



Elements of Mathematics used in teaching physics at junior high-school level (Polish “gimnazjum”, children aged 13-16)

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When teaching physics, mathematics serve as a tool which allows to implement issues dealt with in physics: the scientific study of physical matter and phenomena, as well as the detection of general physical laws they are subject to (Rozenbajgier, Kreiner, 1999, 2001). Among the terms composing the language of physics, physical quantities are very important. They are the measurable attributes or characteristics of objects, phenomena and processes. Mathematical issues involving measurements thus play a fundamental role in mathematical contents on which the teaching of physics is based. The results of these measurements often allow for the detection and determination of certain relations between physical quantities, taking the form of physical laws, often formulated as (functional) mathematical relations. Familiarity with these helps to question the issues, which in turn leads to the construction of hypotheses explaining the reasons for the relations observed. Such hypotheses are subsequently verified by conducting relevant experiments. Hypotheses, verified by many experiments and covering a large group, are physical theories. They make it possible to predict the effects of many combined phenomena, for which mathematics are also important as they are related to equations, inequalities or formal rules of algebra. We present in form of a poster the main results of multi-aspect analysis for popular Polish textbook series (Rozenbajgier, Kreiner, 1999, 2001) for physics teaching in secondary schools.

The analyses have been carried out regarding: mathematical content being used, and its mathematical correctness, enclosed problems and their example solutions, applied symbols, correlation with mathematical education purposes, and relation of examples used in the textbook to current economic and social situation in our country. This analyses shows that solved examples, which are important part of textbooks, are first of all computational exercises, in general involving data insertion in a ready formula. No explanations concerning “the idea”, usually only “ready solutions” are shown, which answer “how?”, but not “why?”. This procedure is poorly educating, since on one hand it allows to learn how to solve particular problem, but it does not foster development of skills allowing to solve problems in general. In all parts of textbooks we can find problems to be solved individually and real situations and realistic examples. It is necessary to underline the very good choice of real life situation and examples used in the textbooks an taken from current economic and social situation in our country. Often there are wrong comments concerning problem solutions. Instead of reference to appropriate theorem, generalities are used, or it is permitted to use an incorrect from point of view of mathematical accuracy, identification of graphic interpretation with numerical value of a certain physical quantity (“The work is equal to rectangle area”). There is no references to definitions of mathematical concepts, or to theorems, and we can see incorrect symbols and also we can observe applying for mathematical objects the names, which are not used in mathematics.

To recapitulate, we should state that the physics textbooks subject to analysis implement the targets from all three mathematical education levels (Krygowska, 1986) only to minimum extent.

It would be purposeful to begin works aimed to develop mathematics and physics textbooks, which would ensure complete correlation in teaching of these two subjects, and in particular allow for



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implementation of mathematical education purposes, also during the physics lessons. Mathematics textbooks should focus more on the issues involving measurements, with particular consideration of the unit exchange issues. Typical exercises should be accompanied by tasks - problems to be solved, and solved examples should also show analyses regarding “ways to reach the solution”, not only showing “ready solutions”. How to proceed to prepare teams capable to do this task difficult - it is good actual question to answer, if we want realize the ideas of integrated education in junior high school.

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