

Beata Semków-Nędza, M. Sc. Eng

Abstract of the dissertation entitled:

**Elementary school students' understanding of physics
versus the use of information and communication technology tools**

Doctoral advisor: Wojciech Walat, Ph. D., Prof. at University of Reszów

Auxiliary advisor: Krystian Tuczyński, Ph. D.

Abstract

Introduction. The modern world is marked by constant transformations in many areas of life. Digital technology is advancing at a very fast pace. As a result of these changes, students have changed, and their educational needs are vastly different from those of earlier generations. Physics teachers have been confronted with a difficult task, as the continuous transformation, digitization of the Polish school has been confronted with the teaching-learning process of physics. Among the proposed solutions for adapting the process of teaching-learning physics to the requirements of modernity and the perception of the world by today's students is the inclusion of information and communication technology (ICT) tools in the educational process.

Research Objective. The main objective of the own research was to determine the differences that occur in the understanding of physical issues by students in grades 7 and 8, which are the result of the use of ICT tools compared to traditional education, using the example of two selected sections of physics: "dynamics" in grade 7, "vibrations and waves" in grade 8. The theoretical-cognitive objective and the practical objective of the own research were also distinguished. The first was to enrich the knowledge of education using ICT tools, and to determine the essence of understanding in education and the possibility of improving it through the use of ICT tools in teaching physics, and their relationship to the levels of students' understanding of physics. The practical goal of the own research concerned the development of the author's curriculum for teaching physics in elementary school for grades 7 and 8 containing methodological extensions - with particular emphasis on ICT tools, and in addition, the development of four levels of understanding of physics for two selected departments: "dynamics" (grade 7) and "vibrations and waves" (grade 8). In addition, this objective also concerned the formulation of conclusions, obtained at the stage of analyzing the results of own research, on the effectiveness of the implemented ICT tools and their relationship to students' understanding of physical issues. In addition, practical solutions were identified for the dissemination and implementation of ICT tools for teaching-learning physics in grades 7 and 8 of elementary school.

Materials and Methods. The study included 295 elementary school students, 122 students in grades 7 and 173 students in grades 8 from the Subcarpathian region, respectively. In the present

dissertation, the diagnostic survey method was used as the first method, which allowed us to find out opinions relating to the author's physics curriculum for grades 7 and 8, with a particular focus on ICT tools. For this purpose, a survey questionnaire was used, prepared for a properly selected group of competent judges. In order to objectify the research process, a methodological procedure was used, i.e. triangulation of research methods. The main method of conducting our own research was a pedagogical experiment, using the parallel group technique. The students subjected to the study were divided into experimental and control groups. The experimental factor under study, i.e. the author's curriculum, was introduced to the experimental group. The control group served as a reference for the experimental group, and the experimental factor under study was not introduced into it. The tool used to verify the comprehension of the students subjected to the pedagogical experiment was a pre-comprehension test and a post-comprehension test with specially prepared tasks assigned to one of the four levels of understanding of physical issues adopted in the study.

The method of research, conducted in parallel with the pedagogical experiment, was observation. In the implementation of our own research, a special case of this method was used, i.e. participatory observation by the teacher conducting a lesson in a particular class, using a sheet for observation of student work.

Analysis of results and conclusions. The paper presents a detailed analysis of each comprehension level and the differences occurring in comprehension at a given level, resulting from the inclusion of ICT tools in the educational process or teaching lessons without these tools. The obtained comprehension results depended on the analyzed comprehension level, the selected physical issue and the analyzed class.

Conclusions. The paper presents conclusions resulting from the analysis of own research. The conclusions provide a hint for teachers who face the difficult task of implementing students in the process of teaching-learning physics, starting with the introduction of difficult definitions, physical phenomena and other physical issues, ending with solving complex tasks that require the synthesis of knowledge from different areas of physics and other school subjects (such as mathematics). Based on the conducted research, recommendations were established that contribute to conducting the teaching-learning process with a focus on improving the understanding of physics among students in grades 7 and 8 of elementary school.

Keywords: information and communication technology (ICT), understanding, physics, school children