DOI: https://doi.org/10.2298/GEI2202129T
UDC 371-053.5:341.229
Original research paper

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Upper Primary School Children's Cosmogonic Ideas: Childhood and Space*

This paper collates research on the ideas about the origin of the universe and the planet Earth that pupils from Years 5 to 8 of primary school in Belgrade have. Such knowledge should open space for us to further analyse the attitude of young people towards science and the world it describes. With them, it is possible to gain a better insight into the basic ideas about reality that people build and adopt in general. The starting hypothesis is that pupils themselves create hybrid concepts that combine knowledge from classes, ideas from popular culture, and modern scientific theories that are available to them through various media. The cosmological knowledge offered to pupils in geography classes will be analysed, along with the popular discourse accessible to young people. Finally, a preliminary ethnographic study of pupils' cosmogonic ideas conducted on a pilot sample will be presented. The aim of the research is to understand the pupils' fundamental knowledge about reality, about the formation of a cognitive framework in which pupils inscribe their own ideas about the place of the Earth and life in space.

Key words: cosmology, worldview, school, geography, universe, Big Bang

* This text is the result of work in the Institute of Ethnography SASA, which is financed by the Ministry of Education, Science and Technological Development of RS, and based on the Agreement on realisation and financing of academic research work of NIO in 2022 number: 451-03-68 / 2022-14 / 200173 from 04.02. 2022.

Космогонијске представе код деце виших разреда основне школе: детињство и свемир

Рад доноси истраживање представа о настанку свемира и планете Земље које имају ученици од 5. до 8. разреда основне школе у Београду. Таква сазнања требало би да нам отворе простор за даљу анализу односа младих људи према науци и свету који она описује. Са њима је могуће стећи бољи увид у темељне представе о стварности које људи уопште граде и усвајају. Полазна хипотеза је да ђаци сами стварају хибридне концепције које комбинују знање са наставе, идеје из популарне културе и савремене научне теорије које су им доступне путем различитих медија. Биће анализирано космолошко знање које се ђацима нуди на часовима географије, као што ће бити описан и један популарни дискурс приступачан младим људима. Напокон, биће представљено прелиминарно етнографско истраживање космогонијских представа ученика обављено на пробном узорку. Циљ истраживања је сагледавање фундаменталних знања о реалности, о формирању когнитивног оквира у који ученици уписују сопствене представе о месту Земље и живота у свемиру.

Кључне речи: космологија, поглед на свет, школа, географија, васиона, Велики прасак

INTRODUCTION

The purpose of this text is to see the scope and depth of cosmological knowledge that children accumulate during their time in primary school. This corpus of ideas is important as an integral part of a broader worldview that focuses on building a system of norms or philosophy of living based on scientific ideas and knowledge, based on what the latest theories in astronomy, quantum physics and cosmology bring to the modern world. The correlation of scientific ideas, worldviews or value systems in children and young people should be studied more seriously in order to gain a more complete insight into all the mentioned categories, and this is only the first step in that direction. The basic question from which we start in this text is: do children learn enough about the origin of the cosmos and its evolution? In essence, it is important to consider whether pupils rely on this knowledge in creating their own worldviews and whether

they draw some particularly important conclusions from them for people of their age.[1]

The research was conducted at the end of 2021 in Belgrade through a questionnaire filled out by ten pupils from Years 5 to 8 of primary school, who were selected after their parents were informed about the scope and nature of the research (Marković 2008). The questions were focused on the knowledge of basic cosmological concepts, but they also aimed to look for the deeper philosophical implications of this knowledge in pupils. The Year 5 geography textbook was also analysed, since it contains the only lessons that deal with space and vague instructions on theories that consider its origin. In addition to textbooks, the popular science book *Svemir* (*Space*), which could be purchased in the Lidl retail chain at the beginning of 2022, was analysed and served as an illustration of material or reading available to children older than ten. The textbook, book and questionnaire are tools with the help of which it is possible to open the door of children's understandings of the universe as a manifestation and extension of the natural environment that they can directly experience.

THEORETICAL FRAMEWORK: COSMOLOGY, WORLDVIEW AND THE MEANING OF MYTH

Cosmology can be defined as a science that deals with humanity's relationship to their own environment, primarily to nature and the entire universe. It is almost certain that there is no culture without cosmology, and anthropology assures us that it is through cosmological ideas that people understand where they come from, who they are and what the position of their lives in the wider picture of the world might be. Mythological cosmologies often clarify 'true relationships in reality' and show people how they should behave, think, and feel. They are generally not factually accurate, according to modern scientific standards, but they have frameworks and armatures of their own value systems in which they figure as inviolable truths that establish codes of meaning, behaviour and identity. All cultures develop systems for understanding natural phenomena. Sky provides us with a living context in which it is possible to inscribe what

[1] At the very beginning of the text, it is necessary to point out that the paper represents introductory research on a topic that requires significantly greater knowledge of developmental psychology, as well as the anthropology of childhood, than the author has. In the light of such an assessment, it is completely clear that the topic of cosmogonic ideas in pupils requires further and deeper research, which will undoubtedly be undertaken.

we have known and experienced as human beings, and it 'takes' form and structure from humanity's daily needs, as well as from established practices to which they themselves adhere. The idea that the heavens are in fact the fruit of social construction, as are other artifacts, and that their conceptualisations are the product of human efforts to understand the universe, allows us to clearly define the "cultural character" of the cosmos (Iwaniszewski 2009, 106).

During the twentieth century the concept of cosmology began to refer to the scientific study of the origin and structure of the universe (Kragh 2007). However, in anthropology, the term has remained reserved for descriptions of the world models conceived as structures of knowledge about the order of the symbolic universe of specific cultures. In this field, the concept of cosmology has been adapted to the idea of a worldview in order to jointly mark cognitive, symbolic and ideational frameworks that shape the ways in which people classify, organise and understand their own physical environment (Dundes 1971; Geertz 1957; Iwaniszewski 2009, 102–103; Tomašević 2021, 187–203). Cosmology is at the same time an explanation of the origin and evolution of the universe, but also the role and meaning that people and life have within the cosmos. From an anthropological perspective, cosmology includes explanations of the past, present, and future of society, and as such includes all forms of existence. People have the ability and knowledge to create and nurture cosmologies as a means of giving meaning to civilisation or the cosmos, so that they themselves can lead fuller and richer lives. Cosmologies contribute to the understanding of nature and the relationships that govern it, and thus also contribute to the awareness of the individual about his or her place in the overall order of things.

The concept of worldview defines the cosmos as a social category, as a set of signs and the embodiment of human meaning and purpose that are inscribed in it. It treats the cosmos and society as clearly interconnected systems that are both physical and ideational (Iwaniszewski 2009, 100). *Worldview* signifies a generally accepted perception of reality. Although it is a fluid category that is constantly changing, a large number of individuals are convinced that it is constant and stable. According to Michael Kearney, it is defined as a system of knowledge, the way people look at their own reality, as a set of existential propositions, life settings that allow them to imagine themselves and others, time and space or their environment (Kearney 1975, 247–248). Based on that, the development of the worldview takes place within the framework of specific traditions that are rooted within the cultural trajectories of specific societies. Although worldviews are culturally specific, special, and unique, they are all composed of the same

formal cognitive categories, such as time, space, self, otherness, causality, relationships, classifications, and so on (Kearney 1975; Iwaniszewski 2009, 102–103). These basic categories are often used as a universal analytical tool in deconstructing specific worldviews and examining intercultural similarities and differences, but very often they are modelled according to the schematic arrangements of anthropologists themselves, instead of the cultures to which they apply. The relationship between cosmology and worldview can help us understand the relationships that human societies and cultures build with the universe. It is believed that cosmologies can be developed only when the 'dehumanised cosmos' is conceived as a separate entity and when it is freed from "human limitations" (Iwaniszewski 2009, 101). On the other hand, every view of the world is historically conditioned, limited and relative. Despite these differences, the concepts of cosmology and worldview are often mixed and used as synonyms.

Cosmogonies, as myths about the origin of the universe, are one of the oldest ways of understanding everything that happens around humanity and is an expression of their systematic orientation in time and space (Čapo 2008; Dundes 1971; Eliade 1970, 15; Geertz 1957; Leeming 2010; Malinovski 1971, 89–128; Meletinski 1983, 39–40; Tomašević 2020, 1101–1118; Tomašević 2021, 187–203). Cosmogonic ideas, sooner or later, become the subject of attention for almost every human being. The connection between science and certain folklore narratives lies in the need for orientation and meaning that every person feels at some period of their own life. Science and myth, along with cosmology and *worldview*, stand as four answers to the same questions: where am I, where am I from, who am I, and what should I be like? Science and mythology thus have a similar task: it is necessary to understand reality and give it some meaning, to discern order in the chaos of reality. Science and myth break reality down into segments and try to valorise the value of the connections between those parts. Mythology and scientific theories separate when it comes to providing answers to the fundamental questions of the human spirit.

COSMOLOGY IN PRIMARY SCHOOL

Pupils in primary schools in Serbia receive their first serious lessons about space at the age of eleven, in their Year 5 geography classes. At the beginning of the school year, children have three classes about the universe. Two classes are set aside for teaching input, and one for revision. These are lessons when pupils are introduced to rudimentary knowledge about the universe, the solar system and planet Earth's position in it.

According to the standards of primary education in Serbia, as an outcome and consequence of those classes, pupils should be able to distinguish between the terms universe, galaxy, solar system, Milky Way and Earth. They should be able to explain and show the structure of the solar system and the Earth's position in it, to distinguish the celestial bodies and list their features, to determine the position of the Moon in relation to the Earth and to name the lunar phases. The idea is for pupils to use the globe to describe the shape of the Earth and provide evidence for claims about the curvature of the planet, and to use the map to describe the distribution of land and water, and to list continents and oceans. They should be able to use examples to explain the action of the Earth's gravity on the geographic envelope, to distinguish and explain the movements of the planet and their consequences, to connect the direction of rotation with the change of day and night, to connect the tilt of the Earth's axis with the different degrees of illumination of the planet's surface, for example in the change of seasons and thermal zones.

The lesson "The Universe" is composed of a set of informative passages that contain key information that children should learn, but that also represent instructions indicating the importance of understanding the context in which this knowledge should be placed.[2] The teaching unit dealing with cosmological knowledge begins with a general definition of the universe and an assessment of the human effort to understand it:

> "The universe is a vast and little explored space. It contains a huge number of astronomical (celestial) bodies, only some of which are known to us. The study of the universe began long ago with the observation of the stars and the moon in the sky. Thanks to the development of science and technology, we understand the universe better today" (*Geography* 2019, 17).

Year 5 pupils are taught that fascination with the night sky is a universal characteristic and that it is inseparable from the development of the technology that brings stars and planets closer to us, but that is constantly raising new and increasingly complex questions.

[2] The *Geography* textbook from the Novi Logos publishing company was used as the material for the analysis. It was selected on the basis of interviews with several primary school teachers, i.e. geography teachers, with whom I spoke. It is their preferred teaching tool, so I thought it adequate for the conducted analysis.

After basic information about the development of astronomy and the scientific means that enable further breakthroughs, the lesson is directed towards definitions. One of the passages that pupils need to master offers a very simplified picture of the universe:

> "The universe is a space filled with astronomical (celestial) bodies. Celestial bodies are: stars, planets, meteoroids, comets, satellites and asteroids. Other names for the universe are: space, cosmos and vasiona. It is not known whether or not the universe is infinite, as its boundaries have yet to be been determined. The science that studies the universe is called astronomy" (*Geography* 2019, 18).

Special attention should be directed to the sentence giving pupils information about whether or not the universe is infinite, since its boundaries have yet to be set. This is exactly the sequence of narratives from the textbook that can encourage children to further research and understand everything that such a *finite, but unbounded universe* implies. It can lead pupils to such concepts as the Big Bang, inflation, the multiverse, as well as to ideas about quantum gravity, the subatomic world or string theory, which are an integral part of modern cosmogonic and cosmological theories. Certainly, it is a space that requires teachers to properly assess the interests and abilities of their pupils, and their desire to grapple with such topics, phenomena and processes.

After explaining that astronomy is a science that deals with the universe, the lesson then introduces an important concept, the idea of the speed of light, which the pupils will later study in physics classes:

> "The universe stretches for billions of kilometres. The distances between celestial bodies are much larger than the distances on Earth, so they are measured in light years. That is the distance that light travels in a year, moving at a speed of 300,000 km / s" (*Geography* 2019, 18).

The idea that distance is measured by light probably creates some confusion in children, but it points them to completely different dimensions from those they are used to. Children are exposed to the vast expanse of space and shown that it cannot be compared to anything else.

After this, the rest of the lesson is dedicated to stars and galaxies. Pupils are introduced to the fact that the stars are "celestial bodies of different sizes are made of gases" and that they "represent a source of light and heat" (*Geography* 2019, 19). It is further explained that the stars are

grouped into constellations, that there are 88 of them in the sky, and that about 60 can be seen from Serbia" (*Geography* 2019, 20).

After information about the universe, stars and constellations, the lesson looks at galaxies:

> "Galaxies are star systems made up of hundreds of billions of stars. Astronomers estimate that there are about one hundred billion galaxies. The galaxy in which the Sun is located is called the Galaxy, the Milky Way or the Godfather's Straw. Many of the stars we observe in the night sky are part of our galaxy, which actually includes many more stars than we can see. In addition to the Sun, the Milky Way encompasses a huge number of other stars.
>
> Galaxies are of different shapes and sizes. The most frequent shapes are spiral, elliptical and irregular. The majority of galaxies have an elliptical shape. The Milky Way belongs to the group of spiral galaxies and has a diameter of about 100,000 light years. All celestial bodies within our galaxy revolve around its centre" (*Geography* 2019, 21).

The realisation that there are about a hundred billion galaxies in the universe with billions of stars and planets could cause deep intellectual shocks in pupils, as well as in any adult. It is interesting that pupils are offered more names for the galaxy in which the solar system is located, but there is no deeper explanation that indicates their origin and meaning. Finally, the last sentence in the quote hints at a black hole, points to the centre of the galaxy's gravitational field and provides the opportunity for pupils to further research and consult with the teacher.

This is all the information that children need to learn in primary school. These are the data that should explain to pupils what the universe is and how big it is, as well as what makes it up. However, the open question remains, is that enough? According to the information received from teachers, it is clear that some children have the capacity to accept far more knowledge, if it is presented to them in an easily digestible manner, and that they can deal with far more complex ideas such as the Big Bang, the multiverse, black holes and a child–friendly explanation of the concept of space–time.[3] The idea of how the cosmos came into being is not articulated, but, like the question of the limitations of space–time, is

[3] However, more serious research needs to be carried out on a larger sample. It is certain that such research would yield even more interesting results and would provide a better insight into both what pupils can and wish to master, and what they can and do not.

left for later, as a field of open unknowns and potential research. The pupils acquire a set of ideas about cosmological facts, such as that the universe is made up of galaxies, planets, stars and other objects. However, a large gap is left when it comes to black holes, dark matter or dark energy – phenomena that make up 95% of the total mass of the universe. These passages give the impression that pupils are presented with a picture of an unlimited universe that has always existed and that could also exist forever. It becomes clear to the children that the universe is inconceivably large, but there is no word in the lesson about its beginning, about the Big Bang or any derivation of that theory.

COSMOLOGY AT LIDL

As a counterbalance to textbook knowledge, there is a huge body of material from popular science books that are not intended exclusively for younger readers (Gleiser 2005; Grin 2012; Hoking 2002; Kaku 2012; Kragh 2007; Tajson & Goldsmit 2005) and various videos available on television and social networks. In the next few paragraphs, quotes illustrating the knowledge available in popular science will be highlighted. This is knowledge accessible and understandable to children older than 10, at least according to the publisher, who emphasised that the book is not intended for readers below that age. As an example of the presence of a modern cosmogonic narrative in popular science, the book *Space: Star Systems – Planets – Galaxies*, issued by the German publishing house Neumann & Göbel Verlag in 2009, was translated into Serbian in 2021 and sold through the Lidl retail chain. The content of the book, which is part of a wider edition, *The Wonderful World of Knowledge*, and does not name the authors of the texts, is very illustrative and touches on similar phenomena and processes as the geography textbook.

Space introduces its readers to the following topics: the cosmos and cosmology (the universe; the Big Bang; symbols and units; is there anyone out there?); the solar system (the Sun, Mercury, Venus, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto, the Earth, the Moon); small celestial bodies (comets; meteors and meteorites; interplanetary matter; planetoids); galaxies (our Milky Way; classification; galaxy clusters; quasars); star systems (stars; types of stars; star clusters; variable stars); and observation of the sky (orientation; astronomical instruments; seasons; movement of the Sun; movement of the Moon; solar and lunar eclipses; magnitude).

The content of *Space* corresponds to the Year 5 *Geography* textbook, but allows much more room for more concrete explanations and a more com-

plex approach to the observed topics. What is extremely important for this text is the segment that deals with cosmology, that is, the theory of the Big Bang and the explanation of that concept. Readers of the book are briefly acquainted with the overall period of the evolution of the universe, but also with the basic theoretical assumption that points to the conclusion:

> "Today, it is believed that about 13.8 billion years ago, everything started with a huge explosion – the Big Bang. How did we come to that figure?
>
> The explanation was offered by the American astronomer Edwin Hubble. He developed a mathematical constant according to which the speed at which very distant galaxies are moving away is proportional to the distance between them. That speed is about 75 kilometres per second per megaparsec (1 parsec = 3.26 light years). But if everything is now moving apart, it implies that at some point earlier, the matter of the universe had to be united in space.
>
> If we reverse the Hubble effect, we can use the constant to calculate when the universe came into being. It is clear that science cannot provide an exact date here." (*Space* 2021, 9).

Young readers are very receptive to this explanation, like playing a film backwards, of the mechanism by which science has reached a fairly precise age of the universe. Certainly, the book cannot deconstruct and describe the whole set of complex mechanisms that characterise the evolution of the cosmos, but it is enough for readers to open the door to knowledge and embark on deeper research.

With the proviso that science does not offer definitive answers, but constantly raises new questions, it is explained to readers that the universe in its initial state had to be contained in extremely small dimensions:

> "Much remains unknown about the first period after the Big Bang. Thus, for example, it has not been clarified whether there may have been a delay in the expansion of the universe. What is certain is that all matter was concentrated in the narrowest possible space" (*Space* 2021, 9).

'By reversing the arrow of time', readers are shown that all existing matter had to be placed in extremely small dimensions. Finally, a part of the initial conditions of a very young universe is described:

> "Immediately after the Big Bang, after less than a millionth of a second, the temperature was still infinitely high (50,000 billion degrees Kelvin),

> despite the beginning of the expansion. Particles and antiparticles were formed from that radiation. They turned into photons, and from them again particles and antiparticles were formed. The expansion was inconceivably fast. After just one second, the diameter was four light years" (*Space* 2021, 9).

Rapid expansion and the emergence of matter are not topics that can be simply described to readers, so it is always necessary to make simplifications. In this context, this means omitting the story of the hyperinflation of space–time, the separation of the forces of nature, and the creation of the capacity for everything that would follow after the end of the initial phase of the evolution of the universe.

The book briefly describes the completely different conditions of the universe from those currently known to man:

> "Compared to the initial phase, it was already quite cold (10–15 billion degrees Kelvin). After a few minutes, the temperature dropped to one billion degrees, and the density was the same as the density of iron. The first nuclei of helium formed from protons and neutrons.
>
> The Big Bang ended after 100,000 years. The diameter of the propagation was then seven million light years. Since then, matter has formed and the period of the radiation of the universe has ended" (*Space* 2021, 9).

From the selected quotations, one can infer that complex theories can be adapted to pupils under the age of fifteen, at least according to the team that prepared the book in question. If it is possible with the theory of evolution or with complex theological ideas taught in religious education classes, if it is possible with complex mathematical calculations, chemical formulae and formulae in physics classes, the question arises: why do children not learn about the scientific concept of the formation of the universe? Based on the selected quotations, it seems that less than one page is thought sufficient to communicate basic cosmological and cosmogonic ideas to the pupils and to direct them to further, independent research, as the book *Space* already does. Therefore, I am convinced that it is necessary to find room in textbooks for the adequate presentation of the basic cosmogonic ideas that are currently advocated by modern cosmology. It seems very important that pupils be informed that science has its answers to the eternal religious and philosophical question: what was in the beginning? The imperatives of modern life indicate that it is very important that pupils from an early age gather knowledge and develop an awareness of the full complexity

of the world around them, and that this complexity has been grasped and deconstructed by humanity, as self-conscious beings able to seek answers, using their own intelligence and with the help of science, to the most difficult questions they are constantly faced with. The question also arises as to why cosmological ideas are important. My research so far shows that this is because answering the fundamental questions of the beginning of the universe, the origin of everything we can comprehend, is deeply important to every free and thinking person, no matter how old they may be and where they may live. Based on the answers we understand, we as human beings build our perspectives on life, our attitude towards authorities, the foundations of our own lives. Based on the answers we become aware of, we build relationships with others, with the Other, but also with ourselves. Research shows that people are deeply shaken by some of the ideas that modern cosmology confronts them with. However, subsequent earthquakes are what could make a difference in the perception of the world, but these effects are often ignored. A large number of people have no need to further elaborate the acquired knowledge and change their own behaviour as a result.

PUPILS AND THE BIG BANG

In order to gain a more complete insight into what children know about cosmology, preliminary research was conducted in Belgrade at the end of 2021, by formulating a questionnaire filled out by pupils from Years 5 to 8 of primary school. The questionnaire was completed by four girls and six boys. The answers are grouped thematically, as a deeper analysis of each individual answer would require significantly more space, and would not provide significantly different information, in the context of this research. The main task of the questionnaire was to show what children know about cosmology and space, how they perceive the Big Bang theory and how they assess the significance of this knowledge for their own philosophical views (if they have any). The questionnaire also aimed to examine whether pupils value this knowledge as part of a value system and whether these concepts are part of the children's worldview, whether they have their own place in their personal identities and philosophies of life. The questions asked were selected in accordance with the assumption that children are interested in these topics and are willing to engage in their own research.

The first question put to the pupils was whether the universe was created or has it always existed? The obtained answers showed that children have knowledge about the existence of cosmological theories and that they build their own attitudes about them:

> "The universe, like everything else, has a beginning and an end" (boy 2007). "I believe that everything must have a beginning, including the universe, but I don't think I've thought enough about having an opinion" (girl 2007). "We can't know for sure if it had a beginning" (girl 2007). "The universe once didn't exist" (boy 2010). "I think it has always existed and has no beginning" (boy 2007). "I think the universe has always existed" (girl 2007). "The universe has a beginning" (boy 2007).

The pupils' answers are divided exactly as it has been throughout history. Arguments for the emergence of the universe from nothing, that is, for the thesis of the endless universe, have been an integral part of the past of philosophy since Parmenides and Lucretius. They are equally important and challenging today, when the concept of an eternally existing multiverse is being developed. The fact that some children accept that the universe is an endless process or phenomenon testifies to the value of debates about cosmogonic theories in which pupils can be involved. Their authentic argumentation testifies to the fact that they are capable of rethinking cosmogonic issues long before, according to the curriculum, they meet them in secondary school philosophy and physics classes. These topics are close to the children and they accept them relatively easily, and the people responsible for compiling school curricula and syllabi should be aware of that. The obtained answers show that it is quite clear to the children who participated in the research that theories about the origin of the universe have their own conceptual problems; that they are difficult to understand; that they call for deeper thinking; and that understanding them requires a wide knowledge of various branches of science. It should also be noted that the obtained result indicates the need for more significant research based on a knowledge of child psychology and sociology, which will deepen the understanding of the way they adopt and use cosmological concepts.

The next corpus of questions considered how pupils imagine the cosmos. They were asked to describe the appearance of the universe and to list what is in it. At the same time, they were asked if they knew the concepts of black holes and wormholes, and finally, to describe the place of the Earth in the universe:

> "In space there are: planets, stars, black holes, meteors..." (girl 2009). "Dark and empty, but full nevertheless. Planets, stars, galaxies, nebulae... black holes are masses infinitely folded into one one-dimensional point. Wormholes are theoretically "tunnels" for traveling long distances in space" (boy 2007).

"The universe looks dark and complex because it is never peaceful. In addition to planets, there are satellites, stars, meteors and certainly a million other unusual bodies in space. Black holes are the part of the universe where the magnetic force is large, so they attract objects and bodies. Earth is in the solar system. It is the third planet from the Sun. It is located between Mars and Venus" (girl 2007).

"Infinite almost empty space with celestial bodies" (boy 2007). "The universe is an infinite space, it contains stars, planets, black holes... no object or matter can escape from a black hole" (girl 2007).

"The universe probably just looks like a set of stars and nebulae getting bigger and bigger, seen from the outside. There is matter in space: substances and physical fields. Black holes and wormholes are holes in the fabric of space–time. The difference is that black holes simply destroy the matter they swallow while wormholes move it to another place, even though they are deadly to humans. The Earth's place in space is impossible to describe. The only thing that's certain is that it's not at the very edge of space, because on one side of the sky there would never be stars, because it would be on the boundary of the universe" (boy 2010).

"The universe looks black, it's full of stars, galaxies and planets. I don't know much about black holes. The earth is just one small atom compared to the universe" (boy 2007).

"The universe is infinite space and time. There are substances in space that are made of particles from space. Black holes are transport to parallel universes that are still in the universe. Earth is a large set of particles from space that has favourable conditions for the development of more connected particles that work together as bacteria and substances" (boy 2007).

"The universe is a space that is unlimited, full of interesting planets and probably some more advanced creatures. In my opinion, black holes are tunnels or maybe some portals that transfer us from galaxy to galaxy. Wormholes are (as I heard in a movie) holes or channels (tunnels) that will probably dump someone somewhere else when they suck them up. I imagine them as space lifts. The place of the Earth in space is very small in my opinion and there are vast expanses around us with other planets" (girl 2007).

"The universe is a huge, airless space filled with celestial bodies. The Earth is in the Milky Way galaxy, but I can't really describe where it is in space" (boy 2007).

The obtained answers testify to the consideration of the vastness of space–time and the potential composition of the universe, the number of galaxies and planets as possible worlds supporting the emergence of life through scientific ideas and concepts. The answers show a very rational view of the natural environment, raised to the cosmic level, as well as an attitude towards space open to further research in astronomy. Children understand the character of the universe very well, as an unprecedented possibility for the existence of different celestial bodies, as a vast expanse that contains quite exotic phenomena. The pupils are aware that the Earth is only one habitable world, and it is clear to them that it is possible that there are similar planets in space. All this points to a clear, thoughtful and interested attitude towards the appearance of life on the planet, to a rational approach to understanding the role of humanity in space.

The next set of questions was dedicated to the idea of the Big Bang and the ideas that pupils have about it. They were asked how the universe came into being, and when and how they imagined this 'event'. These questions provided answers that speak most vividly about children's conceptual categories of space and time, about how they make cause–and–effect relationships and are guided by the logic of causality:

> "The universe came into being in a big bang" (girl 2009). "About 14 billion years ago, as far as I can remember. I imagine it would be something like a black hole" (boy 2007) "Apart from the Big Bang theory, I personally imagine the creation of the universe as a thickening of substances that later become space bodies, as filling a large gap during the change of some compositions and merging of substances" (girl 2007). "I imagine it came from something very small" (boy 2007). "It is thought to have originated about 13 billion years ago. I first imagine it as a small space that has expanded over time" (girl 2007).
>
> "The universe was created 13.7 billion years ago by an infinitely small dot exploding and making the universe. It probably looked like a very bright ball that came out of nowhere and the more it started to expand the less bright it got" (boy 2010).
>
> "It came into being very, very long ago when the explosion happened and the universe came into being" (boy 2007). "The universe came into being at the beginning of time, which means it has always existed. The beginning of the universe does not exist, because it is infinite" (boy 2007).
>
> "It was formed many years ago, because our planet is also old, so the universe is certainly older. It was probably formed by some stars or

celestial gases accumulating and creating more and more mass, which later had a place for life. Although the universe had to come from something, which means there was something before it and it goes on indefinitely. That's how various galaxies, beings and things came into being. They also came out of stardust and other celestial things" (girl 2007).

"It was formed by the expansion and contraction of a black hole billions of years ago. When the universe came into being, it was just simple atoms, compounds and bonds evolved from simple atoms. The simplest atom is hydrogen, which has one proton and electron; all more complex atoms have over one hundred and fifty protons and electrons" (boy 2007).

The largest number of answers received testifies that the pupils are familiar with the Big Bang theory. However, it is necessary to underline that there are pupils who simply do not believe that this theory is correct. Some respondents do not like the idea that the cosmos came into being at some point in the past. Like Albert Einstein, before he changed his mind, some pupils have a more receptive understanding of the endless universe governed by the laws of nature in maintaining equilibrium at the macro level. It is interesting that children intuitively understand that the creation of the universe implies the formation of matter, but also of space and time. However, a conceptual error is also evident, which has been repeated ever since the moment Fred Hoyle somewhat mockingly called the modern cosmological conception the Big Bang theory. It should be remembered that this theory describes the origin of space – time, matter, and even the laws of physics. There was no space in which the explosion could happen, could be "noticeable". The notion of explosion is repeated as the simplest option of conceptualising the origin, the beginning, the creation of everything that exists. Pupils who tried to describe the Big Bang repeated what popular science and the media offer them as an unquestionable fact. However, all this does not diminish the fact that pupils have an idea of the origin of the universe at a fairly clearly defined moment in the deep past. This opens the possibility for the conclusion that a change in the curriculum is necessary and that more room is needed for cosmogonic ideas in geography, and even physics, textbooks for primary schools.

In the continuation of the questionnaire, a specific question was asked about the origin of the knowledge that pupils have. All the respondents agreed that they had acquired basic knowledge about the universe and the position of the Earth in the solar system in geography classes. However, in the case of children who gave more elaborate answers and illus-

trated deeper than basic knowledge, the constant answer was that they had found the specific information by which they expanded their knowledge for themselves. The majority of the pupils with a significant interest in cosmology, pointed out that they had learned what they were interested in through social networks, primarily through YouTube and the videos that can be viewed there:

> "In geography class" (girl 2009). "Research because I was bored, I'm into astrophysics and various lectures on YouTube" (boy 2007). "It's mostly geography classes and a few YouTube clips" (girl 2007). "Geography mostly" (boy 2007). "On TV shows" (girl 2007). "I learned about space through a physics video from YouTube" (boy 2010). "On YouTube" (boy 2007). "I learned a lot from cartoons and movies. Mostly from *Star Wars*" (boy 2007). "Mostly on the basis of various clips from YouTube, but also movies and popular sci-fi shows. I gained my opinion based on these things, not knowledge" (boy 2007). "I gained knowledge in geography, from movies, shows, sometimes from a physics teacher and sometimes on YouTube. I've heard a lot in cartoons. From books and *Mali Politikin Zabavnik*. I also dream about it, so various films inspire me that everything can be" (girl 2007).

The fact that most children found the information they are interested in on their own is the best evidence of how important it is to place the topics of the universe and the main ideas of the Big Bang theory in the geography curriculum for Year 5 of primary school. It is evident that the children with whom the research was conducted know much more than the textbooks from a range of publishers provide them with. The preliminary research shows that they independently seek out what interests them, and are capable of independently researching the available content. Interest in the Big Bang theory, as well as the phenomena that exist in the universe, indicates the need to better reflect on the content of the lesson on "The Universe" in Year 5 geography. The answers received testify that the pupils are interested in cosmogony, that they are able to deal with complex terms and concepts, and that it is necessary to provide them with more comprehensive and layered knowledge about the origin of the universe than they currently receive in school. This is important because scientific cosmogony represents fundamental knowledge, the basis on which pupils can build their further understanding of both the universe and the immediate world around them. With clear ideas about how the universe came into being, they can later build their own philo-

sophical views, worldviews and identities rooted in secular value systems and a humanist ethos. They are able to connect the knowledge they care about with the world in which they grow up and which they strive to understand and comprehend.

Finally, pupils were asked whether knowledge of the Big Bang theory in any way affects the formation of their worldview. At the same time, they were asked: does the idea of the existence of infinitely large space–time affect your understanding of the values and significance of life? Negative answers were received from almost all interlocutors. The children simply wrote that knowing the Big Bang theory does not affect them and their views of the world. The research suggests that the pupils may not have understood the question because it was poorly posed, but also the possibility that it is too complex an issue and requires in-depth interviews with respondents. Finally, it is quite possible that the answers obtained indicate a more significant need to raise the given topics and an open space for communication between teachers and pupils. Only a few more elaborate statements were obtained:

> "It influences the formation of further theories about the formation of various celestial bodies" (boy 2007). "Not really, because I don't go into these issues so much. They are not part of my everyday life; and yet somehow they are because I live on that Earth" (girl 2007). "The first theory affects me, because I know there is a multiverse and other universes. The second theory wouldn't affect me too much, because I would know that the universe will never disappear and that's why I don't have to run away from it, but I would be a little disappointed, because I would not see space outside the universe and experiment with other laws of physics" (boy 2010). "My knowledge of the Big Bang does not affect my view of the world because I think it is not true. Yes, the idea of infinitely large space and time affects my understanding of the value of life" (boy 2007).

It can be assumed that the last set of questions is not well phrased and requires additional reflection and research. At first glance, it is quite clear that children do not connect the Big Bang theory with their attitude towards the world because it is a scientific concept that describes an extremely distant event. However, if the relationship between the Big Bang theory and the myth of the origin of the Abrahamic religions (present in Islam as much as in Christianity) was more clearly set out for children, it is certain that pupils would offer different and more complex answers.

This is an assumption that requires completely new research and a series of in–depth interviews. Moreover, it is possible that asking this question in the context of humanity's relationship to potential extraterrestrial beings and cultures would lead to more complex assessments of both the value of life on Earth and one's own identity. All this points to the fact that the relationship between popular cosmology, ethos and worldview among primary school pupils, i.e. young people who are slowly forming and adopting their own value systems, is a very fruitful research field that can provide us with relevant data on how in Serbia today, a very clear and concrete relationship to the culture and the people with whom living space is shared is established.

Alternatively, it is possible that the knowledge of cosmogonic ideas really has no influence on the formation of their worldview. The initial hypothesis of the paper was that cosmogonic ideas have a significant place in the process of building a system of children's knowledge as the basis of the idea of the nature of reality itself, and as such represents the basis of an interpretive framework in which pupils inscribe meaning and significance. It turned out that the hypothesis formulated in this way and the research as set did not yield the expected results. The fact that these questions do not provide answers that would give us more information, leaves open the door to research what does actually influence children to think about their worldview and what they think about the process of forming their value systems and identity. Children's interests go beyond what textbooks offer them, they learn what interests them much more easily than what the curriculum sometimes imposes on them. On the other hand, pupils should learn about cultural values and forming a worldview in classes of religious instruction, civic education and through alternative sources of knowledge, primarily through social networks and the video clips they find there.

More specifically, ethnographic research, as a kind of methodological examination of what can and cannot be learned from young people of a particular age about value systems close to them or the identities they seek to build, requires more sustained contact with the pupils, as well as a more comprehensive questionnaire that would provide even more valuable data through in–depth interviews. That is why the research was presented and characterised as 'preliminary'. The questions asked were designed to illustrate whether the children think about the selected topics at all, and to acquaint us with the level of knowledge that the pupils have. The questionnaire showed that the children who filled out the questionnaire were very well informed, but that they came to this knowledge on their own

initiative. On the other hand, it turned out that the questionnaire alone is not enough to obtain more comprehensive information about children's value systems and the ways in which they use the acquired knowledge in the process of forming their own identities. It seems that the chosen set of questions was too extensive and too demanding to provide answers concerning personal philosophies and worldviews. Simply put, for children, the topic of cosmology is too complex and tedious to yield answers that would allow us insights into their intimate worlds. This does not mean that they do not have them or that they are not able to elaborate them. On the contrary, it only means that such a task requires different preparation and more concrete research. What the offered questionnaire showed is that primary school pupils are very capable, and able to think deeply about the world around them and that it is necessary to pay adequate attention to them if we want to find out what their observations look like and what conclusions they draw from them.

CONCLUSION

The presumption that pupils form their own cosmogonic assumptions and ideas proved to be correct. All pupils stated that they acquired a part of their knowledge outside school, being interested in deeper ideas and knowledge about space. The scope of knowledge and depth of concepts acquired vary from pupil to pupil and their interests. It is quite certain that a significant number of pupils, who could not be covered by this research, do not touch on these topics at all, that they are not interested in them, and to a certain extent they are pupils who did not want to participate in the research. However, the pupils whose answers were recorded show a solid level of understanding of cosmogonic and cosmological theories among children who still attend primary school compared to the general ideas available through television and popular science cosmological literature.

The paper revealed a positive answer to one of the initial questions: do children acquire adequate knowledge about the origin of the cosmos and its evolution? Pupils in school receive minimal information about the universe, but based on their own research and interests, they gain a more complete picture of the processes and phenomena that determine the origin and character of the universe.

Conversely, it has been shown that pupils do not connect modern cosmological theory and cosmogonic conceptions with their own philosophical views and worldviews. The question remains as to how they themselves experience the process of forming an identity and value system, how they

adopt and understand cultural norms and ideas. Certainly, this is a topic that requires much deeper and more serious research and to which it is necessary to return in the future. What is important to acknowledge at this moment is that children have not recognised the cultural value of scientific cosmology, and that they do not regard it as relevant for their own vision of determining their place in the world. On the other hand, the conclusion points to the fact that pupils adopt values that are important for establishing cultural identity and worldview, in addition to what they learn in the family and from peer groups, in classes of Serbian language and literature, history, religion and civic education. Likewise, the assumption remains that the process of acculturation often takes place equally through learning through social networks and content that can be found there.

It is quite clear to the children that the universe is endless, and that it is actually extremely difficult to gain full awareness of its vastness. A number of respondents are familiar with the concepts of black holes, wormholes and multiverses, so it can be concluded that pupils have a developed awareness of the complex composition of the cosmos. It is certain that the *Geography* textbook does not offer too much information that interests pupils, but it leaves quite enough material for interested children to research independently. Research has shown that children, with whose help the research was conducted, show the ability to be inspired to understand concepts such as space–time, Grand Unified Theory and the emergence of the Laws of Nature, and even the multiverse, as a consequence of the inflation of the universe.

Finally, the question arises: why are cosmological and cosmogonic notions and ideas important at all? One of the answers says that it is because they explain processes and phenomena from the very beginning, as events that will lead to ourselves, to our lives, knowledge and emotions in the overall order of things. These are ideas that describe to us where we come from and what we really are, what we are made of and what we have 'behind us'. These are notions created by the human mind motivated by science, research and experimentation, by a rigorous process of testing and rejecting false theories. In this context, cosmological theories and cosmogonic ideas figure as knowledge very close to the truth, and this is just one of the views on which it is possible to build a specific humanist philosophy of life, a cultural ethos that implies the pursuit of knowledge and deep respect for life, the cosmos, millions of years of human development and millennia of civilisation.

In that sense, positive and encouraging answers were received from the surveyed pupils. Although children currently, in the observed period

of their lives, do not value the philosophical aspect of cosmological theories, their knowledge shows the capacity for deep reflection on these topics. Such a conclusion obliges us, as ethnologists and anthropologists, to become better acquainted with the issue of building philosophical views in children and understanding their worldviews.

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Примљено / Received: 23. 02. 2022.
Прихваћено / Accepted: 06. 09. 2022.