



Implications of Creativity for Early Childhood Science Education

Yi-Huang Shih¹, Muhammad Zammad Aslam², Patrick Cheong-Iao Pang³, Blandina Manditereza⁴

¹Center of Teacher Education, Minghsin University of Science and Technology, Hsinchu, Taiwan

²University of Science Malaysia, George Town, Malaysia

³Faculty of Applied Sciences, Macao Polytechnic University, Macau, Macao

⁴Department of Childhood Education, University of Free State, Bloemfontein, South Africa

ARTICLE INFO	ABSTRACT
Published Online: 11 August 2025	Creativity is not merely an expressive capacity displayed by young children in artistic activities; rather, it constitutes a fundamental driving force in their scientific learning. It ignites curiosity, encourages diverse modes of expression, and strengthens problem-solving abilities. Through imaginative play, creativity infuses science learning with both enjoyment and vitality, thereby fostering meaningful and engaging educational experiences. This paper examines the implications of creativity for early childhood science education, with particular attention to: (1) stimulating young children's curiosity and motivation for scientific exploration, and (2) cultivating their problem-solving and critical thinking skills.
Corresponding Author: Yi-Huang Shih	
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1. INTRODUCTION

The cultivation of young children's character, as well as the acquisition of knowledge and skills, cannot be achieved merely by passively sitting in a classroom. Teachers should adopt diverse teaching approaches to stimulate children's interest and curiosity in learning. In his educational philosophy, Dewey emphasized the importance of attending to children's interests, arguing that they must be genuinely engaged in the activities they undertake in order to engage in authentic learning. For Dewey, interest is the spark that ignites the desire to learn; without it, curiosity cannot flourish. Only when learners perceive their learning activities as valuable can they sustain enthusiasm, develop intrinsic motivation, and actively engage in the learning process. This idea also influenced the subsequent progressive education movement, which advocates that education should be guided by children's needs and interests (Dewey, 1969; Dworkin, 1959; Fishman, 1998; Marshall, 1995; Mayer, 1950).

Curiosity and inquisitiveness are signs of a strong desire for knowledge and are inherent traits of young children. Numerous studies have shown that children who exhibit high levels of creativity also tend to be curious and ask many questions. The world-renowned inventor Thomas Edison, for instance, was known for his inquisitive mind from an early age. He constantly questioned the world around him, and this curiosity fueled his many inventions throughout his life. This clearly demonstrates that curiosity and the habit of asking questions are foundational to learning science, and they also

form the basis for the development of imagination and creative thinking. This paper aims to explore the implications of creativity for early childhood science education. It investigates how fostering creativity in young children can enhance their scientific thinking, inquiry skills, and problem-solving abilities. By examining the interconnections between creativity, curiosity, and scientific exploration, the study highlights the importance of integrating creative pedagogical approaches into early science learning environments (Shih, 2024, 2025a).

2. THE MEANING OF CREATIVITY

Creativity has long been a focal point of inquiry in the fields of education and psychology. Since J. P. Guilford's landmark address as president of the American Psychological Association in 1950, in which he emphasized the need for systematic research on creative thinking, scholarly interest in creative behavior has grown substantially (Guilford, 1950). Subsequent decades have witnessed significant theoretical and empirical advancements, yet the conceptualization of creativity remains both complex and contested. Despite extensive research, there is still no universally agreed-upon definition. Broadly, two dominant perspectives can be identified in the literature: one conceptualizes creativity as a cognitive ability inherent to individuals, while the other interprets it as a dynamic, socially and contextually embedded process (Runco & Jaeger, 2012; Sawyer, 2012). These differing viewpoints underscore the multifaceted

nature of creativity and the challenges inherent in its study. Proponents of the view that creativity is a psychological ability include influential scholars such as J. P. Guilford, J. W. Getzels, P. W. Jackson, and D. W. MacKinnon. Guilford (1950, 1967) made a foundational distinction between two modes of thinking: convergent thinking, which involves deriving a single correct solution to a problem, and divergent thinking, which he closely associated with creativity. Divergent thinking refers to the capacity to generate multiple, varied, and original solutions to a given problem, highlighting flexibility and fluency in thought. Similarly, Getzels and Jackson (1962) conceptualized creativity as a cognitive style that reflects an individual's propensity to question assumptions, explore unfamiliar domains, and synthesize novel ideas into coherent frameworks. MacKinnon (1962) further elaborated that highly creative individuals often demonstrate superior abilities in drawing upon past experiences, engaging in critical and independent thought, solving problems effectively, and integrating new knowledge meaningfully with existing cognitive structures. These perspectives emphasize creativity as a measurable and relatively stable set of cognitive traits or capabilities that distinguish creative individuals from their peers. In contrast to ability-based conceptions, another influential perspective regards creativity as a process—a dynamic and often non-linear sequence of cognitive and behavioral stages. Early theorists such as Graham Wallas (1926), I. A. Taylor (1959), G. F. Kneller (1965), and E. P. Torrance (1974) advanced various stage-based models to explain how creative thinking unfolds over time. Wallas (1926) proposed a seminal four-stage model of the creative process: (1) preparation, during which the problem is consciously explored; (2) incubation, a subconscious processing phase; (3) illumination, where insights suddenly emerge; and (4) verification, in which the idea is tested and refined. Similarly, Taylor (1959) articulated a four-stage process involving exposure, incubation, illumination, and implementation, emphasizing the developmental flow from stimulus to realization. Kneller (1965) built upon these earlier models by introducing a five-stage sequence: insight, preparation, incubation, illumination, and verification, allowing for a more nuanced understanding of the recursive nature of idea development. Torrance (1974), known for his empirical contributions to creativity assessment, placed particular emphasis on the cognitive steps inherent in creative problem-solving. He described creativity as a structured process involving the identification of problems, recognition of inconsistencies or missing elements, generation and testing of hypotheses, iterative revisions, and eventual communication of the outcome. This process-oriented approach highlights creativity as a purposeful and adaptable mode of thinking that can be cultivated through education and practice.

3. IMPLICATIONS OF CREATIVITY FOR EARLY CHILDHOOD SCIENCE EDUCATION

In the face of the globalization of education, many countries have made efforts in recent years to promote the export of education, especially early childhood education ((Dewey, 1969; Shih, 2019, 2024a, 2024b). Creativity is not only a form of expression in young children's artistic activities but also a driving force at the core of scientific learning. It sparks children's curiosity, supports diverse forms of expression, strengthens their problem-solving abilities, and, through play and imagination, brings joy and vitality to the process of learning science.

3.1 Stimulating Young Children's Curiosity and Motivation for Scientific Exploration

Creativity is largely considered to be the highest form of thought. All individuals are born with creative potential but if not encouraged or fostered, this might be lost upon adulthood. Creativity is not just a means for personal and individual expression, it can be a way of admiring and showcasing beauty and the spreading of important and valuable messages. Young children's creativity is inherently connected to their curiosity about the world. When a child begins to question a phenomenon, their creativity drives them to imagine possible explanations, actively propose hypotheses, and initiate exploratory actions. This intrinsically driven motivation to learn lies at the heart of early childhood science education. Teachers should encourage children to ask questions freely, respect their perspectives, and design open-ended questions that spark a desire to explore and stimulate their interest in learning (Harold, 2024; Shih, 2025a, 2025b).

3.2 Cultivating Problem-Solving and Thinking Skills

Dewey asserted that “thinking is a tool employed by the individual in adapting to the situations of actual life,” or, more concisely, that human beings think in order to live. He further emphasized that life is in a state of continuous flux, such that the problems of tomorrow will inevitably differ from those of today. From this perspective, it becomes evident that individuals are constantly confronted with varying problems within the contexts of their lived experiences. For Dewey, thinking attains its full significance only when it is applied to concrete life situations (Dewey, 1910; Mayer, 1950).

Creativity is pivotal for innovation across various domains, including science, technology, engineering, and mathematics (STEM). Scientific activities often involve trial and error, and creativity enables children to face challenges with flexible and open-minded thinking. For example, when a bridge structure collapses during construction, creativity guides young children to consider alternative materials or design approaches—this is a direct practice of innovative thinking and problem-solving. In teaching, educators should encourage children to view mistakes as valuable learning opportunities, guiding them to reflect on how to improve from their errors. This process fosters scientific thinking and

cultivates a spirit of innovation (Blue et al, 2025; Harold, 2024; Shih, 2025c, 2025d).

4. CONCLUSION

The learning of scientific concepts holds profound significance for young children’s cognitive, emotional, and social development. According to Jean Piaget’s theory of cognitive development, young children are at the transitional stage between the preoperational and concrete operational stages, during which concrete manipulation and exploratory activities can effectively foster the emergence and construction of scientific thinking. In addition, Lev Vygotsky’s theory of social interaction and scaffolding emphasizes that, in contexts where teachers provide appropriate guidance and children engage in peer collaboration, they can more effectively comprehend and internalize scientific concepts. Therefore, the development of kindergarten curricula should regard science education as a core component, integrating it not only into everyday life contexts and play-based learning but also into the design of challenging and inspiring inquiry activities to cultivate children’s observation skills, curiosity, and problem-solving abilities. At the same time, teachers should flexibly adopt diverse instructional strategies and open-ended questioning, while providing abundant experimental materials and exploratory spaces, enabling children to construct knowledge through active participation. In this way, science education can not only lay a solid foundation for children’s future learning but also help nurture lifelong learners equipped with critical thinking and creativity (Piaget, 1964; Vygotsky, 1978).

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