

ASTRONOMY: RESEARCH METHODS OF TEACHING. M.V. Proshletsova¹ and N.I. Perov²,
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“Learning becomes education in itself only after achieving of superior field of science, entering into the world of idea and bringing of this idea about reason and heart of man. Only at this scientific stage and not at school one, the science acquires of moral strength.” – K.D. Ushinsky.

Introduction: The analysis of the well-known general-educational programme of studying of astronomy and physics makes draw a conclusion – the teacher play a role of transmitter and controller of knowledge of pupils at the low level of their work without assistance. Modern investigation in astronomy teaching pay attention the pupils and the students may perform scientifically significant astronomical discoveries and astronomy is one of school subjects (with little exception) that give lucky chance to study exclusively basing on research methods [1], [2], [3]. Such situation is explained by small number (~10000) of professional astronomers on the Earth and astronomical numbers of astronomical objects (the Galaxy consists of 10^{11} stars and there are 10^{12} - 10^{13} unidentified cometary’s nuclei in the Solar system).

The “Standard” Methods And Forms of Efficiency Teaching: The “standard” methods and forms of efficiency teaching: are stated in the monograph [4]: a) various ways of development of logical structure of a subject; b) application of multiform of visual aids; c) use of problem teaching for formation of creative thinking; d) independent compiling of school problems by pupils; e) acquaint students with the individual-differential training; f) a composite use of technical means of training; g) application of group study; h) introduce of systems of control for lessons; i) enlist students and pupils for research work, which is significant means for development of their creative potential (but this form of teaching often considers scientific discoveries of pupils which are significant only for themselves). The efficiency of all these methods and organization forms of teaching of pupils and students are determined by psychological training, pedagogical mastership of a teacher (an instructor) and specify of the subject [5]. The cooperative way of a pupil and the teacher for the truth is presented in pedagogical literature from epochs of Confucius, Lomonosov, and Tsiolkovsky to our day. This turn of cognition of nature is known now as pedagogic of co-operation [4].

The Methods of Organization of Scientific-Research Work of Students: One of the attempts to elucidate the methods of organization of scientific-research work of students in astronomy was undertaken in the monograph Paley A.B [1]. It is stressed

in the paper of [6] there are three aspects of creative activities: combinative creation (to create the novelty based on the combinations of the well-known thesis); innovatory creation (to bring new before unknown elements); research creation (to originate a new method of approach or an idea). All these aspects of creative activities we use for forming of professional qualities and creative powers of pupils and students. The process of organizing of the collective activities embraces: projecting of aims and purposes; prognosis of results; selection of participants; co-ordination and amending of their actions; assessing of the results. These factors are taken into consideration at forming of creative groups of young astronomers. In the process of guidance of the students and the pupils, who take an active part in significance astronomical scientific research, we pay attention the mechanisms of their socialization; a) education (rational knowledge about the world); b) enlightenment (self- development, self-education); c) breeding (cultural of orations, politeness in daily round); d) traditions (cultural experience of social being); e) religion (it removes psychological frustration in connection with inexplicability of many aspects of life by rational way); f) art (it implements, like religion, psychological-compensating functions and expands enumeration of real or invented social collisions being before man). Auspicious conditions for organizing of significance scientific astronomical research of students (pupils) are in universities (schools) where instructors (teachers) are active working and who are astronomers as well as pedagogues [1], [3]. Matters very much for accomplishing of scientific discoveries by students and pupils are modern computers and free access to bases of data and automatically telescopes using INTERNET. The important condition of success of scientific – research work of students and pupils is creative cooperation with the representatives of astronomical and others scientific societies, whose interests lie in the field of cosmic research. In this case the broad choice of topics of investigation is opened. These topics are experimental, observable, and theoretical or based on the numerical experiments and stochastic investigations, putting systematization of the known knowledge; forecasting of new astronomical phenomenon and discoveries of unidentified celestial bodies. We consider the statistic experiments in astronomy as a perspective direction of organizing of scientific research work of students of universities and pupils of the secondary school. We mark the classical form of scientific work of students and pupils like scientific observations at astronomical

observatories, optical and radar station (searching for comets and asteroids, investigation of variable stars, study of physical nature of the Sun, the Moon, planets, and interstellar matter, exploration of the near Earth expanses, based on the observation of the artificial satellites of the Earth).

On the Scientifically Significant Discoveries of Students: If the teacher succeeds in working up and (or) in stimulating creative initiative of students and pupils then the results of the students' scientific research may be represented at All Russian and International conferences, devoted the different problems of modern astronomy. Publications in astronomical journals of the Russian Academy of Science and in International editions are not excluded. (The paper is considered as scientific one, if it is published in a scientific journal). Moreover, the publications of students in reputable magazines give rise to heightened interest of representatives of means of mass information and this fact stimulates morally of students to continue of their investigations. The striking results of scientific work of students are encouraged by the Russian and International scientific and educational funds. (The electronically addresses of these funds and institutes connected with research of the Solar system are presented in [7]). It is obviously in the modern Russia the instructors of astronomy should make students-astronomers take part in competitions of scientific works in order to receive probably the corresponding grants. Of course, the scientific discoveries are not accomplished only for the mercenary motives, but also for unquenchable desire of the man at truth. It should be noted in respect of social status scientific society is consolidated from without by system of financing of science and it is consolidated from within by system of special training. So we may say scientific-significant astronomical discoveries of the students and the pupils consolidate social status of astronomy. Set forth ideas about organizing of astronomical scientific-significant researches of students and pupils have been approving at the Secondary School № 1 (Yaroslavl, Russia) for 10 years (in 8th -11th classes) and during 15 years at the department of physics of Ushinsky Yaroslavl State Pedagogical University, where the students-physicists of the 3rd form study astronomy. The International program "Competence of Pupils" (Russia-Great Britain), in which the Secondary School №1 takes part and post-graduate studentship (in the field of "cosmology" at the department favor of the development of research methods of teaching of astronomy in Yaroslavl. The principal and interesting results of individual creative work of the students and the pupils are summed in the papers [3]. There are a hundred such topics in creative books of problems in astronomy [8], [9]. These problems have to do with unsolved ones and the solutions

of them matter not only for the students (pupils), as discoveries "for themselves", but matter for development of astronomy.

Conclusion: In the creating significant scientific research works of students and pupils are widely used problem-analytical methods; the cult of own creative work and the joy of creation are being prospering; the compilation is denied; the stabile creative interest is formed; the individual education is going on at the conditions of moral and active comforts. The author of the paper [10] asserts at the such organizing of the teaching and educational process the quality of "author's" is more fundamental and superior to classical one; the explosive mastering of knowledge takes place; the possibility of two-folded of increasing of subjects and trice-repeated the level of their fundamental nature with the integral whole board of practice are opened; the volume of mastering of educational material makes up 90%. The cost of the non-traditional education is smaller by a factor of 60 in comparison with the classical ("standard") education. Even using one-quarter of the good things of research methods of teaching and significant scientific discoveries of the students and pupils, we may expect high efficiency of the non-traditional process of education.

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