social interactions can guide and mediate a person's learning ability. The theory suggests that socialization contributes significantly to learning. Essentially, this

theory outlines three core concepts related to cognitive development: (1) culture plays an influential role in learning, (2) language is the root of culture, and (3) individuals learn and develop within their communities.

15.9 Zone of proximal development (ZPD)

A learner is traveling between two terminals: the known and the unknown. Guidance and encouragement from a knowledgeable person can help a learner who is having difficulty mastering certain skills. A skilled partner can guide and encourage a learner to achieve greater results than he or she could on their own. In other words, those skills the learner is “close” to acquiring are considered.

16. Case in point

The teaching environment in Oman involves three main factors: learners, teachers, and obstacles. Therefore, the comparison of students’ results after certain methodical interventions with a control group reflected the difference in achievement. Omani colleges’ English classes, for example, provide students with both basic language skills and a foundation for advanced language abilities that will be crucial to completing their degrees. The process of learning a second language requires more than just language skills. For our learners to be successful at learning a new language, they must be in control of their own learning and self-management.

A longitudinal study was conducted at Mazoon College, Sultanate of Oman. A total of 176 students (mixed ability learners) taking preparatory English language courses for a bachelor’s degree were chosen as the subject of study from six different sections of the authors’ own classes. The data were collected over a period of 14 months (three semesters). Learners were given reading and writing exercises that focused on abstraction, thinking, hypothesizing, and drawing conclusions. The study was conducted on an experimental group of 93 students and compared with a control group of 83 students.

16.1 Theoretical perspective

Guided by the theory of cognitive development to understand the interplay between teaching strategy and cognition in education, students use a certain amount of working memory, which is explained by cognitive load theory. Observing and recording the assessments that how stress and emotion alter the cognitive processes that support performance our study concluded from findings in the preview of cognitive psychology and education point of view.

16.2 Methodology

The study was descriptive in nature and used both quantitative data on samples selected at convenience. The intervention strategy was based on the premise that cognition mediates learning and behavior. Cognitive-behavioral instructional strategies (CBIS) were designed to promote learning and behavior change. Students were taught to examine their feelings and thoughts in their lessons. Interventions included single-task training, integrated training, meditation, group work, and transcranial

stimulation to improve cognitive control. The strategies were based on cognitive restructuring, exposure, and response prevention to develop the following targeted skills:

- Verbal and written English language skills
- Thinking skills
- Developing knowledge
- Memory development
- Perceptual skills
- Emotional control

Outcomes (**Table 1**) are based on the assessment of students' data on given tasks. A tendency investigation of summative assessments and behavioral outcomes assessment measured the following: verbal comprehension, perceptual reasoning, response to challenging situations, processing speed, number of mistakes, and willingness to accept a challenge (**Figure 1**).

	N	Mean	Std. Deviation	Range	Minimum	Maximum
Control Group Average	83	73.132	5.773	24.00	62.00	86.00
Experimental Group Average	93	81.096	4.745	16.00	74.00	90.00
Valid N (listwise)	176					

Table 1.
 Descriptive.

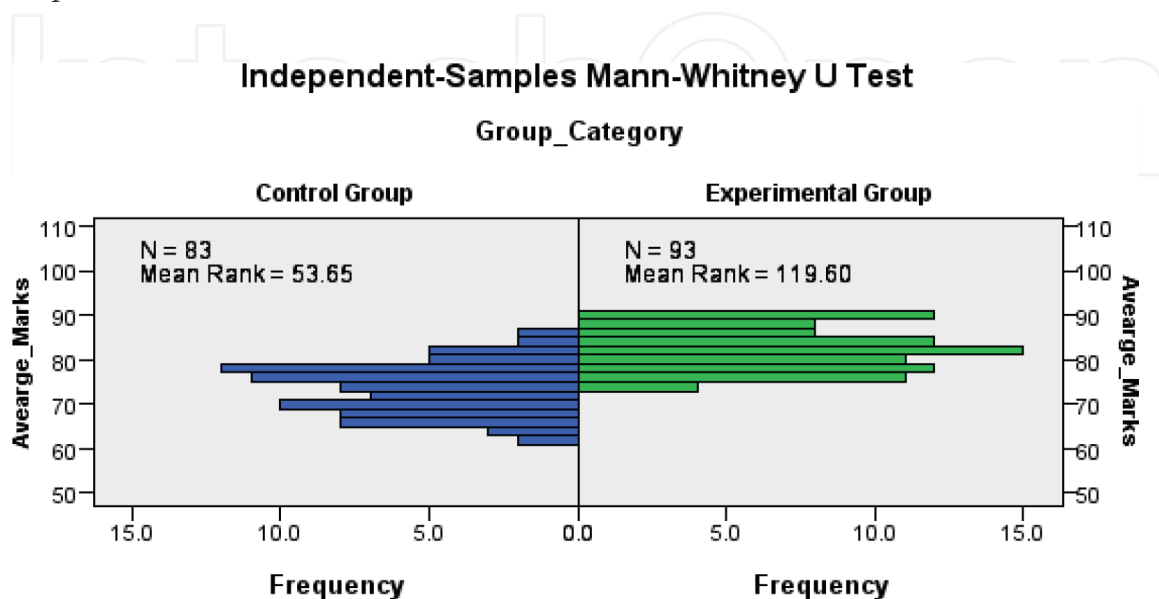


Figure 1.
 Marks average.

Null hypothesis	Test	Sign.	Decision
The distribution of average marks (samples) is the same between categories of groups	Independent-Samples Mann-Whitney U Test	0.000*	Reject the null hypothesis

*Asymptotic significances are displayed.*The significance level is 0.05.*

Table 2.
Hypothesis test summary.

There was a significant difference in variance (**Table 2**) between the control group and the experimental group.

17. Conclusion

Based on research on cognitive development among students of English as a second language in higher education, this chapter examines cognitive development's theoretical grounds and criticisms, as well as its value and contribution. Additionally, the chapter illustrates how pedagogical approaches are guided by the dimensions of student learning. The outcomes of the study highlight the study process as a chance to develop new skills in students through cognitive engagement. Attending English as a second language class evokes thoughts of learning and achievement in students. Examination of given situations revealed that study engagements may lead to feelings of tension, apprehension, or fear about performing up to the expectations set for learners by teachers and curriculum. Therefore, learners of English as a second language feel under pressure from anxiety and stress. The acquisition and demonstration of knowledge cannot simply sum up what students learn in class. Memory, attention, cognitive control, motivation, and emotions all play a role in academic performance. Providing students with close supervision, assistance, and interaction opportunities enhanced the performance outcomes of the experimental group. Pedagogical interventions integrated with cognitive development perspectives applied to the experimental group resulted in improvements in learning and a reduction of anxiety and stress compared to the control group. The following categories of activities and strategies are presented based on assessments (e.g., formative and summative) aimed at developing cognitive control functions in the language classroom (ages 18–25) or combinations of those activities.

17.1 Determine the level of the learners and assign appropriate activities

Based on the description above, it is evident that these activities provide a dual benefit by developing language skills and improving cognitive control functions simultaneously. Taking part in these activities enhances one's ability to control cognitive processes. Stress and positive emotional engagement play an influential role in the development of cognitive control.

It is likely that the activities will be repeated over time and that the challenges will become increasingly challenging.

17.2 Learning from mistakes

Ensure that your learners understand that making mistakes is natural and that you do not grade them according to how they perform these tasks. Remind them that these

activities will be performed on a regular basis. If they spend more time focusing on and enjoying the activities, their performance will improve.

17.3 Teaching English as a second language: methods of improving cognitive control


- The use of self-talk to improve cognitive control skills improves a student's ability to set and achieve goals, and plan and carry out plans.
- It is imperative to monitor and analyze a process when it is taught to people rather than expecting that they are already familiar with it.
- A script can be used to support this process, which includes model questions, templates, and checklists. It is critical that students repeat these language routines over time in order to gradually internalize them and use them in their own self-talk.
- This process can also facilitate the acquisition of a high level of proficiency in the target language. It can be taught to students individually or in groups.
- The development of self-control strategies in the classroom is intended to create a culture of can-do in the classroom.
- It is critical to encourage students to develop further by replacing negative beliefs about their abilities. This phase can be challenging in terms of establishing a positive classroom culture. Furthermore, negative beliefs about students' abilities may adversely affect teachers' attitudes toward their students.
- Develop metacognition and study strategies for young adults. The importance of recognizing that any concerns teachers may have regarding cognitive control functions may not be about the core skills themselves cannot be overstated. They may choose to combine these skills in a more sophisticated manner.

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