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## DIFFERENTIAL TEACHING IN SCHOOL SCIENCE EDUCATION: CONCEPTUAL PRINCIPLES

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**Abstract.** School reflects needs of society which change in the course of time. Therefore, a new shaping of both teaching and bringing up of individuality should be realized. Conceptual approach strengthens necessity of essential perfection of content and meaning of the differential teaching.

**Keywords:** differentiation, content of school chemical education, pedagogical conception, integration, humanization, reflection.

Modernization of school education in Ukraine predicts inculcation of differential teaching, using individual and group approaches that are grounded on taking into consideration of individual demands and natural abilities and passions of pupils, their professional intentions and life directions. Reconstruction of school education was caused by reflection of moral experience of Ukrainian people among these ones there were always traditional – life of man, his/her health, honor and dignity. Today these indicators are determined the highest social values. Dominant tendency of Ukrainian teaching and upbringing becomes democratization of individuality and its relationship with liberty; without it we haven't perspective. "It is impossible to change spontaneous source of power with the help of any discipline and any strict stare which gushes from the depths, of free human soul" (Погрібний, 1997).

From this point of view we examine methodology of differential teaching of school education as generalized system indicator of development of individuality, educational establishment, which is grounded on diagnostic measuring of mastering of content of chemical education according to the contemporary state programs, textbooks and corresponds to the aims of education, strategy of its development in the context of native and world tendencies. Pedagogical categories such as aim, tasks, principles, forms of organization of differential teaching unite into pedagogical conception.

It is known that term "pedagogical conception" comes from Latin *conceptio* – understanding, system of outlooks on essence of pedagogical activity, its aim, tasks, object and subject of activity, ways and means of its fulfillment.

ЯКОВЛЕВ (2000) has ideas for construction of conception of development of differential teaching of school education; he thinks that compositional account of pedagogical conception as system of scientific knowledge and as form of presentation of results of researches includes: general statements, conceptual apparatus, theoretical and methodological bases, core, substantial and essential filling of conception.

The main role has aim and tasks in the determination of content of education than society demands before school.

Let us examine the aims of differential teaching in its four main aspects from the outlook on fulfilled retrospective analysis of pedagogical theory.

(1) In social plan the aim of differential teaching is purposeful influence on forming of creative, intellectual, professional potential of society in a whole, aspiration for the total usage of possibilities of every member of society (M.O. Danylov, Y.K. Babans'kyi, O.O. Budarnyi, I.M. Osmolovs'ka, M.M. Shahmaev and others).

(2) From psychological point of view aim of differentiation of teaching is directed to creation of favorable conditions for transfer on subject – subject relations in the system “pupil – teacher” when every co-participant of pedagogical interaction becomes condition and mean of development of other co-participant. At the heart of these relations there is joint useful activity of teacher and pupils which guarantees their self- development (B.G. Ananiev, L.S. Vygodsky, D.B. El'konin, L.V. Zankov and others).

(3) In didactical aspect aim of differentiation of teaching is creation of optimum conditions for exposure of inclinations, development of interests and abilities of every schoolchild by the way of realization of unity of methods, forms and means of teaching that are organized with taking into consideration individual abilities of pupils with the aim of anti-action of leveling personality. The most important mean for achieving this aim is giving help to pupils in their choice (Y.K. Babans'kyi, V.V. Bouryak, O.O. Boudarnyi, M.O. Danylov, Y.Z. Guil'bouh, V.I. Zagv'yazynskyi, O.O. Kyrzanov, V.I. Kyzenko, V.F. Palamarchouk, E.S. Rabouns'kyi, V.V. Onystchuk, P.I. Sykors'kyi, I.M. Cheredov, I.E. Ount, O.G. Yaroshenko and others).

(4) From methodical point of view the aim of differential teaching is decision of problems of general educational teaching establishment by the way of creation of more perfect methodical system which grounds on external (selective and elective) and internal (level) differentiation of teaching taking into account compulsory observance of educational standards (O.I. Bougayov, N.M. Bouryns'ka, M.I. Bourda, Z.I. Slepkan', T.M. Hmara, O.G. Yaroshenko and others).

One of the main components of pedagogical conception is content of school chemical education which is actual link in modernization of school. School reflects needs of society and thus it always changes. New ideas appear in pedagogical science and practice – learning of achievements of leading countries in school education. It is not astonishing

that all leavers of secondary schools that will enter higher educational establishments take part in external independent assessment and this fact demands re-understanding of content of subjects (chemistry), volumes of demands to teaching achievements of pupils and system of control, that's why there is need to essential perfection of content of school education.

Analysis of literature of the problem mentioned above (Коберник, 2002) permitted to determine that fundamental principles of construction of content are as follow: *humanity, integration, differentiation, developing direction, subjective character, variation, flexibility, self-development and reflection.*

Examining essence of these principles, it is important to note that:

(A) Principle of humanity is reflection of tendencies of humanity of contemporary society in education, when man's individuality is determined as the highest value and man's wealth is the most important criterion of social relations (O.M. Barno, S.U. Goncharenko, V.I. Dobrynin, T.N. Kouhtevich, M.E. Dobrouskin, I.A. Zyazoun, Y.S. Krasyl'nik, E.I. Shiyanov). Essence of educational process becomes purposeful change of social experience into individual one, involvement of man into the whole treasure of culture. Humanity of education is defined as orientation of its aims, content, forms and methods on schoolchild's individuality, harmony of his (her) development; it foresees recognition of uniqueness of a child, his (her) activity, internal liberty, spirituality.

Uniqueness is valuable attitude to man's individuality. Activity means recognition of man as creative, active, self-dependent person in his/her actions. Internal liberty is examined as respectful attitude to individuality, at the heart of it is recognition of his/her eternal right – free choice of educational establishment, teaching program, point of view, variants of solution of teaching task and so on. Spirituality – moral, outlook, intellectual values – we understand as the main orientation in the development of individuality, in upbringing of his/her main significant qualities.

The main mean of humanity of content of education is its human character which means that in the base of forming of individuality must be put knowledge about man and humanity that are used for his/her wealth. Traits of humanity of content of education are: *fundamental character* – guaranteeing of deep and solid knowledge; development of individual qualities of a pupils, his/her abilities, interests, thinking, speaking, aesthetic taste, enrichment of knowledge, skills and habits; *dialogue character* – interaction, partners' relations between participants of educational process that demand of conscious and active cognitive activity; *integration character* – forming of integral conception about the world; *existence character* – development of intuition, creative imagination, emotions, feelings.

So humanity of education must be directed not to the process of forming of individuality but to the creation of conditions for its development through satisfaction of his/her basic needs.

(B) Notion integration comes from Latin *integer* – entire, integral. It is not simply connection of parts but their union into integral one on the base of mutual penetration of two or more subjects (M.I. Balagourova, P.S. Gourevich, L.A. Petrenko, O.S. Myhailova). So organic connection of list of other teaching subjects around one topic gives opportunity to enrich information perception, thinking and feelings of pupils thanks to using interesting material and also it gives possibility to know any event, notion from different sides, to achieve integrity of knowledge.

(C) Exposing of essence of differentiation of teaching demands scientific definition of notion “differentiation”. Scientists S.U. Goncharenko, O.I. Bougayov, D.I. Daykoun, P.I. Drob’yazko, V.M. Volod’ko, I.E. Ount, A.A. Kyrsanov, E.S. Raboun’kyi, M.E. Polenova, O.O. Bratanich and others write about importance of analysis of scientific notion “differentiation” in pedagogic. Logical and semantic analysis of notion “differentiation” was made on the base of learning articles, dictionaries and encyclopedias. Word “differentiation” comes from Latin *differentia*, which means difference, distinction. Notion “differentiation” is determined here as: separation, breaking up division of integrity into different parts, forms, stages; or as appearance in the organism (or in its separate part) morphological and functional differences in the process of development. Different approaches to understanding of notion “differentiation” give us base to affirm that it has multi-profile character: (i) In biological aspect scientists examine differentiation as philological and genetic one (breaking up of integral group of organisms on two or on some parts in the process of evolution; process of creation of species that is accompanied by appearance of hierarchical system of species), ontological and genetic (appearance of difference between homogeneous cells and cloths that leads to specialization), sexual ones; (ii) In philosophical aspect differentiation is divided into structural (presence of definite structure of system) and functional (process of broadening of functions of separate elements). Theory of differentiation was created at the end of the XIX-th century by English philosopher G. Spencer, who proclaimed it general law of evolution of substance from simple to complex one; (iii) Contemporary sociology (structural and functional school of T. Parsons and so on) examines differentiation as division of social unity or its parts into mutual connected elements as process which leads to appearance of different kinds of activity, roles and groups; (iv) In psychological aspect differentiation is the difference as well as individual and psychological peculiarities of individualities and its groups. Analyzing different aspects of point of views of scientists, didactic pedagogues, it is possible to make conclusions, that differentiation is: (a) first of all, presence of differences of separate groups of unity (structural differentiation); (b) secondly, process of division of unity on typological groups according to concrete signs (functional differentiation).

Analysis of psychological and pedagogical literature shows (Logachevs’ka, 1998) that there is no mono-semantic approach to definition of such complicated and many aspect

categories as “differentiation of teachers”. Different authors come to the definition of it from different positions, aspects, pointing to structural or functional signs of notion, examining it from point of view: (a) construction of school system (where and whom to teach); (b) content of education (what to teach); (c) process of teaching (how to teach).

Researching the principle of developing direction of differential teaching, it is important to note that teaching involves not only the system of forming of teaching material (chemistry) but ability to use it. The main part of teaching activity of pupils is not “a portion of information”, but a situation of subject vagueness and contradictions. System of problem situations gives possibility to develop dialectically contradictory content of teaching of chemistry in dynamics and thus to guarantee objective preconditions of forming of theoretical and practical thinking. Content of developing direction is system of teaching tasks, models, situations that regenerate by different forms of joint activities and conversations of subjects of teaching and upbringing process.

(D) Realization of principle of subject relations foresees mastering of pupils in the process of forming of general pedagogical knowledge and skills determined by individual system of humane value orientations of pupils that at the end favors to their formation as real subjects of pedagogical activity, able not only to do important functions but to successful individual self-realization.

(E) The principle of differential teaching of variations and flexibility helps pupil to orient in his choice of life and professional way. Forming of basic competences of pupil is taking place according to his (her) needs and interests. Analysis of research points that this principle in contemporary situation of chemical education appeared at the end of the 90-s but not in a perfect form, because of variability component of teaching program had insufficient guaranteeing (teaching and methodical, material and technical base of teaching studies (chemistry), personnel guaranteeing by pedagogical staff of teaching establishments).

Teaching plans and programs of learning of school subject (chemistry) consist of two components: invariant and of variability. Invariant component of program has basic level of knowledge, skills and of variability foresees special, optional courses, elective courses. Division on time between basic component (invariant) and of variability is realized according to 70-80%: 30-20% on the base of national component of education (1996).

(F) On the base of analysis of realization principle of self-development and reflection of pupils can be understood as special kind of subject-object-subject purposeful teaching activity. Search of ways of joining of subjects to teaching process to self-realization foresees transfer of accents from informational and reproductive that orient to perception of knowledge, skills, habits, to problem and research that proclaim joining of subjects of teaching to creative activity and cultural values. In the context of decision of these tasks reflection is a very actual one, which foresees realization of critical analysis of fulfilled kinds of activity, achieved results and search of reserves for rise of their effectiveness.

Problem of development of reflexive sphere of subject of teaching was the subject of research of many scientists including N. Vazheevs'ka, T. Davydenko, T. Shamova and others. In their works they determined the role of reflection in self-perfection of subjects of teaching and cognitive activities, set the bases of reflexive management of teaching process before a traditional one (Шамова, 1982). There is lot of points of views on the notion "reflection", but we understand that reflection is a process which comprehends our own activity, analysis with the aim of further purposeful perfection.

As I. Lerner affirms, reflection must be included to all components of content of education. It means that it needs principal changes in pedagogical and methodical approaches to organization of process of teaching, the essence of those we can express like this: knowledge and kinds of activity, where subject joins during its acquisition to mechanisms of development of subject; knowledge and actions that are not connected with the development of subject of teaching, his/her ability to realize his/her need, individual significance and value are dead.

Researches of directions of development of content of differential teaching indicate to methodological, didactical, methodical ones that always change and realize in the system approach in school education.

О. Савченко (2010) researches methodological direction of content of school education. She approved that further perfection of content of general secondary education couldn't carry out in the procedure of alienation from value principles and strategic aims of development of contemporary school. Briefly, it is strengthening of spirituality, moral, civic qualities, perception of values of culture by pupils; upbringing and development of desire and skills to teach, work; forming of ecological outlook, informational and technological knowledge. In the content of contemporary school it is necessary to locate purposefully such kind of upbringing and developing potential that every educational branch will favor to enrichment of teaching process by convincing, accessible material for development and upbringing of children. Knowledge, intellect, individual approach, differentiation becomes exceptional value.

Contemporary pedagogic (Сікорський, 2000) uses three main approaches to construction of didactic direction of content of differential teaching and in accordance – methodology of organization of teaching process: (a) priority direction is subject and informative filling of content, that is to say what is taught (subjects, topics, courses), and the main attention is devoted to volume and solidity of learned material in the organization of teaching; (b) in choice of division into structures of content of teaching and methodic the accent is diminishing on the process of cognition – how do pupils master material, what do they teach to do, what kind of skills, means of activity do they learn, so priority direction becomes procedure, and in teaching – technological component; (c) in choice of content and organization of teaching the priority direction is creation of preconditions

for achievement of strictly determined teaching results by every schoolchild. According to this sign dominant factor is competent approach in the choice of content, in the means of its mastering and assessment of the results of teaching.

We think that realization of didactical direction of differential teaching of contemporary school has not yet the object of solid didactical and methodical researches. On empirical level we can make a conclusion that in pedagogical practice prevails attention – what and how is taught than to result component of mastering of content, its individual importance for pupils. This fact testifies to such expressions of schoolchildren after lesson as: “We studied...”, “We read...” and very seldom we can find reflexive judgments: “I have been taught...”, “Now I can...”, “I don’t still understand everything after listened material...” “I want to read about it once more...”, “Now I know where I can use it...” Methodical inattention of teachers to result component of teaching activity does not stimulate pupils to self-analysis of their actions, motivates purposeful affords poorly for achievement of better results, self-dependent cognition and thus reduces individually significant influence of differential teaching.

Exposing methodical direction of content of differential teaching we concentrate our attention on effectiveness of the main instruments that influence on the quality of process. The main instruments of content of chemical education are: standardization, competence approach, concordance of result part of content with the demands of effectiveness of its mastering, information character. Mastering of chemical knowledge depends on the fact how it was interpreted in textbooks, how open it is for pupils, teachers, how parents assess it, society in a whole. That is why it is so important to develop variations of chemical textbooks, to realize their multi-functional character.

Mentioned instruments as basic orientations must be taken into consideration only in their mutual connections. О. Померуш (2003) thinks that projecting of content of school education must be based on individual and social aspects. Effective base of criterion’s approach, according to our point of view, must serve social didactic and methodically grounded model of leaver of main and senior school.

О. Локшина (2007) emphasizes that in working out criteria of selection of content of school education we must orient on forecasting of teaching results that we plan to achieve in secondary education. Criterion’s approach after results holds in the authors of standards, programs and textbooks from huge volume of information, practice inter-subject ties, commit them to guarantee real succession between stages of school education. Such approach will give opportunity through teaching content to organize differential teaching, to construct systems of inter-subject tasks and situations, to activate practical experience and life needs of pupils in school education.

Teaching programs for different profiles according to their volumes, correlation between structural components of content, objects of control of teaching achievements

must take into consideration differences in styles of thinking and abilities of pupils. Components of conceptual approach must be mutual connected and have system process which foresees changes in legislative, managing, methodical guaranteeing, guided by scientifically grounded valuable principles of school education. Forecasting of changes must be done in the models of socially and individually valuable content for pupils on each stage of general secondary education and needs of qualitative differential preparation of pupils to further education.

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