Exploring Thermoelectric Phenomena by the method of Blended Learning

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Abstract. Blended learning combines online learning in guided home self-study with active student inquiry in the school's learning lab. During the workshop, the teacher will alternately be in the position of a student trying to understand the physical nature of thermoelectric phenomena but also in the position of a teacher discovering the supporting elements of flipped learning and habitat rotation in blended learning. Peltier cell stations will be available to participants through different activities. At the end of the workshop, participants will use personal experience to evaluate the suitability of blended learning for active student physics learning.

Introduction

Thanks to the Internet, the media, social networks as well as book and magazine sources, the student has enormous access to the latest knowledge. The student creates his own set of concepts with varying depth and correctness of understanding. In information overload, we perceive two essential cognitive problems: superficial processing of information mainly at the level of memorization and insufficient development of inquiry skills.

We understand the essence of education as giving meaning to a child's new experiences, in cooperation with others. The sustainability of the quality of education depends on conceptual decisions, the deployment of adequate educational methods, preparedness and professional support of teachers [1]. Education is a difficult but strategic investment for the future. Already today in school, we need to prepare students for jobs and technologies that do not yet exist. From the point of view of challenges in education, we see the deployment of blended learning as one of the appropriate solutions. It is an approach that combines traditional classroom instruction with online learning [5]. Blended learning is a learning model that gives learners control over the learning process while facilitating collaboration with others. However, it is difficult to propose how to prepare educational activities in a school environment [6].

From several models of blended learning, we will check flipped learning and station rotation in the workshop [4]. For the workshop participant (teacher), it is about gaining initial positive experience and personal conviction about the contribution of the teaching method to physics education. During the workshop, the teacher will alternately be in the position of a student trying to understand the physical nature of thermoelectric phenomena, but also in the position of a teacher discovering the supporting elements of flipped learning and station rotation within blended learning.

After studying a short motivational material (as a student), he clarifies a possible understanding of the problem and defines areas of interest for school research. On the basis of feedback from the student's home self-study (as a teacher), he (she) prepares activities for station rotation and supporting clarification of primary student concepts. When working in small groups (as a student), he (she) observes and investigates basic events and tries to understand and interpret them. Under the guidance of lecturers, the teacher (as a student) summarizes the findings and clarifies the acquired knowledge about the physical principle of thermoelectric phenomena and their use in realized observations and measurements.

The Workshop – Activities

Part 1. Online self-study (before the workshop).

An electronic textbook for home self-study is made available to the participants. With a view to conceptual understanding, the physical principle of thermoelectric phenomena is clarified and basic practical applications are described. With online feedback, we verify the degree of participants understanding achieved by initial concepts and self-study and their theoretical preparation on practical activities during the workshop.

Part 2. Laboratory station rotation (during the workshop).

Participants work in small groups using worksheets to make selected observations and measurements by rotation at three of the six stations (S1 - S6). They seek answers to established research questions regarding the operation and principle of the Peltier cell. S1: How does changing the polarity of the voltage source affect the temperature on the cell walls? S2: How does the magnitude of electric voltage change with increasing temperature difference? S3: What effect does increasing the temperature of the hearth plate have on the speed of rotation of the fan? S4: What is the maximum voltage value that we can achieve using the temperature difference? S5: What is the electrical output of a Peltier cell? S6: Can we charge a mobile phone using a temperature difference and a series of connected cells?

Fig. 1. Fireplace fan and mobile phone charger with Peltier cell.

At the end of the workshop, based on personal experience, the participants will evaluate the appropriateness of blended learning for conceptual student physics education and school practice.

Acknowledgments

The work was created and supported as part of the grants: APVV-22-0515 Blended learning of Physics in the Future Classroom Lab, VVGS-2023-2540 Action research on blended learning.

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