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Pupils' Preconceptions about the Natural Phenomena at the Beginning of Primary Education – A Burden and/or an Opportunity[2]

Extended summary

Learning about the world that surrounds a child begins well before the start of primary education. Experiential concepts, which children form in direct interaction with the environment, represent an experiential basis on which the formation of scientific concepts in the teaching process relies. Two school subjects, *The World around Us* and *Social, Scientific and Environmental Education,* are a good example of the school subjects firmly grounded in the pupils' everyday experiences. This fact is evident in the curricula for the two subjects which clearly state that teachers should acknowledge pupils' perceptions of themselves and the world around them, but that the ultimate goal of learning the subject matter is to build scientific knowledge of the nature, society, and culture (Prosvetni glasnik, 2017).

Experiential concepts, though important for the children's understanding of their environment, generally tend to be out of sync with scientific facts and can become an obstacle for learning scientific concepts, especially in terms of the concepts related to science. Experiental notions based on ungrounded generalisations and misconceptions are also known as preconceptions, alternative ideas, and naive beliefs.

Generally speaking, there are two different methodological strategies that can be used for tackling children's alternative ideas related to science. One approach refers to the conflict

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between "two types of knowledge", namely, the primary school teacher's effort to replace the incorrect ideas with the correct ones. The second approach implies that learning science is a process in which children's preconceptions are gradually enriched and restructured, while the incorrect ideas are used as a basis for planning and implementation of relevant activities in which pupils are able to check the validity of their own naïve ideas.

The aim of this paper was to examine pupils' preconceptions about physical phenomena in the fields of the Physical Properties of Materials and Movement and Light at the beginning of primary education. The survey was conducted on a sample of 324 students, by using a criteria-based test of knowledge. The questions in the test of knowledge were based on the curricular content for the subjects *The World around Us* and *Social, Scientific and Environmental Education*, and typical misconceptions about the above-mentioned phenomena were also taken into account (Pine et al., 2001; Smolleck & Hershberger, 2011; Radovanović, 2017). The results of the research indicate that seven-year-olds from Serbia have some typical preconceptions and doubts that were confirmed by the previous research conducted in other countries (United Kingdom, USA). Our pupils struggle with the concept of powder-like materials as a special form of materials in solid state, as well as with the idea that water in gaseous state is still water. The expected preconceptions were observed also in the segments related to the behaviour of bodies in water, natural sources of light, and the position of the shadow relative to the source of light. The respondents had the fewest misconceptions about the movement of bodies and the properties of light, while they mostly had wrong beliefs about the physical properties of materials.

The pupils demonstrate statistically significant success in solving tasks dealing with the movement of bodies, and a lower level of success in solving the tasks dealing with the physical properties of materials and light. One of the reasons for different scores in these areas may be that pupils have plenty of opporuntities in their daily lives to observe and practise the movement of different objects, contrary to the other two areas that do not constitute pupils' regular experience.

Pupils' preconceptions about natural phenomena are not per se undesirable in the teaching process, despite the fact that they are not (entirely) scientifically correct. These preconceptions are not mistakes that can be simply replaced with the correct meaning of the concepts. In fact, they require an active and conscious reconstruction and adaptation of the existing knowledge (Antić, 2007) that will occur when a situation is created in class in which pupils are not satisfied with the existing concepts, whereas the new ones are plausible and believable (Posner et al., 1982), both at school and outside of it. Given that the identification of the preconceptions that pupils have at the beginning of primary school can be useful for the creators of educational policies, textbook authors and teachers when deciding which physical phenomena should be given additional attention because they are not well understood by students, or what phenomena are pupils already familiar with, a more in-depth research of this content in teaching is necessary.

Keywords: teaching Social, Scientific and Environmental Education, pupils' preconceptions, physical phenomena.

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