Required Adaptations for Future Electrical Engineers to Meet the Evolving Reality of Renewable Energy: Insights from a Hydrogen-Focused Action Learning Program

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Abstract:

The global transition toward low-carbon energy systems is reshaping the professional profile and competencies required of future electrical engineers. In particular, the rapid emergence of renewable hydrogen and other alternative energy technologies demands not only updated technical knowledge but also strengthened soft skills, systems thinking, and societal engagement. This paper examines the adaptations needed in electrical engineering education through an in-depth case study of the "Green Ambassadors" action learning course at the Holon Institute of Technology (HIT), Israel. The course integrates sustainability, renewable energy, and hydrogen-related content with community-based experiential learning in elementary schools, positioning engineering students as peer-educators on environmental and energy topics. Using a mixed-methods design, the study analyzes quantitative pre- and post-intervention surveys and qualitative reflections from three stakeholder groups: engineering students (N=17), elementary school pupils (N=80, including a subsample of 51 who received a dedicated hydrogen workshop), and school staff. Findings indicate that participation in the program led to an expanded understanding of renewable energy sources beyond solar power, increased awareness of hydrogen as a clean energy carrier, and a more holistic conception of sustainability among engineering students and pupils alike. At the same time, students reported substantial gains in teamwork, communication, and classroom management skills, while staff highlighted the effectiveness of hands-on, mobile-laboratory demonstrations for fostering engagement and ecological awareness.

Based on these results, the paper identifies key educational adaptations required for future electrical engineers: embedding sustainability and hydrogen-related topics across the curriculum; integrating action learning and communityoriented projects; explicitly cultivating soft skills such as collaboration, pedagogical communication, and time and risk management; and promoting interdisciplinary, experiential approaches that link technical content with societal and environmental impacts. These adaptations are proposed as a concrete roadmap for aligning electrical engineering education with the evolving reality of renewable and hydrogen-based energy systems and for preparing graduates to act as knowledgeable, socially engaged change agents in the energy transition.

Keywords:

Electrical Engineering Education, Renewable Energy Competencies, Hydrogen Awareness, Action Learning, Soft Skills, Sustainability Literacy.