Journal of Positive School Psychology
2022, Vol.6, No.4, 1624-1629

http://journalppw.com

Requirements for the Training of Pedagogical University Undergraduate Students in Astronomic Education

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Abstract:
The article describes the requirements for the students' preparation in astronomy, as well as the knowledge they can obtain on theory and practice of teaching and learning Astronomy.

Keywords: Astronomy, Astronautics, astronomical training, knowledge of astronomy, students' scientific outlook.

1. INTRODUCTION

The modern system of higher education is faced with the task of forming an educational environment focused on supporting the development of students in the science of astronomy and the use of new technologies in it. The solution of these problems is possible by changing the role of natural and mathematical education, increasing its prestige, quality, efficiency and close relationship with other areas of practical application.

A holistic perception of the world is the main feature of the modern style of scientific thinking. Therefore, when organizing the educational process in astronomy for students of pedagogical universities, one of the important tasks is the formation of a holistic perception of the structure and evolution of the Universe, the disclosure of the astrophysical picture of the world through the use of forms, new methods and teaching technologies [1].

LITRERATURE REVIEW. MATERIAL AND METHODS

In accordance with the new modern programs for the Astronomy course for students of pedagogical universities, it is necessary to know what knowledge, skills and abilities can be obtained by bachelors in astronomical education. In this regard, we have developed and summarized the requirements for undergraduate students of pedagogical universities in astronomical education.

Astronomical education can play a crucial role in solving many problems in the upbringing, development and training of students of pedagogical universities.

The importance of astronomical researches is that they reveal the nature of the Universe, the relationship between the Earth and the Cosmos, show the boundless of Universe in space and time. Due to astronomy science, it is possible to expand the scientific picture of the world and this contributes to the formation and development of a modern scientific picture of the world among students, as well as systemic thinking and a scientific worldview.

The astronomy science includes astronomical questions that show the place of a human being in the universe, contribute to gaining knowledge about astronomical phenomena and processes, all these are the bases for the formation of a modern scientific outlook.

In the process of learning astronomy, students actively master the scientific

methods of cognition, owing to them the studies of celestial bodies are carried out such as stars, planets, galaxies, quasars, etc.

A wide range of people such as scholars, astronomers, schoolchildren, students and just astronomy lovers are interested in astronomy, because astronomical knowledge is an integral part of human culture.

Astronomical education for future bachelors in the specialty of "Physics and Astronomy" will be sufficient if the methodological system of astronomical training takes into account the current level of development of astronomy as a science; the educational process will be organized in accordance with the pedagogical and psychological characteristics of students' perception of information; if the content of the programs includes material of a historical nature; as the basis of teaching give preference to independent learning and observation of celestial objects, to conduct a "research" as a laboratory and practical work.

The main didactic principles in the process of training students of pedagogical universities in astronomy are the principles of consistency, scientific character, accessibility, which can be implemented:

- the principle of consistency – the consistency of the astronomical content and activities of the teacher and students of pedagogical universities;
- the principle of scientific character and accessibility – means compliance with the current state of astronomy science, and the content of students' training in astronomy, considering psychological, physiological and individual characteristics.

Teacher's objective is to take into account the peculiarity of the Astronomy course, to use independent observations performed by students, consistently explaining either the causes and the relationship of the studied astronomical phenomena. The teacher should streamline and systematize the information on astronomy that students receive from various sources of information, while widely using all the methodological approaches which he/she familiars with [2].

Modern pedagogy considers the cognitive activity of students in the learning process as a decisive link in the entire educational process in a pedagogical university. The task of the methodology is to offer students appropriate tasks, organize and direct them to the implementation of educational and cognitive activities. The compilation and use of tasks and questions on astronomy of various levels of complexity allows for a differentiated approach to teaching, which creates good conditions for the development of students' creative activity.

The assimilation of modern scientific ideas about the Universe is the basis for the formation of a scientific worldview in the process of studying astronomy. When students have stable views and beliefs in their minds, this knowledge creates the integrity of outlook, which can influence a person's actions and behavior as well.

The solution of these problems will be in close connection with the educational work of students. The teacher, revealing the role of science in the life of society, draws attention to the role of learning with life and practice. It is necessary to emphasize the role of astronomy and astronautics, as a science, in modern scientific progress. The increasing importance of rocket and space technology for solving national and economic problems, therefore meteorological, navigation and communication satellites are served in this case.

The Astronomy course should provide undergraduate students of pedagogical universities students with the following opportunities:

- learn to observe astronomical natural phenomena, describe the results of observations, form the necessary astro-climatic conditions for the successful observation of astronomical phenomena.

Form the bases of a scientific worldview;

- to develop interest in astronomical phenomena and processes in the Universe;
- develop creative abilities in the process of solving problems of astronomical content, performing observational tasks of a research type;
- to form the ability to acquire new scientific knowledge in accordance with vital needs and professional interests;
- gain experience in perception, processing and critical evaluation of natural-scientific information from different sources, presented in different forms;
- gain knowledge in astronomy related to environmental issues, the need to protect the environment, preserve human health;
- learn how to use astronomical instruments, assemble a telescope for studying celestial objects, provide observation results, and identify empirical patterns on this basis;
- apply the acquired knowledge to explain various astronomical phenomena and processes, predict the results of the interaction of bodies;
- get an idea about the natural - scientific and physical picture of the world: the laws of conservation of energy, the structure and structure of the Universe, and their main theories in astronomy;
- to realize the role and importance of knowledge of astronomy in the daily practical activities of a person;
- get an idea of the general laws in astronomy nature [3].

The modern astronomy science is different from the content of astronomy in the 2000s of our centuries. Owing to scientific and technological progress, astronomical observational instruments are being improved, and space technology is expanding the range of electromagnetic radiation.

Nowadays extra-atmospheric and all-wave astronomy is developing. Observation of celestial objects in the ultraviolet, x-ray, infrared and gamma ranges has become available. Radio astronomy plays an important role in the development of astrophysics, scientists - astronomers observe distant radio objects: radio galaxies, pulsars, blazars, quasars, etc.

The pedagogical universities of the Republic of Uzbekistan are faced with great demands for astronomical training, future teachers of physics and astronomy, corresponding to the state and development of modern astronomy.

The curriculum of the Astronomy course for Pedagogical Universities for the 2021-2022 academic year includes 50 hours of lectures and 56 hours of laboratory and practical classes for second-year students. Third-year students of pedagogical universities continue studying this course; thus, the amount of lectures are 52 hours and practical classes – 12 hours as well.

In the given paper, we will present the knowledge, skills and abilities that second-year students should learn when studying Astronomy in pedagogical universities. Discipline The course Astronomy for second-year students of pedagogical universities includes the following sections: “Spherical astronomy”, “Fundamentals of practical astronomy and celestial mechanics”, “Physical nature of the bodies of the solar system”, “Fundamentals of astrophysics”, “Stars”, “Structure and composition of our galaxy”, “Types of galaxies” and “Elements of cosmology and cosmogony”.

After studying the section “Spherical Astronomy”, students should learn the relationship between theory and practice in terms of theme. They should know the initial concepts of spherical astronomy: the starry sky, the celestial sphere and its main points, lines and circles, the concept of a constellation, as well as the name of the brightest stars – these concepts reflect the signs, properties and patterns of the world around us [4].

While studying “Spherical astronomy” the students must learn the concepts of the celestial sphere: the celestial pole, circles of declination and heights, the mathematical horizon, the celestial equator, the ecliptic, know the difference between the equatorial and horizontal and

ecliptic systems of celestial coordinates, about the culminations of bodies and height of the climax.

In the "Practical Astronomy" section, students should learn the concept: sidereal time, mean solar time, universal and standard time, etc.; know the concepts: the celestial meridian, the pole of the world, the zenith, the nadir - all this refers to the celestial sphere as well. Second-year students should be able to apply formulas and solve problems on the topic: Celestial sphere, its main points, lines and circles. Finding the coordinates of a celestial body. Students should know "ecliptic" concept, its correct formulation: the apparent annual movement of the Sun in the twelve zodiac constellations; know information about the location of the Sun on the days of solstices and equinoxes [5].

Students ought to know what calendars exist in the world and how they differ from each other, as well as the history of the origin of various calendars; be able to answer the questions: What calendar is used in Uzbekistan? Which countries use the Muslim calendar?

They must master the concept of longitude and latitude of the area, based on the definition of the upper and lower climax of the luminary, as well as solving problems on these topics.

In the process of studying "Structure and composition of the solar system" students learn the concepts of the configuration of the planets, generalized laws of Kepler, the Law of Universal Gravity, Problems of two bodies, regarding these topics it is also important to solve problems and know the formulas. They should know the history of cosmological views, the difference between the geocentric system of Ptolemy and the heliocentric system - Copernicus, the works of G. Galileo and J. Bruno.

The theme "Phases and eclipse of the Moon, eclipse of the Sun" is of a great importance for the students' assimilation as these astronomical phenomena can be clearly observed in the sky at a certain time. You can see the time of the onset of solar and lunar eclipses in the Astronomical calendar for the current year, and also be able to use the astronomical reference book and calendar. This topic from the Astronomy course students could previously study it at a secondary school in the subject of the "World around us", then in the subject of Physics in the 6th grade, which leads to continuous learning astronomy.

The requirements for pedagogical universities students' knowledge referring the course "Astrophysical Methods" are as follows: knowledge of astrophysical instruments, knowing the difference between a refractor and a reflector, the device of a radio telescope, the use of a spectrograph and the main characteristics of telescopes. Regarding the topics of "Astrophysical Methods" students should be able to apply formulas and solve problems on the characteristics of telescopes.

Students should also be aware of the world's major observatories and their main astrophysical instruments. The students' knowledge about the Ulugbek observatory in Samarkand, as well as about the high-altitude observatory Maidanak, located in the Kashkadarya region at a mountain altitude of 2350 km is also important.

In the astronomical training of a future teacher in physics and astronomy, the knowledge of Solar physics is important in this case. Since the Sun is the closest star to our planet, and the study of which makes it possible to understand the physical nature of other stars. The influence of the Sun on other bodies of the Solar System is very important: planets, satellites of planets, comets, asteroids, etc. Knowledge of the nature of the Sun is of great importance for the work of a future teacher in physics and astronomy; there is also laboratory work on this topic in the Astronomy course, which can be performed by using a computer [6].

Knowledge about the processes of solar activity, the influence of the Sun on the biosphere and the atmosphere of the Earth,

the knowledge that students should acquire on modern problems on this topic.

Regarding the topic "Physical nature of the terrestrial planets and giant planets" the students should learn the physical parameters of these celestial bodies: temperature, radius, mass, density, the presence of rings, atmosphere, satellites, etc. Analyzing the physical nature of the terrestrial planets and giant planets, students perceive modern cosmogonic hypotheses, an understanding of the possibility – the emergence of life on other planets, and what conditions should be created there as well. Students reflect their knowledge of the bodies of the solar system in the form of a table of the physical characteristics of these bodies.

Second-year students studying the Astronomy should form concepts about the methods of parallax of stars, absolute and apparent stellar magnitudes, about the change and diversity of the color of stars, the dependence of the temperature of stars on luminosities, spectral class, etc. Students, when studying the "Stars" section, should form concepts about a wide variety of types of stars: from white dwarfs to physical variable stars, Cepheids, new and supernovae, etc. They must understand the evolution and model of the internal structure and internal energy of stars, the concept of black holes. They should also solve problems on the topics "Physical parameters of stars", "Determination of the temperature and luminosity of stars", "Determination of the radius and mass of stars", know the basic formulas of these topics and be able to apply them in solving problems [7].

Learners should have an understanding of non-stationary variable stars and how they differ from long-period stars. Also, they should know that the Milky Way is our galaxy, as well as the location of the Sun in it; have an idea about the types of galaxies, diffuse and dark nebulae, globular and open clusters of stars and other objects; know the physical properties of galaxies: luminosity, spectrum, mass, etc.; understand what a Metagalaxy, galaxies with active nuclei, radio galaxies and quasars are. They ought to know the difference between cosmology and cosmogony, and the purpose of these sciences; the concept the redshift of galaxies and the Hubble law, Doppler's law, be able to calculate the distance to external galaxies and apply formulas when solving problems in astronomy on these topics.

According to the "Cosmonautics" section, students should know the followings: What cosmonautics studies, its historical outline; how a rocket works and the purpose of rocket engines; which forces act on the spacecraft during the flight; the appointment of artificial satellites of the Earth, and their flights to the planets.

The students should know about orbital stations in space and the most important spaceports in the USA, Russia and other countries. The section "Cosmonautics" includes 6 hours of practice, such as solving problems on the topics: Tsiolkovsky's formula, weightlessness, movement in the sphere of planets' influence, landing of the spacecraft on Earth. They should be able to apply formulas on these topics and solve astronomical problems in the "Cosmonautics" section.

2. CONCLUSION

The paper presents the basic requirements for the knowledge and skills of second-year students in astronomical education, on the main topics of lectures, practical and laboratory classes. This article may be useful for researchers while listing the knowledge, skills and abilities of students in Astronomy course in pedagogical institutions.

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