Long-lasting opinions on physics and physics education in the Czech Republic

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Abstract. The aim of this contribution is to showcase the results of a nation-wide survey conducted in the Czech Republic on general public regarding the long-lasting opinions on physics and physics education originating mainly in lower secondary school and high school physics classrooms in collaboration with the Institute of Sociology. The results of this survey aim to support the modern ideology of focusing more on conceptual understanding and inquiry-based approach to physics education rather than traditional methods focused on formulae and constant memorization.

Introduction

Research [1] reveals that students' knowledge about studied topics shift from being "remembered" (meaning the students remember particular moments when they learned answers to the presented questions) to being "known" (meaning the students just know the correct answer). The same research also states that most of the knowledge shifted was conceptual knowledge, rather than encyclopaedic facts. A follow-up research [2] concludes that all learnt knowledge starts in episodic memory and needs to be schematized to enter long-term memory. Plain facts are hardly schematized and thus are easily forgotten, whereas concepts are more often used and practiced, which forces schematization and are thus remembered for longer and "known" when asked about.

An important step in remembering something is learning it. All pieces of information start in the working memory, where they stay for only a few seconds. If the working memory manages to find something to bind this new piece of information to (like a similar or analogous thought), the new piece of information advances to the long-term memory, otherwise it is lost [3].

Another important step is the process of recalling a piece of information. All pieces of information in the long-term memory make up a web of interconnections that allows us to remember them. The more connections a piece of information makes, the easier it is to recall it and the harder it is to forget it (because to forget it, all its connections would have to be severed) [3]. Conceptual knowledge is more complex than factual information and thus creates a more intricate web of connections, making it easier to be remembered.

Numerous studies have shown that interactive and engaging learning methods are found to be more interesting and fun than traditional learning methods [4], boost student interest in the studied subject [5] and in natural sciences in general [6]. The most important aspects of learning that affect students' relationship towards natural sciences are high level of student involvement, the use of unusual learning activities, support through encouragement and attention, among others [3].

Inquiry-based education and interactive learning methods allow students to take part in the process of learning. This active engagement provides them with countless opportunities to schematize their knowledge, make a rich web of connections and practice and the learnt pieces of information. Combined with the students' desire for interesting and non-boring learning activities, interactive and inquiry-based learning methods seem to provide a very beneficial learning environment for students.

Research questions and methodology

Many studies have delved into the short-term effects of interactive education methods on knowledge of and attitude towards physics. However, too few studies have looked into what the long-term effects might be, which we decided to unveil.

A questionnaire was created to give a deeper insight into the topic of opinions of the general public concerning physics and physics education. In the Czech Republic, physics lessons are deemed to be one of the least popular ones as research from 2010 concludes [7]. For this, several sociological institutes were contacted and through them the questionnaire was spread among the general populus of the Czech Republic.

One of the research questions is "What experiences do people bring from physics lessons into their lives?". Research mentioned in the introduction shows that learning activities affect students' interest in physics and natural sciences, thus a research question was formed "How do learning activities affect students' interest in learning physics or keeping in touch with physics?".

The questionnaire assimilates items from the 2015 TIMSS international questionnaire into the context of Czech physics education. These items probed the respondents' interest in learning physics at school on a 5 point Likert scale. This part of the questionnaire also asks about remembered activities conducted during physics lessons. The provided list of activities was built around the evaluation tools propagated by the Czech National Institution of Technical and Vocational Education. Responders could also add any additional learning activities.

The second part of the questionnaire asks responders their opinions about what activities should be taught at elementary and high schools and how the frequency of learning activities would have to change to increase their favourability of physics lessons the most.

In the third and last part of the questionnaire, the current interest in physics was studied. Items were assimilated from the 2015 PISA international questionnaire from natural sciences to physics.

Findings of this questionnaire will be presented at the 4th World Conference on Physics Education 2024, Kraków, Poland.

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