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Planetarium Pedagogy – Contribution of After School Educational Activities in Planetarium to the Improvement of Quality of Astronomical Education in Teaching Geography and Physic

Extended summary

This paper is on the analysis of possibilities of development astronomic education through application of the planetarium in pedagogy, deeper connection of pedagogical praxis in planetarium, socio-construtivistics' theory of learning and contemporary concepts of quality education. The aim of the research is determining the significance a basic characteristics of teaching and learning in afterschool activities in the planetarium (VOAP) function for realisation astronomical contents in teaching geography and physics. The aim of the Reserch is taking the critical variables, which can describe the influence of learning in the planetarium on development of astronomical education and quality of teaching Geography and Physics.

Theoretical frame of the research includes psychological theories of learning (socio-constructivists' theory, SKT), pedagogical approaches to teaching and learning (contextual teaching and learning, student directed teaching, cultural-historical theory of human action), didactical elements of teaching (contents, means and methods) and elements for improving the quality of teaching and education (directed towards the outcomes – achievements of students and development of educational resources).

The significance of the research includes contribution to connecting astronomy and pedagogy through teaching geography, physics and VOAP. Theoretical contribution refers to the analysis of the development of relations of school and out-of-school education as well as mutually dependable social processes through history and determining characteristics of learning through didactical hexagon (for school learning). Practical contribution refers to defining so-

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cio-cultural potentials and weaknesses of VOAP; analysis of development of the planetarium as a teaching tool through history, identifying planetarium resources at global, local and virtual level (the Internet); and suggestion for introducing three indicators for following the quality of relation between the school and out of school education (the number of school by the planetarium, number of school visits to the planetarium at the annual level and the number of visits to the planetarium during primary education per student).

Transversal research has multidisciplinary character and it was posed as theretical-empirical. It was done in 60 places in Serbia, with the population of Geography and Physics teachers, who were employed in the school year 2014/15. Descriptive-analytical method was used for checking hypotheses, and research methods of questionnaire, scaling and testing were used. The following instruments of research were used: questionnaire for teachers of Geography and Physics (anonymous on-line questionnaires), questionnaire for students and the astronomy knowledge test (anonymous questionnaire and testing under supervision of subject teachers and class teachers). The research was done in the period between April and August, in the school year 2014/15. Software including the following statistical methods was used for data processing: methods of descriptive statistical analysis (tale contingency and frequency of occurrences, i.e. frequency, measures of the mean value and variations), and methods of statistical concluding (statistical tests of hypotheses), analysis of the variance (ANOVA), correlation and regression analysis.

The most significant results of the research showed the following: in the teaching practice, VOAP is very rarely used as the form of after-school activities (54.5% of teachers had never been to the planetarium, and 25% of Geography teachers and 19% of Physics teachers); in school teaching there are more and more verbal methods of teaching and VOAP is more frequently used as a method of showing and practical activities and research work of students which is more present than in the school praxis; most of the teachers who visited the planetarium thought that VOAP contributed to improving quality of geography and physics teaching (80.4%); students have low level of achievement at the astronomy knowledge test (less than 50%).

The main conclusions of the research show that it is possible to distinguish four critical variables which enable measuring of VOAP to the improving quality of teaching geography and physics: 1) frequency of VOAP (as a degree of development of relations between school and after school education); 2) overall achievement of students at the astronomy knowledge test; 3) achievements of students in the field of declarative, conditions, procedural and conceptual knowledge and 4) degree of satisfaction of students by socio-constructivists' parameters of learning (topic, space, visual effects, encouragement of teachers and personal participation in the process of learning). Pedagogical implications of the VOAP research refer to improving astronomical education through using combined teaching methods (verbal methods, showing, scientific discussion, telling stories and individual activities of students) and more frequent using of planetarium technology as a teaching tool (mobile planetarium, software for desktop computers and applications for mobile devices) in teaching natural sciences, particularly Geography and Physics. For the purpose of more detailed and thorough measuring of the influence of the planetarium on the process of learning and improving quality of Geography and

Physics teaching, it is necessary to do the next research with the sample of different population of students and teachers, with a greater sample, for educational activities in school teaching, at sight and mobile planetarium.

Key words: Planetarium pedagogy, scientific literacy, astronomical education, socio-constructivists' theory, quality of education.

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