THE USE OF HELIOTECHNICAL TOOLS IN EDUCATION AND INNOVATIVE APPROACHES

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Abstract. *This article explores the integration of heliotechnical tools — devices and systems utilizing solar energy — into the educational process. The study emphasizes their role in fostering students' intellectual growth, developing practical skills, and promoting sustainable thinking. It also discusses innovative approaches in pedagogy that combine heliotechnics with digital technologies, STEAM methodology, and problem-based learning.*

Keywords:*heliotechnology, solar energy, educational process, technical thinking, environmental awareness, laboratory model, engineering skills*

Introduction

The 21st century is marked by global challenges such as climate change, energy crises, and the urgent need for sustainable development. Education plays a decisive role in preparing a new generation of specialists who are capable of addressing these problems. In this context, heliotechnical tools — educational devices and experimental setups that utilize solar energy — are becoming increasingly relevant in the training of future engineers, scientists, and educators.

The application of heliotechnical tools in education is not limited to teaching physics or engineering principles. They represent a multidisciplinary platform that connects natural sciences, technology, mathematics, and environmental studies. Students who work with solar dryers, photovoltaic panels, or solar water heaters are not only exposed to theoretical knowledge but also develop practical competencies such as measurement, analysis, and system optimization.

Another critical aspect is the innovation potential of heliotechnical tools. They enable the implementation of new pedagogical methods such as project-based learning, interactive simulation, and STEAM-oriented curricula. Through such methods, learners can design solar-powered models, simulate energy

efficiency under varying weather conditions, or analyze the economic feasibility of renewable energy systems.

Furthermore, the integration of heliotechnical devices into educational practice increases students' awareness of sustainable development goals (SDGs), particularly SDG-7 (Affordable and Clean Energy) and SDG-13 (Climate Action). Thus, these tools do not only serve as instruments of technical instruction but also as catalysts for building ecological responsibility and innovative thinking.

In recent years, several universities and technical institutes in Central Asia and worldwide have piloted programs that integrate solar energy systems into laboratory training. These initiatives have shown that students engaged in heliotechnical projects demonstrate higher motivation, stronger problem-solving skills, and deeper understanding of energy transformation processes.

Below are illustrative examples of figures that can be included in the article:

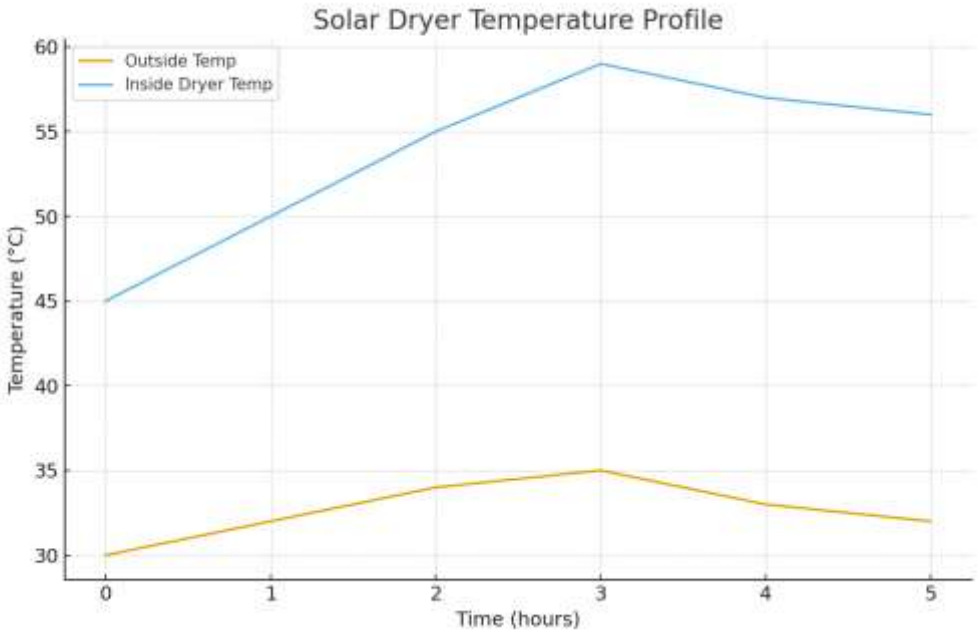

Figure 1. Solar dryer temperature profile (inside vs outside).

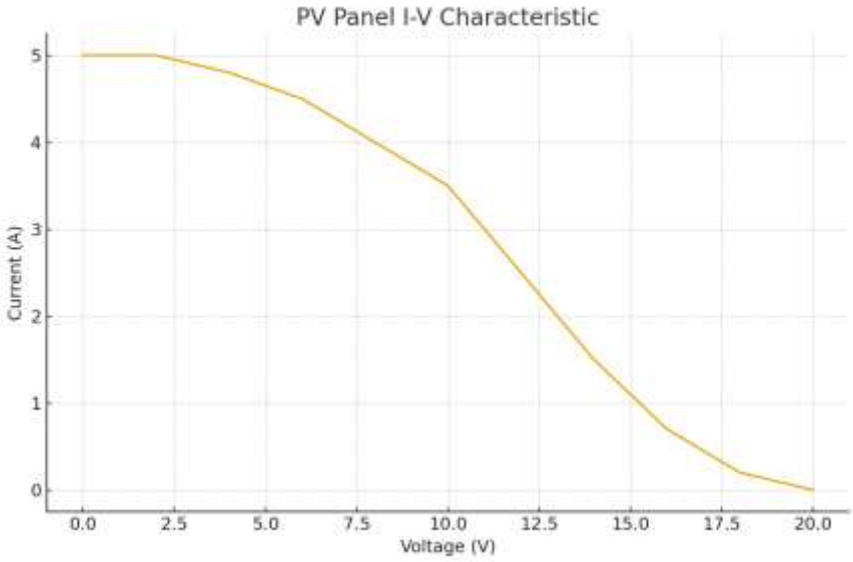

Figure 2. PV panel current-voltage characteristic curve.

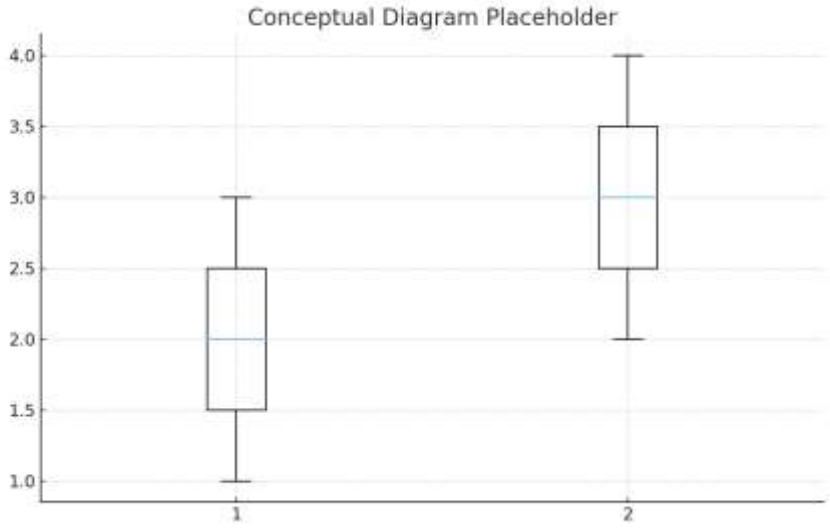

Figure 3. Conceptual diagram of heliotechnical tools in education (illustrative).

Conclusion

The integration of heliotechnical tools into education offers significant opportunities to improve both the quality and relevance of the learning process. These tools provide students with a platform to connect theory with practice, foster creativity, and enhance problem-solving abilities. Through innovative approaches such as STEAM integration, project-based learning, and digital simulation, heliotechnical devices enable students to gain not only technical

knowledge but also ecological awareness and sustainable thinking. Ultimately, such educational practices prepare future engineers, scientists, and educators to play a key role in the global shift toward renewable energy and sustainable development.

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