

Comparison of the knowledge of Croatian and Slovenian elementary school and grammar school students about the human evolution

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ABSTRACT

Previous studies show that students have difficulties in understanding the evolution of human beings due to difficult conceptions and complexity of the subject. The objective of this research was to determine the knowledge of Croatian and Slovenian elementary and grammar school students about human evolution. We wanted to see if there was a difference in knowledge between the students of two countries, genders, and ages. Besides the knowledge, we wanted to determine whether there exist some characteristic students misconceptions about human evolution. The research was conducted in 2017 in Slovenian and Croatian gymnasiums and primary schools. 170 students participated, of which 100 Croatian and Slovenian elementary students, and 70 high school students from these countries. An anonymous knowledge test was used for the research, and the data were processed in the SPSS program with the Mann-Whitney test. Research has shown that the knowledge of tested students about human evolution is satisfying. The overall average success on the anonymous test of knowledge was 64,8%. The most common correct answer was about the Neandertal site in Croatia, where 96,4% of students selected Krapina as correct answer. We have compared and checked the results that we collected. We can conclude that there are differences in the knowledge of human evolution between students of different countries, and grades. Slovenian high school students showed more knowledge about the evolution than Croatian high school students (we found 14 statistically significant differences, $p < 0.05$), while Croatian elementary students were more successful than Slovenian (we found 16 statistically significant differences, $p < 0.05$). Croatian gymnasiums have shown worse results than Slovenian elementary school students. Primary school knowledge about human evolution differs from grammar school by the frequency of correct answers in the test. Croatian elementary school students have shown more knowledge about the human evolution than Croatian high school students. There are negligible differences in the knowledge of human evolution between the genders, and Croatian and Slovenian students have similar misconceptions associated with human evolution. 41,5% of students think that we have evolved from chimpanzees, and 39,2% of students think that we are all descendants of Biblical Adam and Eve. The obtained results will effect on changes of teaching with a purpose of achieving better student outcomes associated with the concept of human evolution, and especially to prevent the creation of new misunderstandings.

Keywords: human evolution; knowledge; Croatia; Slovenia; elementary school; gymnasium

INTRODUCTION

The research that has been conducted so far indicates that students have certain misconceptions when it comes to understanding human evolution. Human evolution is a challenging topic and students have difficulty understanding it. The reasons for it are different emotional, epistemological and religious factors which contribute to the non-evolutionary view of the world. (Nehm et al, 2007; Smith, 2010).

The Croatian and Slovenian curricula do not plan a sufficient number of lessons and do not define the teaching aims clear enough to contribute to the understanding of human evolution. The approach to teaching human evolution should be objective and the personal attitudes of the teacher towards

religion should not affect the students (Smith, 2010). There are other factors that affect the acceptance of the origin of humans such as: sex, age, education, socio-economic status, geographic area in which the person lives, religion and the understanding of macroevolution itself (Barnes, 2014). Experts believe that teachers need to be given better tools for teaching the development of human beings and suggest different teaching methods that can be used to achieve that (Flammer, 2003; Pobiner, 2012; Price, 2012).

The aim of the research was to establish if the knowledge about the evolutionary development of the *Homo sapiens* at the end of primary education is satisfactory and how it differs from the knowledge of students who attend secondary grammar schools. Another aim was to establish if there are differences in the knowledge between Croatian and Slovenian students with the aim or recognising potential misconceptions in the knowledge about human evolution.

METHODS

For the purpose of the research an anonymous test about the knowledge of human evolution was used. The students were tested in 2017 in their biology class in different schools. 170 students were tested, 100 Croatian and 70 Slovenian students. The research was conducted in two secondary and two primary schools. The students answered open-ended questions about human evolution and use the Likert scale to say how much they agree or disagree with a certain statement about the origin of humans. The SPSS software was used to analyse the research and the data was statistically analysed using the Mann-Whitney test.

RESULTS

The total students' achievement in the anonymous test about human evolution was 64,8%. The highest percentage of students answered the question about the location of the archaeological site in Croatia where remains of Neanderthals were found. 96,4% of the students chose the answer Krapina. 94,6% of the students agreed with the statement that fossils show how different forms of life changed throughout history. Most students also understand that the modern man developed through the process of evolution (91,5%).

Students also think that people developed from monkeys – chimps. 41,5% of the students who were tested agreed with this false statement. There are divided opinions about the biblical Adam and Eve and 39,2% of students think that all people are their descendants. 24% of the students believe that the Bible best explains how humans developed on earth. About half of the students who were tested believe that the modern man developed from Neanderthals (55,2%). Alongside believing all the creationist theories, the students did not show a grasp of biology. 57,2% students think that people do not have more than half of the genes which are the same as mice.

Croatian primary school students showed they are more knowledgeable about human evolution than the Slovenian primary school students and the Slovenian grammar school students showed a better grasp of human evolution than the Croatian grammar school students.

DISCUSSION

The primary school students achieved a total score of 30,34% in the knowledge test so it can be concluded that the knowledge of primary school students is not satisfactory. The most common misconceptions of the students are connected to the creationist beliefs that go against the theory of evolution. Such misconceptions were found to be present among the students who were tested.

Because of the religious influence students agree with the statement that people originated from the biblical figures of Adam and Eve and that the biblical explanation of the development of people best describes the development of human beings. Research that has been done before confirm this (Brezovšček, 2016).

Students believe that modern humans developed from Neanderthals and that all humans first developed from chimps. Brezovšček (2016), Gešman (2016) and Mitevski (2016) claim that the same results were obtained in the Slovenian research. Because the concept of evolution itself is not clear to the students, misconceptions arise and because of them the development of humans is not understood. Students do not fully understand evolution because certain fossils have not been discovered yet. This presents a problem for the students so they do not understand or accept the concept of evolution.

To better understand and not to resist the concept of evolution several improvements of the teaching process have been proposed. The concept of teaching should be improved so that evolution is connected to other subjects. The development of humans should be presented to students using practical examples that relate to their lives. In order to bring the scientific concept of evolution closer to the students, more fossils should be used, which are evolutionary evidence that clearly prove the existence of human ancestors and their physical changes such as the size of their brain and the shape of teeth of primates (Smith, 2010). This can be achieved by studying, determining and comparing the skulls of primates and the skulls of modern humans (Price, 2012). Mafarth et al (2004) suggest presenting the 3D CT scan technique to the students so that they can analyse the *Homo sapiens* skull, as well as skulls of other species, more precisely and thus emphasise the importance of fossils when explaining the origin of humans.

Students need to experience the evidence of human evolution directly as well as present them facts which will eliminate the existing misconceptions about their own development. This can be achieved by a visit to a museum at the site where Neanderthals were found in Croatian or the Slovenian exhibitions of the development of primates to modern humans.

The educational conflicts between religion and science are becoming more and more evident and therefore modern society can develop new educational designs which do not necessarily put religion and science on two opposing sides. (Jokić, 2013; Nelson, 2007; Ridley, 2004). Students need to be familiarised with the fact that the creationist view cannot be empirically proven and the religious theory thus cannot be confirmed. These theories can be seen as one possible view of the world, but not as a scientific concept (Buss, 2012).

CONCLUSION AND TEACHING IMPORTANCE

The following conclusions can be drawn from the research that has been conducted:

- ☞ the students' grasp of the evolution of *Homo sapiens* is not satisfactory at the end of their primary education
- ☞ there are differences in the understanding of the concept of human evolution among students of the same age in the Republic of Croatia and the Republic of Slovenia
- ☞ there are significant differences among primary school students and grammar school students when it comes to the understanding of the concept of human evolution
- ☞ Croatian primary school students showed greater knowledge about the subject than the Slovenian primary school students

- ☞ Slovenian grammar school students showed greater knowledge in the test than the Croatian grammar school students
- ☞ the teachers' approach to teaching evolution in Croatian primary schools should significantly improve
- ☞ there are no differences between boys and girls in the knowledge about human evolution
- ☞ there are misconceptions about human evolution present among Croatian and Slovenian primary school and grammar school students
- ☞ in order to change the results of the acquisition of concepts of human evolution among students it is necessary to improve the curricula in primary schools and grammar schools alike and define the aims of teaching human evolution more clearly

IMPORTANCE FOR TEACHING

To start changing teaching methods with the aim of achieving better results among students related to the concept of human evolution, especially to prevent the appearance of misconceptions that were found to exist, and thus raising teachers' awareness of what an important concept human evolution is in biology if you want to understand life. The improvement of the students' knowledge in Croatia and Slovenia, educational institutions, curricula and teachers should lower the influence of misconceptions about the origin of human beings.

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