PEDAGOGY

On the problem of value-oriented teaching in natural-science school subjects

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Abstract. This paper presents the theoretical grounds of the axiological principle and the reflexive approach in the teaching of natural-science school subjects as mutually complementing pedagogical phenomena. Their basic characteristics are studied in contextual aspects and their manifestations within the components of the education system are commented upon – objectives, study content, methods, means and forms of organization. The axiological principle sets the general directions for conducting of a value–orientated and value-regulated educational process. The reflexive approach as a system of interactive methods, reflexive approaches and forms of organization specifies the application of the principle in real school practice. Experiental evidence of the applicability of the idea are presented in the following dissertations and published papers: Y. Dimova "Reflexion On Chemical Knowledge At the Basic Level Of Teaching Chemistry" (Sofia, 2000) and D. Dimova "Methods and Means Of Conducting Value-orientated Chemistry Teaching" (Sofia, 1998).

Keywords: *axiological principle, reflexive approach, new paradigm in science education*

Introduction

Contemporary research in the field of natural-science teaching importunately raises a number of questions: what the parametres of scientific literacy in everyday-life practice are; in what way we can transform objective knowledge into personally significant one; how to join children to scientific values and scientific way of thinking. This paper deals with all these topical issues.

The condition of contemporary science and culture inevitably determines the renovating processes in the fields of education. Nowadays most of the countries in the world carry out transformations and reforms aimed at improving the quality of education. Conceptual changes in contemporary natural science training require correspondence between the cultural and educational model, and, that is why, they seek their grounding in the following sources:

1. The remarkable changes, taking place in scientific knowledge, most commonly described as "humanization" or "humanitarization" of science; an increasing interest in conceptual, ethical, social and personal assessment of scientific knowledge as a process and result.

2. Putting science and all spheres of practical activity on environmental basis; awareness of the necessity of building such a system of social ideas, which is to give a new meaning to the relationship Man-Society-Nature, and to motivate adequate transformations in the values of individuals of all walks of life.

3. The continually changing ideas of what knowledge is and what the characteristics of an "educated person" are; aspiration for purposeful establishment of "civic science literacy", "action competence", "public understanding of science and technology "public awareness of science", "social communication of knowledge", "availability of scientific knowledge for every person" at school. [8, 9, 10, 11]

4. Directing of education sciences towards examining the problems, connected with simultaneous development of a person's cognitive, value-emotional and active and practical aspects of , focusing researchers' attention on building up an individual's metacognitive abilities (thinking about one's own thinking) in the educational environment [2, 4, 5, 6]

The teaching of natural-science school subjects undoubtedly has its specific place and significance in the transformation of the new social and cultural realities into educational realities. In the contemporary international and state documents on the development of natural-science teaching the general direction is presented clearly enough – beginning with knowledge acquisition through formation of knowledgeable and metaknowledgeable competence towards value-oriented relationships and their corresponding behaviour in real-life practice.

To make it possible for the above-mentioned trends to find their adequate implementation, it is necessary in the teaching of natural-science school subjects that a principle, called "axiological principle", be stated and applied: a system of requirements to define the content, organization, methods and the kinds of activities for everybody participating in the value-oriented educational process.

Theoretical background

The term "value" is rather broad, being interpreted in various ways by researchers in different scientific fields. We subscribe under the understanding of some psychologists and pedagogists that the value layer of human mind comprises a system of psychical phenomena value-orientations, opinions, interests, needs, personal significances, points of view, generally called assessment relationships. Through conscious activities these relationships are transformed into personal assessments, and some of them into personality values, regulating the behaviour and the activities of the individual. [1]

One of the most important tasks of education, undoubtedly, is the formation of socially significant values and building up of conditions for self-education and development of value-oriented qualities, value-relationships and value-structures. In this context the idea of value-orientated teaching in natural-science school subjects

takes the form of a long-term strategy. It is based on the values of contemporary culture, falling into the following basic directions:

– Universal human values (freedom, good, beauty, etc.). which are predominantly related to the humanization of the "Person-Person" relationship.
– Scientific values and scientific thinking (truth, knowledge, method, etc.) which are interpreted as landmarks to humanization of science through transforming of the "Man-Society-Nature" relationship into "Individual-Individual" relationship;
– Civic society values (equality, humanism, democracy, etc.) which support the realization and stimulate the development of the individual;
–Individual values (health, success, education, etc.), which create personal capabilities of developing self-knowledge, self-development, self-improvement.

Purpose

The purpose of this publication is to present in a systematic way theoretical and practical dimensions of axiological principle relative to natural scientific education.

Results

Essential characteristics of the axiological principle

1. Theoretical results

In the context of these different but mutually connected levels of assessment we could draw some traits and features of the axiological principle, related to natural-science training.

The axiological principle sets natural-science knowledge in the context of all conceptual, historical, methodological, theoretical, social, health and environmental, moral and ethical problems of scientific knowledge as a process and result. It connects the values of the skills and knowledge obtained at school with a possibility of their being applied in varied real-life situations. That requires a purposeful formation of value-oriented attitudes to skills and knowledge in the student, as well as assessment criteria about their significance and applicability.

The axiological principle directs the unified process of learning and teaching towards the formation of cognitive, metacognitive abilities and social competences of the students – systemic thinking, abilities to analyse, information processing, fact- structuring, finding out and analysing problems, reasoning, communication abilities, team work, civic activity, participation in decision making, etc.

This principle sets the requirement for building an educational environment, which supports individual activity, efficient interactivity, dissemination of the results achieved among the community, extension of the connection between school and the whole social environment.

The axiological principle can be implemented through a system of approaches, emphasizing, from a different, but mutually complementing point of view, on the value aspects of study content and study activities.

Environmental approach – its core consists of the knowledge on environmental problems and their manifestation in a regional, national and global aspect. It presupposes the student's awareness of the complex character of human relationships with the environment, as well as the possibilities of their conflict-free existence and development. The results expected include habituation of environmental values and formation of environmental awareness and environmental behaviour. [7]

Integrated approach – its contemporary parametres are characterized with vast enrichment and extending of the connections within a subject and among the subjects in the study of systemic objects. Its influence is linked to building up of students' understanding of the integration processes in science and in the practical activity of people. Its effect is described by the term "integrated qualities of personality" (mainly an active attitude to life, conscientiousness, communicativeness, etc.).

Reflexive approach – in its core it contains the reflexion in its varied manifestations (intellectual, praxeological, personal, inter-personal, etc.). The effect of applying this approach is related to the formation of personal knowledge in student, to attainment of conscious relationships, value systems, self-assessment, etc. The results expected include activating and developing of critical thinking, as well as stimulating attempts at creative activities. [2]

Historical approach – Attention is directed to the mechanisms of scientific development, to the characteristics of scientific thinking as a model of effective and prolific thinking, and to the ways in which truthful knowledge about the surrounding world is obtained.

Problem approach – This approach is based on processes of rationalizing, formulating and solving problems, in the context of purposefully modelled problematic situations. It is expected to result in acquiring a systemic natural-science knowledge, formation of some common intellectual skills and development of productive thinking by the student.

Constructivist approach – constructivism has worked out a variety of learning and teaching models – experiential learning, collaborative and cooperative learning, contextual learning, independent learning, protect-based teaching, etc. They put an accent on obtaining knowledge through one's own experience and applying them to different practical situations. [11]

The practical parametres of the axiological principle in education can be distinguished, if we answer the following basic questions:

- What scientific knowledge could become a source of arising and manifesting value-oriented attitudes towards science, nature and man who studies them?
- How could education in natural science school subjects contribute to the building of "educated citizens", capable of dealing with the endless challenges of value choices in the new century?
- How, by what methods and what means could value-oriented education be conducted?

2. Practical dimensions

The axiological principle has its specific requirements to all basic components of the teaching system – objectives, study content, training methods, means, forms of organization, control. Below we represent its appearance within the reflexive approach. (Table 1) [2, 3, 4, 5]

Table 1. Requirements of axiological principle to basic components of the teaching system within the reflexive approach

Requirements towards the teacher	**Requirements towards the student**
1. Identification of he objectives • Formulating objectives connected with the higher levels of the taxonomy of the objectives in the cognitive and affective field, objectives that should direct the student to accept and co-experience values or display value relationships; • Motivation of "outer" aims, creating conditions for independent aim-building by students	Understanding, transformation and interpretation of "outer" aims, formulating "inner" aims; motivating and planning learning activities.
2. Modelling the study content. • Working out key ideas, problems, concepts, which play the role of axiological kernels for value interpretation of the study content; • Selection of specific study content which allows modelling and appearing of assessment situations, connected with value aspects of knowledge and dealing with them; • Axiologization of the study content through including knowledge into a broad inter-subject, practical or social context.	Applying what is learnt in a value context; use of criteria for analysis and assessment of information or of situations; defining the value, the importance of the objects studied; arranging and re-arranging of values; responding and decision making from the point of view of chosen or self-formulated value criteria.
3. Choice of methods, means and organization forms • Working out a complex of methods and means for revealing the deeper value layers of the study content and for axiologization of the study process; • Combining individual and group work with prevailance of the latter; • Building a harmonious educational environment to support the learning and provide opportunities for public expressions and public dissemination of the results obtained.	Choosing suitable approaches and means of attaining the aims formulated; individual and group work when solving real environmental, moral and social problems, connected with knowledge application; discussing the process and the results of the activities; listening to other people's opinion; formulating decisions in the group, based on mutual agreement.
4. Control of the study process and study results. • Working out and applying control methods and control means, stimulating real individual and group activity of students • Reflexive control; • Comparing the achievements of every student both to the previously set criteria and to previous personal achievements; • Indirect management of the study activities through planning and using various activities and resources.	Positive mutual control and self-control; applying adopted value criteria in analysing the process and the results of the study activities; becoming conduct, based on consciously accepted values; correlating actual personal achievements to previous ones; formation of adequate self-assessment; self-managing and self-regulating of activities through planning and employing the inner sources of the individual.
5. Communication • The teacher – an equivalent partner, interlocutor and facilitator	• The student – an equivalent partner and interlocutor.

Conclusion

This matrix directs at the cooperative, mutually intensifying influence of the separate components of education for building up of educational environment, which simultaneously stimulates:

– natural-science literacy acquisition;

– development of cognitive, metacognitive abilities and social competences;

– achieving of self-knowledge, self-education and self-development of the personality.

In this way the education in natural science school subjects fulfils its important socializing functions with respect to the human personality, supports thinking and actions, based on the values of contemporary culture, thus becoming an inseparable part of civic education.

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