Social Science and Human Research Bulletin

ISSN(e): 3050-5542
ISSN(p): 3050-5534

Vol. 03(06): 703-707, June 2026

Home Page: http://sshrbjournal.org/

Classical Conditioning and Cognitive Development Theories as They Relate to Professional Practice – The Irieponics Aquaponics in Schools and Communities Program

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Article DOI: 10.55677/SSHRB/2026-3050-0610 **DOI URL: https://doi.org/10.55677/SSHRB/2026-3050-0610**

KEYWORDS: Classical conditioning, cognitive development, learning theories, aquaponics, robotics, STEM/STEAM

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Published: June 30, 2026

ABSTRACT: Learning theories are a part of set of frameworks that guide educational practice. These theories explain how individuals acquire knowledge and develop behaviors. This synthesis paper examines a practical application of Ivan Pavlov's Classical Conditioning Theory and Jean Piaget's Cognitive Development Theory within educational settings, particularly through the Irieponics aquaponics initiative and school robotics programs in rural Jamaica. Classical Conditioning explains how repeated associations with rewarding learning experiences increased positive attitudes toward STEM/STEAM education, agriculture and self-sustainability. Whereas, Piaget's theory emphasizes hands on experiences: where cognitive growth is realized through active learning, knowledge construction through inquiry, experimentation and problem-solving. This paper examines how these theories complement each other while engaging students to think critically and provide the positive motivation for their academic development. Using aquaponics and robotics as practical examples, it demonstrates how positive behavioral conditioning and cognitive development can be integrated to create meaningful learning experiences. The synthesis highlights the value of combining behavioral and cognitive approaches to support lifelong learning, innovation, and sustainable development.

INTRODUCTION

Learning theories provide educators and professionals with frameworks that explain how individuals acquire knowledge, develop behaviors, and respond to environmental stimuli. These theories shape teaching methods, classroom management, curriculum development, counseling, leadership, and workplace training. Among the most influential theories in educational psychology are Classical Conditioning, developed by Ivan Pavlov, and Cognitive Development Theory, developed by Jean Piaget. Although these theories differ significantly in focus and methodology, both contribute valuable insights into professional practice, particularly in education and human development.

Classical Conditioning emphasizes observable behavior and the role of stimulus-response associations in learning, while Cognitive Development Theory focuses on internal mental processes and the stages through which learners develop intellectually. Together, these theories help professionals understand how behavior is shaped and how learners process information at different developmental stages. This paper synthesizes both theories and examines their implications for professional practice, specifically in education, classroom management, curriculum planning, student engagement, and professional interactions.

Overview of Classical Conditioning

Classical Conditioning originated from the experiments of Ivan Pavlov during the late nineteenth century. Pavlov discovered that dogs could be trained to salivate at the sound of a bell if the bell was repeatedly paired with food. Initially, food naturally caused salivation, making it an unconditioned stimulus that produced an unconditioned response. After repeated pairings, the previously neutral stimulus—the bell—became a conditioned stimulus capable of producing salivation independently, now referred to as a conditioned response.

The theory explains learning as the pattern of associations between stimuli and responses. According to Pavlov, learning occurs when a neutral stimulus is linked with a naturally occurring stimulus through repeated experiences. Classical Conditioning also introduced concepts such as extinction, spontaneous recovery, generalization, and discrimination.

The significance of Classical Conditioning extends beyond laboratory experiments. The theory demonstrates how emotions, habits, fears, and behaviors can be developed or modified through environmental associations. In professional practice, particularly education, the theory helps educators understand how students develop emotional responses to subjects, teachers, and learning environments.

Overview of Cognitive Development Theory

Jean Piaget's Cognitive Development Theory differs significantly from behaviorist theories because it focuses on mental processes rather than observable behaviors. Piaget believed that children actively construct knowledge through interactions with their environment. According to Piaget, cognitive development occurs through a series of developmental stages that influence how children think and learn.

Piaget identified four stages of cognitive development: the sensorimotor stage, preoperational stage, concrete operational stage, and formal operational stage. Each stage indicates distinct patterns of thinking and reasoning abilities. Central concepts within Piaget's theory include schemas, assimilation, accommodation, and equilibration.

Schemas are mental structures that help individuals organize information. Assimilation occurs when individuals incorporate new information into existing schemas, while accommodation involves modifying existing schemas to fit new experiences. Equilibration refers to the process of balancing assimilation and accommodation to achieve cognitive stability.

Piaget emphasized that learning is an active process. Learners are not passive recipients of information but active participants who construct meaning based on developmental readiness and experience. His theory has profoundly influenced educational practices, curriculum design, and child-centered learning approaches.

Relationship between the Two Theories

Although Classical Conditioning and Cognitive Development Theories were born from different psychological theories, both theories contribute to understanding how learning occurs. Classical Conditioning focuses primarily on external stimuli and observable behaviors, whereas Piaget's theory emphasizes internal cognitive processes and intellectual growth.

These theories have one major similarity; both acknowledge the importance that a person's environment played in learning. Pavlov emphasized environmental stimuli as the basis for behavioral responses, while Piaget recognized the environment as essential for cognitive exploration and development. Both theorists also viewed learning as a process involving adaptation to experiences.

However, the theories differ in their assumptions about the learner. Classical Conditioning portrays learners as relatively passive, responding automatically to environmental stimuli. In contrast, Piaget viewed learners as active thinkers who interpret and create new knowledge independently.

Another difference lies in instructional implications. While Classical Conditioning is generally best utilized in structured learning environments that use reinforcement and associations to condition behavior. Cognitive Development Theory supports discovery or intuitive learning, problem-solving with the appropriate developmental instructions.

Despite these differences, the theories complement each other in professional practice. Educators can use behavior altering strategies to create positive learning environments while simultaneously promoting cognitive growth through active learning experiences.

Application of Classical Conditioning in Professional Practice and Cognitive Development Theory in STEAM Education

Theory in STEAM Education

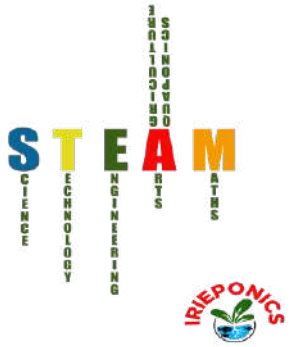
Science, Technology, Engineering, and Mathematics (STEM) education is an integrated approach to learning that combines multiple disciplines to help students solve authentic, real-world problems. Rather than teaching subjects in isolation, STEM encourages learners to apply scientific inquiry, technological tools, engineering design, and mathematical reasoning in meaningful contexts. Contemporary STEM education emphasizes critical thinking, creativity, collaboration, communication, and problem-solving skills that are essential for success in the twenty-first century (Gavrilas & Kotsis, 2025).

As STEM evolved, many educators expanded the model to STEAM by incorporating the Arts. STEAM recognizes that innovation often requires creativity, design thinking, communication, and cultural awareness alongside scientific and technological knowledge. Through STEAM education, students are encouraged to explore interdisciplinary connections while developing their technical competencies and creative capacities.

Modern STEM and STEAM approaches are grounded in learner-centered theories, such as constructivism, experiential learning, and social constructivism. These theories view students as active participants who construct knowledge through inquiry, collaboration, experimentation, and reflection rather than through passive reception of information. Consequently, STEM and STEAM classrooms emphasize hands-on learning experiences, which engage students in authentic problem-solving situations and prepare them for future academic, professional, and societal challenges (Gavrilas & Kotsis, 2025).).

Application in Professional Practice -Aquaponics in schools and communities project and school robotics program

Aquaponics In Schools & Communities



A brief History

The project aimed to establish an aquaponics-based STEAM initiative in schools across rural Jamaica, focusing initially on Clarendon. By introducing, and hopefully one day integrating, aquaponics into school curricula, the project will promote hands-on learning in STEAM subjects (science, technology, engineering, arts and mathematics) and sustainable agriculture. Aquaponics, a method combining aquaculture (fish farming) and hydroponics (growing plants without soil), provides an interactive platform for students to engage with biology, chemistry, and environmental science.

The project highlighted four main objectives:

1. **Curriculum Integration** – Introducing aquaponics in schools for real-world learning.
2. **Skill Development** – Teaching students and community members practical skills related to aquaponics.
3. **Community Engagement** – Involving local groups in sustainable agricultural practices.
4. **Capacity Building** – Offering technical training for widespread adoption of aquaponics.

Application of Classical Conditioning in Professional Practice

Classical Conditioning has important applications in professional practice, particularly in educational environments where positive attitudes, behaviours, and emotional responses can be developed through repeated associations. Historically, traditional agriculture or "farming" has often carried negative connotations among some of our youth. This can be attributed to its association with manual labor, heat, and low prestige, thus acting as a conditioned stimulus that elicits aversion. The Irieponics program systematically counter-conditions this response by pairing the agricultural environment with highly positive, culturally resonant Unconditioned Stimuli (UCS). In the initiative, students are consistently exposed to engaging, rewarding, and enjoyable learning experiences that become associated with STEAM education, agriculture, and environmental sustainability.

One significant by-product of the use of classical conditioning is the development of positive attitudes toward learning and innovation. Evaluative conditioning throughout these programs, allowing students to pair experiences such as exhibiting at the Denbigh Agricultural Show, with receiving recognition for their projects, interacting with community members, and seeing tangible results from their work naturally produce feelings of pride, excitement, and accomplishment. Through repeated exposure, these positive emotions become associated with science, technology, engineering, agriculture, and environmental learning. As a result, students develop increased enthusiasm and motivation toward STEAM-related activities and careers.

Classical Conditioning is also evident in the establishment of learning routines and environmental cues. Students regularly engage with aquaponics systems, observe fish and plant growth, monitor water quality, and participate in laboratory activities. Over time, the physical with the aquaponics systems, including the sight of the growing systems, the sound of circulating water and the structured routines associated with maintenance and experimentation, may become associated with curiosity, engagement, and focused learning. These conditioned associations can contribute to positive classroom behaviours and increased participation.

Another important application is in community engagement and environmental stewardship. The program repeatedly pairs sustainability practices with positive social experiences, including teamwork and public presentations. Through repeated pairings, these technical spaces and agricultural concepts morph into Conditioned Stimuli (CS). Consequently, students develop a Conditioned Response (CR) of automatic excitement, intrinsic motivation, and professional pride whenever they engage with STEAM and smart-farming technologies. As students experience success and recognition while participating in environmentally responsible projects, they may develop positive emotional connections to conservation, food security, and sustainable agriculture. These conditioned responses can encourage long-term commitment to environmentally responsible behaviours.

Application of Cognitive Development Theory

Jean Piaget's Cognitive Development Theory has significant implications for professional practice because it emphasizes active learning, problem-solving, and the construction of knowledge through interaction with the environment. The Irieponics aquaponics initiative provides numerous examples of Piagetian principles in action through experiential learning and inquiry-based activities.

One major application is the use of developmentally appropriate learning experiences. Younger aged students participating in aquaponics demonstrations benefit from concrete experiences such as observing fish, handling plants, and examining water systems.

These activities align with Piaget's concrete operational stage, during which learners understand concepts most effectively through direct interaction with physical objects and observable phenomena. Rather than merely reading about ecosystems or agriculture, students are able to see ecological relationships operating in real time.

For older students, the program provides opportunities that align with the formal operational stage of development. In another aligned program, students engage in robotics, automated irrigation systems, engineering design, data collection, and scientific problem-solving. These activities require abstract reasoning, hypothesis testing, and analytical thinking. Learners must evaluate system performance, troubleshoot challenges, and apply scientific concepts to real-world situations, thereby strengthening higher-order cognitive skills.

The aquaponics initiative also demonstrates the processes of assimilation and accommodation. Many students enter the program with the belief that plants can grow only in soil. When they observe healthy plants growing in nutrient-rich water supplied by fish waste, their existing cognitive schemas are challenged. This cognitive disequilibrium encourages accommodation, leading students to revise and expand their understanding of agriculture, ecosystems, and sustainable food production. Through this process, learners construct more sophisticated knowledge structures.

Another important application of Piaget's theory is discovery learning. Students are not passive recipients of information; instead, they actively investigate, experiment, and solve problems. By monitoring fish health, measuring water quality, maintaining systems, and evaluating results, students become active participants in their own learning. Such experiences promote deeper understanding, critical thinking and knowledge retention.

Synthesis of the Theories Classical Conditioning and Cognitive Development Theory

The integration of Classical Conditioning and Cognitive Development theories provides a comprehensive framework for understanding learning within professional practice. While Classical Conditioning explains how positive emotional and behavioural responses are developed through experience, Piaget's theory explains how learners actively construct knowledge through cognitive processes. Together, these perspectives offer a more holistic understanding of learning and development.

The Irieponics aquaponics initiative illustrates the complementary nature of these theories. Students participate in meaningful, hands-on activities that promote cognitive growth while simultaneously experiencing positive emotions associated with achievement, teamwork, innovation, and community recognition. As students engage in problem-solving and inquiry-based learning, they develop deeper conceptual understanding through assimilation and accommodation. At the same time, positive experiences such as successful harvests, public exhibitions, competitions, media recognition, and community engagement foster favourable attitudes toward STEAM education and sustainable agriculture.

The combination of both theories is particularly valuable for classroom practice. Teachers can create supportive learning environments that reduce anxiety and increase motivation through positive associations while encouraging active exploration and cognitive growth. Behavioural routines and classroom expectations can be reinforced through conditioning, while inquiry-based projects and collaborative learning activities promote cognitive development and higher-order thinking.

Technology integration further demonstrates the relevance of both theories. Educational technologies often incorporate motivational elements such as rewards, recognition, and immediate feedback that encourage participation. Simultaneously, simulations, design projects, robotics activities, and interactive learning environments support conceptual understanding and problem-solving. The aquaponics initiative effectively combines these elements by using technology and innovation as tools for both motivation and cognitive growth.

Ultimately, the synthesis of Classical Conditioning and Cognitive Development Theory supports professional practice that addresses emotional, behavioural, and intellectual dimensions of learning. Such an approach creates learning environments that are engaging, meaningful, and capable of fostering lifelong curiosity, innovation, and personal development.

CONCLUSION

Classical Conditioning and Cognitive Development Theory continue to provide valuable insights into learning and professional practice. Pavlov's Classical Conditioning theory explains how positive emotional and behavioural responses can develop through repeated associations, while Piaget's Cognitive Development Theory emphasizes the active construction of knowledge through interaction with the environment and cognitive development. Although the theories differ in focus, they complement one another by addressing different aspects of the learning process.

The Irieponics aquaponics initiative demonstrates the practical relevance of both theories. Students engage in authentic, hands-on experiences that challenge existing knowledge, encourage problem-solving, and promote cognitive growth. At the same time, positive experiences associated with collaboration, achievement, community engagement, and innovation help foster enthusiasm toward STEM education and sustainable agriculture. Through these combined experiences, learners develop both the intellectual skills and positive attitudes necessary for lifelong learning.

For educators and other professionals, the integration of behavioural and cognitive approaches provides a powerful framework for creating effective learning environments. By fostering positive emotional experiences while encouraging active inquiry and critical

thinking, professionals can support meaningful learning, personal growth, and long-term success. The continued relevance of these theories highlights their enduring contribution to educational psychology and contemporary professional practice.

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