**Abstract**

The upcoming challenges of the twenty-first century require the planning of a new approach in the teaching of science and technology, encouraging the training of the scientists and engineers of the future and based on the standards included in NGSS (Next Generation Science Standards, 2013).[[1]](#footnote-1) Science teaching faces multiple challenges as a result of technology and the explosion of knowledge and channels of communication. Accordingly, the education system must adapt itself in these directions and equip its graduates with the skills needed for optimal functioning in the twenty-first century. This direction requires the updating of existing curricula to reflect the latest standards and content in science, as well as the implementation of advanced technological means in teaching-learning-evaluation processes (NRC, 2013; STL, 2017). The standards included in the NGSS document reaffirm the assertion that research and metacognitive guidance lead to the discovery of new knowledge and contribute to the development of scientific literacy. Recent studies have shown that metacognitive guidance that constitutes the peak of higher-order thinking promotes meaningful study and understanding among students, develops scientific research skills, and improves students’ motivation and attitudes regarding science studies. Accordingly, metacognitive guidance forms an integral part of teaching, learning, and evaluation of processes in science classes. The present study examined the impact of metacognitive guidance on scientific content knowledge, research skills, and motivation and attitudes to science studies among junior-high school students in laboratory environments. The study included the operation and evaluation of a study unit on the subject of photosynthesis in plants.

In order to examine the effectiveness of the metacognitive guidance, a research framework was developed for two groups: The research group, which undertook research learning in the laboratory with metacognitive guidance, and a control group that undertook laboratory learning without meta-cognitive guidance. The study was undertaken in a sample of 124 students in the 9th grade, aged 15-17 years old.

The study included three key stages in both groups: A. Pre-learning; B. Implementation of the intervention plan; C. Post-learning. In the pre-learning stage, the study examined aspects of the students’ scientific knowledge about plants and their motivation and attitudes regarding science studies. This research was undertaken in order to gauge the changes caused through the implementation of the study unit. The intervention included teaching a study unit entitled “Photosynthesis in Plants.” During the program, research skills were examined. After learning, the three variables mentioned above were examined: the students’ scientific knowledge about plants and processes in living organisms, such as photosynthesis in plans; scientific research skills; and the students’ motivation and attitudes toward science studies In addition, the study also examined meta-cognitive knowledge in the research group only, before and after learning.

The findings show the effectiveness of metacognitive guidance following inquiry-based learning in a laboratory setting: In the research group, a significant improvement was observed after learning compared to the control group with respect to the three variables examined: The level of knowledge of the scientific content, the level of research skills, and students’ motivation and attitudes toward science studies. In addition, the study provided insight into the characteristics of metacognitive knowledge after the provision of metacognitive guidance for the students.

**The Impact of Metacognitive Guidance on**

**Scientific Content Knowledge, Research Skills, and Motivation toward Science Studies**

**in a Laboratory Environment**

**Final Research Project for a Master’s Degree**

**in Science Education**

**Hemdat Hadarom College for Education**

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**Elul 5778 September 2018**

1. From: <http://www.nextscience.org> [↑](#footnote-ref-1)