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ANALYSIS OF KNOWLEDGE OF THE ISSUES OF ATOMIC PHYSICS IN THE CONTEXT OF THE DEVELOPMENT OF NUCLEAR ENERGY IN POLAND

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Abstract: Nowadays, when demand for energy is growing, we have to consider all possible sources of generating energy. As far as renewable energies such as wind, solar or tidal currents no longer arouses such drastic emotions, so much energy from the atom is not acceptable on a large scale by the public. At the same time it should be noted a correlation between low level of acceptance of energy from nuclear power and the lack of reliable knowledge about it. This phenomenon will be deepened if we do not introduce serious measures to inform the public about the advantages and disadvantages arising from nuclear energy.

Keywords: the energy of the atom, public awareness, school core curriculum, permission for the construction and operation of nuclear power plants.

Introduction

In the age of computers, when there are no problems with the flow of information it proves that the public does not reach alone the knowledge of energy technology. At a time when every day is increasing demand for energy we do not try to understand how you can obtain electricity. We turn on the computer and we do not think how the electricity reaches our homes. On the question of how to raise the energy, most of us think about traditional methods of producing energy like hydroelectric power plants [3]. This phenomenon that occurs because we have not got any information about production of energy.

Analysis of the students' knowledge of the issues of atomic physics

Consciousness associated with nuclear power or scope of knowledge on the elementary information in the field of nuclear physics that have even young citizens of our country is low. A survey conducted, in January 2016, with the first year students at the Maritime University of Szczecin showed great ignorance of the elementary issues of atomic structure. The study group consisted of 211 people. Students were asked five simple questions in the written test.

For every question students could give one of the four proposed answers. In the first question, the respondents had to indicate isotopes of hydrogen, in the next section, students were asked to choose the correct ending of definition of mass defect. Next task involved the composition of the nucleus. The question No. 4 was to select from the proposed answers correct number of protons and neutrons in the nucleus of the isotope of carbon ^{13}C. In question No. 5 one should indicate the correct record of disintegration α. Percentage of correct answers given by the students shows the Fig.1.

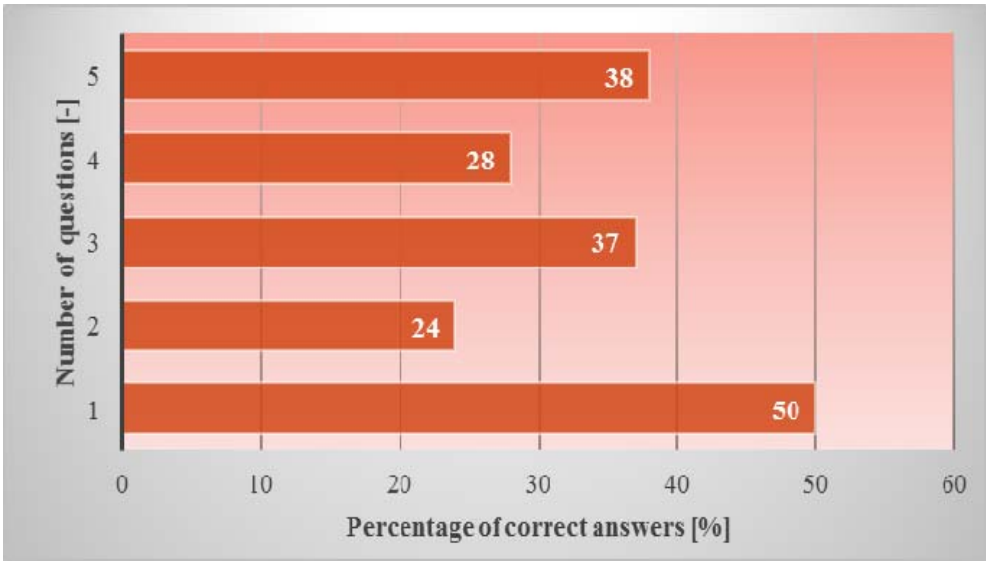

Fig 1. Percentage of correct answers by the students surveyed.

Number of given the correct answer to any question does not exceed 50%. The students coped best with the question concerning the isotopes of hydrogen – half of the respondents gave the correct answer. This may be due to the fact that this issue is discussed both in chemistry class (III and IV level of education) and physics (only IV level of education). The most difficult question was the issue relating to defect mass. This problem is moved only in secondary schools (IV level of education – elementary level) and only on the lessons of physics. With this question coped only 24% of respondents. Objectively speaking, knowledge of respondents with a range of simple questions atomic are not optimistic – especially since the issues raised included the issues of the core curriculum in the field of junior high school and the first year of secondary school.

Teaching content in the requirements of specific core curriculum for the third area of education in chemistry at the second point on "The inner structure of matter" (paragraphs 1–5) include the reading of the periodic table of basic information about the elements (symbol, name, atomic number, atomic weight, type of element-metal or non-metal). In addition, the student should, in accordance with the core curriculum, be able to describe and characterize the composition of the atom (nucleus: protons and neutrons, electrons). According to the third paragraph of the said core curriculum the student should be able to determine the number of protons, electrons and neutrons in an atom, in situation where we know the atomic number and mass number. In paragraph six core curriculum indicates that the student should be able to define the concept of isotope exchange areas of life in which isotopes have been used and explain the differences in the structure of atoms of hydrogen isotopes. Likewise, the present requirements for the core curriculum of chemistry for the fourth stage of education at the basic level. Suggested content of education in the specific requirements include the fifth point – the fuel used in the present and in the future. According to the first paragraph of that point the student should give examples of raw materials used to generate power (directly or after processing), under the fourth paragraph the student should be able to propose alternative sources of energy - analyzing the possibilities of their applications (including biofuels, hydrogen, solar energy, water, nuclear, geothermal etc.). Fifth paragraph suggests that the student is able to analyze the impact of various ways of obtaining energy on the natural environment.

At the same stage of education, but in the advanced level, we have also similar requirements detailed in chemistry, i.e. core curriculum suggests in the first point called 'atom, molecule, and the stoichiometry of the chemical' that the student should be able to calculate the atomic mass of the element based on its isotopic composition and determine the isotopic composition of the element (mass%) based on its atomic weight. Additionally, through the second point, on the structure of the atom, it contained the information that the student is able to determine the

number of elementary particles in the atom and the atomic nucleus, on the basis of record ${}^{A}_{Z}E$.

The core curriculum of physics at the third stage of education does not include in any way problems related to the physics of the atom. Only in the fourth stage of education at the basic level the issues related to nuclear physics are raised. Then the student after completion of the mentioned parts of material relating to nuclear physics should be competent with the concepts of element, atomic nucleus, an isotope, proton, neutron, electron. A student should be able to make out the composition of the atomic nucleus based on the atomic number and atomic mass.

At the same time the classes of physics concepts are implemented: rest energy, the deficit mass and binding energy. In addition, the student calculates these values for any element of the periodic table. A student who has completed the fourth stage of education should be able to exchange properties of nuclear radiation α, β, γ, and they should be able to describe how the gamma radiation was formed. The classes are discussed further the concept of a stable and unstable nuclei. A student should manage to describe the disintegration of a radioactive isotope, using the concept of half-life, while drawing a graph of the number of nuclei that have collapsed since. The core curriculum also involves familiarization with the principle dating substances on the basis of the isotopic composition, for example: ${}^{14}C$ dating. A student at this stage of education describes the nuclear reactions using the law of conservation of the number of nucleons and the principle of the load behavior and the principle of conservation of energy, also describes the chosen method for the detection of ionizing radiation. Extremely important issues which must refer to the student is the impact of nuclear radiation on matter, and organisms, the use of radioactivity and nuclear energy. Student knows how the reaction of uranium fission ${}^{235}U$ occurring as a result of neutron absorption, provides the conditions for the occurrence of a chain reaction. Minimum of core curriculum also includes a description of the nuclear power plant and the benefits and risks of nuclear energy.

The above analysis of the attitudes of the program suggests that young people, on the fourth stage of education, should be highly knowledgeable in the field of nuclear and atomic physics, because these issues are realized both in the classroom with both chemistry and physics, and is discussed on two levels of education. However, as the survey showed, the tested group of people do not understand the elementary issues related to the construction of the atom. This level of knowledge is sadly the cause of the biased approach to many aspects of life, because it is difficult to express honest and informed opinion on such: benefits and dangers of the use of nuclear energy and nuclear power, if you do not have an adequate level of information on the issues discussed. It is also difficult to lead substantive discussion on these issues, because the interlocutor often is influenced by the feelings caused by false information, which may be based on human fear and lack of basic knowledge.

There is a chance that a similar survey conducted next year will be presented slightly better results associated with the awareness of nuclear power, because in survey we asked students who was leaving high school with a new core curriculum. To obtain reliable information we have repeat the survey in the future. At the moment, consider the extension of higher education study programs and the creation of new fields of study related to nuclear power, which will allow you to gain an attractive profession in the country and abroad. At the same time these measures will create favorable circumstances to increase awareness of the technical and technological society and contribute to the increased interest in education in sciences. At the moment in Poland you will notice a significant shortage of specialists in the field of nuclear power as evidenced by the number of technical universities, which introduced the directions related to nuclear power. In the country we can observed a deficit of both specialists in the field in issue as well as personnel training and those who could competently carry on a conversation with performers eventually built plant [4]. A good idea would be to increase the funds for nuclear research funded by the government, so you will be able to form new research programs especially international support development of new safe nuclear technologies. At the same time, it should be noted that in Poland we have a lack of secondary schools preparing for lower-level staff to work in the nuclear sector, this is due to the lack of employment opportunities in the acquired profession, as well as a large social aversion to the energy sector [4].

Unfavorable public opinion dictated by fear of the outbreak of a nuclear power plant in Chernobyl 1986 April 26th is fueled, from time to time, with information about environmental disasters in other parts of the world such as.: Fukushima (11 April 2011). Often, a person listening to objective information through the media choose only these

information which inspires additional reluctance and fear of relatively clean nuclear energy, forgetting that Poland is not in the area of unstable seismic (as mentioned Japan). People forget also that the old technologies (quoted earlier Chernobyl) are replaced by newer much safer. Surveys on acceptance of nuclear power development in our country are not clear. This is probably due to the manner of questioning. According to a study commissioned by "Rzeczpospolita" 57% of respondents opposed the construction of a nuclear power plant in Poland over the next ten years. Positively on the subject commented 34% of people, and 9% of respondents had no clear opinion. Those expressing a negative opinion on the construction of the power plant as a reason to give out the opposition's concerns about the safety of operation (82%), only 13% of respondents cited as a reason for the high cost of investment, and 27% of respondents would not like to have a nuclear power plant in their neighborhood.

In the case of similar studies conducted in approximately the same time, by Pentor [1] commissioned by the Polish Agency for Atomic Energy in December 2006, positively commented on the construction already two times more respondents (i.e. 61%). However, the question was a suggestion to approve the construction of a safe and modern nuclear power conditioning to reduce dependence on oil and gas supplies and reducing harmful emissions into the atmosphere. The survey that resulted increase public support for nuclear power in the neighborhood where its presence would lead to the creation of new jobs and a decline in energy prices. In this case, the acceptance level has increased from the previously mentioned values published by the "Rzeczpospolita" [5] almost doubled reaching a value of 48%.

Analyzing the percentage of support for the construction of nuclear power plants in Poland, it can be concluded that the level of social acceptance for power plant construction increases if the question is eliminated the fear factor i.e. in a survey carried out on behalf of the PAA were asked the question, which suggested the construction of safe nuclear power, while survey conducted by "Rzeczpospolita" did not contain the words suggest in any way the safety of work-related power. It can be concluded that the discrepancy in the acceptance of nuclear power flowing from both surveys is evident from the fear of power failures and potential problems with storage of radioactive waste.

Conclusions

The lesson here is that in order to break the social aversion should implement a system to inform the public about both the advantages and disadvantages of nuclear energy, and which is extremely important safety operation of existing power plants. Resistance to nuclear power plants can be effectively reduced by introducing appropriate public debates and educating younger and younger generations because only conscious society expresses acceptance of nuclear energy.

Maintaining such a low public awareness related to nuclear energy will generate in the future, a number of problems, both social, economic, political and energy [2], as with the increasing demand for energy will not be able to ensure the continuity of supply of that energy. This fact is so obvious that PGE, Tauron and Enea have expressed interest in participating in the consortium on the construction of a nuclear power plant in the country, and the PAA in a permanent seeks to educate the public about the advantages and disadvantages arising from the utilization of atomic energy. The conducted survey suggests that even university students do not have adequate knowledge about the physics of the atom, so it's hard to expect from the older part of the population greater resource messages in this regard. This fact clearly implies a lack of acceptance of new energy technologies, as suggested by studies conducted by independent institutions. Ignorance and fear of new technologies can be overcome only by introducing more early school education. A good idea is to implement the issues of atomic physics in high school.

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