International Conference on
TEACHING, LEARNING and EDUCATION

2 - 4 July 2026 Zurich , Switzerland

Inquiry-Based Science Learning: Insights from Students' Metaphorical Perceptions

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Abstract

Educating future generations for sustainable development requires instructional approaches that promote critical thinking and meaningful engagement with real-world challenges. This research explores the effectiveness of inquiry-based science activities aligned with United Nations Sustainable Development Goals 6, 7, 13, and 14. Four guided inquiry modules were implemented with twenty sixth-grade students. Using a qualitative pre–post intervention design, data were collected through a Metaphorical Perception Form and an open-ended questionnaire to investigate students' perceptions of sustainability, sustainable development, climate change, and the environment. The findings revealed a clear shift from fragmented or misconception-based metaphors toward more comprehensive, scientifically informed, and interconnected understandings emphasizing responsibility, balance, and the interdependence of natural systems. Beyond evaluating instructional outcomes, the study employs metaphor analysis to capture how students conceptualize sustainability, sustainable development, climate change, and the environment following participation in SDG-oriented inquiry activities. By combining guided inquiry with qualitative exploration of students' conceptual representations, the research provides nuanced evidence of conceptual development and offers an instructional perspective that may inform the integration of sustainability themes into middle school science education. Ultimately, this approach demonstrates that inquiry-based learning can foster deeper conceptual change, sustainability literacy, and environmental stewardship among middle school students, offering a transferable instructional model that contributes to Education for Sustainable Development (ESD).

Keywords: Climate Change; Inquiry-Based Learning; Metaphorical Perception; Science Education; Sustainable Development