

INTEGRATED SCIENCE TEACHING BY APPLYING DIDACTIC DIFFERENTIATION: SOME ACTUAL CIRCUMSTANCES

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Dear Readers!

The discussion about integration cannot dispense with antithesis (differentiation) which is also of high importance. The default of it is a fairly serious lack of comprehensive school. Both processes have to follow each other as this is the most plausible way of human understanding and knowledge improvement (Vaitkevičius, 1979).

A public knowledge is always wider than personal information. Ipso facto human cognition and public experience are not differentiated.

Teaching constricted by undivided educational drafts and curricula frequently ignored personal schoolchildren's qualities. Pupils unable to satisfactorily adopt teaching material are overloaded while others state that such load is insufficient. This is why a general background of a number of learners recedes and the motivation of all pupils decreases.

Research indicates that genetically all people differ. Genetic inequality most frequently determines the child's abilities. Natural differences are highlighted by a different situation of upbringing and an environment.

Teaching differentiation is not a new issue of pedagogy but a traditional one. J.A. Komenskij was one of the formers to promote an idea of differentiated teaching. In his work "The Great Didactics" the author offered to take into consideration different schoolchildren's abilities and other personal features and advised to subdivide them into groups. The foundations of differentiated schoolchildren's teaching were laid by the psychologists V.Stern and E.Clapared. Mannheim schooling system carried out an extensive investigation in the field. The deep-rooted traditions of differentiated teaching survive in other countries such as Great Britain, the USA, France.

Differentiated teaching in Lithuania has native traditions. Differentiated education was a field of interest to Lithuanian philosophers and pedagogues such as A. Maceina, S. Šalkauskis etc. A marvellous job in the field was done by J. Laužikas. The problems of differentiation become burning again. Some questions of differentiated education (teaching) were investigated by J. Vaitkevičius (1985), N. Večkienė (1991), L. Šiaučiukėnienė (1996; 2001), A. Budėnas (1991) etc. In many scientific information sources we can find a lot of different terms which are used to express the idea of differentiated teaching, for example, individual teaching, personalized teaching, differentiating instruction etc. It is possible to underline that differentiating instruction, for example, is one of the most applied methodologies in teaching nowadays (Tsavkova, 2009). The main problematic question still now is how to design personalized learning for every student. We can agree with opinion of C.A.Tomlinson that **students may learn in many ways, the essential skills and content they learn can remain steady and students can take different roads to the same destination** (Tomlinson, 1999).

The method of didactic differentiation is rather complex. The teacher should not forget that every child (pupil) needs the best conditions attached to develop his/her abilities when combining unlike work patterns at school. "Every schoolchild needs suitable conditions to be laid down in order to elaborate his/her intellectual inner world. Individual perennial help and encouragement to seek perfection accordingly to the personal programme, the achievement of more freedom to act, to learn, to show not to kill originality are considered to be very helpful features" (Vaitkevičius, 1988). The proportion of integrated to differentiated teaching is also very relevant from a methodological point of view. It can be defined as a system of two contradictory tendencies (Lamanauskas, 1999).

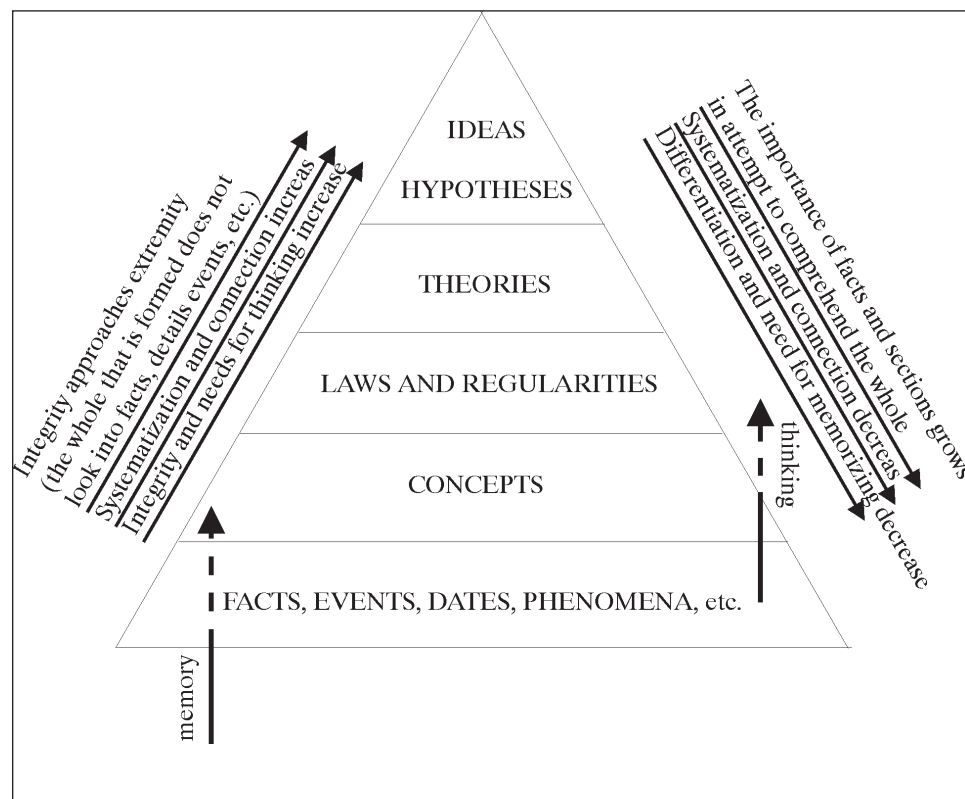


Figure 1. The relation between integrated and differentiated teachings.

Preventive and polyreasoned discretion lies dormant as a dialectic conservation mechanism of natural complexes is hidden here. Though, to some extent, it is suitable for public processes. Natural and public laws work together in training practice. The teachers that grasped this mysterious phenomenon will easily succeed in integrated pedagogy practice. The balance between integration and differentiation is more than necessity.

Didactic differentiation of the class is a kind of teaching when schoolchildren in the classroom are subdivided into the groups agreeably to certain features. Pedagogy literature suggests various definitions. Some authors (Šiaučiukėnienė, 1996; Lukšienė, 1994 etc.) call such differentiation *intrinsic*. L. Šiaučiukėnienė believes that intrinsic differentiation discloses group work that is organized in the classroom. The diversity of pupils' didactic objectives and the specificity of the subject are considered. Other authors (Laužikas, 1974; Gražys, 1977; Simanonis, 1969; Simonova, 1974; Lamanauskas, 2001 etc.) call intrinsic differentiation *didactic* (the term is used to stress its goal and place in the educational process). J. Laužikas supposes that, "the distribution of schoolchildren into groups should follow the next main criteria: learners' knowledge, skills, efficiency and the approach to learning". Nevertheless, there are some doubts if these criteria are

sufficient as the psychologic moments of subdivision into groups are not mentioned at all. The training process has to accept all personal features of the child's psychology: ability to concentrate and transfer attention, the type and level of memory, the rate of thinking, feelings, nervous type, etc. The children with slow-going and rapid thinking often demonstrate the same abilities. The only difference is that the latter need more time to adopt the teaching material. Schoolchildren vary in using their strength of mind in unlike situations. The strength of mind alters, grows, increases along the acquisition of the latest information. Considering their potency of cognition, students' distribution into groups is not appropriate because of two main reasons:

- it is based on a certain teacher's approach and evaluation and often on the dictate;
- the child is not always self-sufficient as s/he frequently simply submits to the intentions and decisions of other personalities.

Teaching material is imparted insomuch that all learners should be offered suitable opportunities to develop skills during the class. The objective can be reached by maximum solidification of the child's self-sufficiency and his/her personal free choice to learn what, how and how much s/he wants. Raising distinctive claims to all pupils, information should be given expediently and definitely. All schoolchildren should achieve at least minimum level (should get satisfactory evaluation) and all willing, engaged and skilful pupils could reach much more. The system of evaluation is not important (a five point, ten point etc. system). One purpose is clear – it also should be differentiated.

According to J. Bruner (1966), every child wants to learn but a need is stifled by the schooling system (inflexible, obsolete teaching methods and forms, etc.). Research carried out by N. Proskurina indicates that 23% of pupils do not understand the purpose of the tasks accomplished in the classroom, 30% of those do not think what the purpose of the tasks is (Proskurina, 1986). Other investigations (Pukelis, 1989) confirm that only 3.3% of the teachers of comprehensive secondary school niggle over the issues of differentiated teaching.

Every child, certainly, learns personally, i.e. according to his/her model. The range of an individual approach to the child is very extensive and involves a number of characteristic features. Didactic differentiation has to shorten the distance between the knowledge perspective gained by the child (obtained in the classroom) and the information that can be reproduced.

Natural sciences are specific. Thus, endless possibilities rise to employ didactic differentiation that is applied to reveal personal pupils' qualities; self-reliance is encouraged, learning motivation increases, i.e. schoolchildren are oriented towards success.

The application of didactic differentiation creates favourable circumstances to implement the key principles of didactics: scientism (schoolchildren with different interests at varying level soak up the content of teaching), the personalization of the teaching process (an individual teacher's approach to learners as to the subjects and personalities of activity), conscious and active knowledge acquisition (pupils' activity, individual work as the basis of creativity), pragmatism (theoretic conclusions and generalization are reached through personal practice because the investigations show that schoolchildren better acquire knowledge if started from specific and proceed to more abstract) and other principles.

Individual teaching is given preference in contemporary education. The concepts of individualization and differentiation are unlikely treated by the sources but do not finally disclose their essence.

Individualization, certainly, is not and cannot be absolute. Nevertheless, we should bear in mind that the whole class rather than a single person was predominating in Lithuanian schools in the second half of the 20th century. Rivalry stopped versatile human education. Personal abilities and potential opportunities practically were not considered. It's scarcely surprising that a negative pupils' approach to learning and teachers formed, they consciously started skipping classes.

The assessment of pedagogy literature commonly reveals dissatisfaction with ordinary (classic) classes and standard principles of work. The individualization of teaching is the necessity as a pupil needs to be offered an opportunity to accomplish the tasks that answer his/her personal skills and interests, to choose the teaching methods and a style that satisfy the learner's temperament.

The schoolchild has to safely go forward (Gage, Berliner, 1994). The examination of the issues of differentiated teaching should not be directed towards one of the forms. The experience of foreign schools (for example, the United States, Germany, etc.) indicates that none of the forms of differentiation (for example, didactic differentiation) is optimal. A proper way is acclaimed to be the combination of teaching forms considering pupils' abilities, interests, aptitudes, natural qualities.

The application of didactic differentiation primarily appears as the question of schoolchildren's distribution into groups because the differentiation of teaching most frequently is grasped as pupils' grouping agreeably to certain criteria (abilities, attitudes, interests, intellect). The majority of the Lithuanian teachers recommend students' distribution into groups (Bajorienė, 1976; Jovaiša, Vaitkevičius, 1989, etc.). Nevertheless, a major part of the teachers of foreign countries are against such actions and call it social discrimination (Unt, 1990; Gozzer, 1991 etc.). M. Lukšienė supposes that learners cannot be evaluated according to social, property, cultural, health and other features (Lukšienė, 1994).

Correct methodology is important to the successful didactic differentiation of the educational process. Teaching methodology based on possible differentiated tasks moves liveliness, encourages individual work (Šiaučiukėnienė, 1994). Didactic differentiation gives a child a chance of choosing the level of learning in the light of content, form, etc. at school as well as at home. Opportunities to decide on the tasks of an appropriate level are meaningful to the pupil. The teacher is only an adviser and helper.

Some authors (Gilbuch, 1991; Kondratenko, 1991, etc.) are certain that a free choice is not possible in the employment of didactic differentiation as intellect, abilities and skills develop only when a child is actively mentally involved, i.e. learns very intensively. Moreover, such differentiation should not be a right decision in terms of the schoolchildren that want and are able to work harder. M. Levina, V. Zagviazinskij (1968) pays much attention to the coordination of differentiated and group work in the classroom and supports the idea of categoric pupils' distribution into groups. There are authors maintaining that students' distribution into groups is comparatively a very mild form of differentiation (Mikalajūnas, 1993).

A. Būdėnas supposes that natural child's development is differentiated and experiences a public way of life, world outlook and customs. This is the way to integrated children's personal qualities as well as psychic processes. Thus, personal students' qualities should not be unified and levelled. Didactic differentiation needs more diverse methods. Teaching material should be expanded into parts (for example, pre-programmed algorithms) (Budėnas, 1991). Scant attention turned to the differentiation and individualization of teaching is often one of the reasons of slow progress (Meškauskaitė, 1977). S. Molis also emphasizes the importance of individual tasks in the educational process. Roganovskij (1991) has analysed the issues of differentiated teaching and focused on the textbook of the subject. V. Monachov and V. Orlov (1990) stress different teaching in the classroom: distinctive tempo, the unequal help of the teacher, the diversity of tasks. They also suggest grouping of schoolchildren. I. Leons (1991) concentrates on the relevance of the individualization of teaching. He believes that the efficiency of suchlike teaching depends on a particular methodology that guarantees the possibilities of didactic differentiation in the classes of natural sciences. However, thorough individualized assistance has to be warranted.

Similar problems have been debated by other researchers. J. Ots (1975) researched the efficiency of individualization and established that the individualization of tasks made pupil active and generated interest in the teaching subject. The author distinguishes the systems of the tasks of three levels and approve learners' distribution into groups. A. Zeidmane (2000) finds four types of differentiation: differentiation by outcome, differentiation by task, differentiation by process, and differentiation by response. However, the author notices that all types have advantages and drawbacks.

Hence, the summary of experience and recommendations of the majority of the scientists that have examined the issues of differentiation confirms that didactic differentiation has to be wider employed in the classroom. Classes have to pay respect to the differences of pupils' learning

pace, unlike psycho physiologic characteristics (imagination, unequal inquisition, learning interests and motives, distinct thinking, workability, the degree of consciousness, etc.), learning motives, interests, aptitudes, etc. at deviant level. Didactic differentiation can be expressed in diversiform ways in the class:

- applying tasks and exercises at different level in dissimilar pupils' learning activities;
- orientating schoolchildren towards various activities (practice, creative, theoretic, draft producing, etc.);
- suggesting teacher's help at different level, etc.

The employment of the integrated course of natural sciences reveals plenty of opportunities of the differentiation of didactic teaching. The tasks at three levels are recommended to be assigned to students. The tasks at level 1 (satisfactory) agree with the requirements of nominal curriculum (standards). The tasks at level 2 are supposed to be suitable for the learners of moderate abilities. The tasks at level 3 are the most complex and require more knowledge and deeper thinking. The assignments are considered to be differentiated in terms of complexity (content size) and the format of activities. Pupils themselves need to be provided a chance to choose the level of tasks. It prompts schoolchildren to evaluate their strength, teaches to act self-sufficiently, broadens and extends their knowledge, sets out conditions to diverse activities. Undifferentiated and impersonalized individual tasks usually are not effective.

Thus, individual and differentiate teaching agreeably to abilities shows that pupils are taught to act self-sufficiently and in groups (Laužikas, 1982). Prof. Laužikas assumes that the most important point is children's protection from failure and unpleasant experience accomplishing school tasks (Laužikas, 1982). The majority of researchers agree that an intense activity is only possible in case of differentiated or individual work.

If one of the objectives of integrated education is a help to the learner of the present to be oriented towards the abundance of information and materialistic-technical valuables, to prevent a child from becoming an immoderate consumer, the key objective of differentiated education (teaching) is the establishment of perfect conditions and opportunities for every child, including weak and bright students, to be trained physically and mentally. Therefore, the implication of the integrated courses of natural sciences into educational process should not ignore the ideas of differentiated education (teaching).

The application of the mechanism of didactic differentiation can be effective seeking the following goals in forms 5 to 9 of basic school:

- to promote learning;
- to develop a free, responsible, able to resolve, self-sufficient personality;
- to foster interests and aptitudes;
- to increase the knowledge of the area chosen by the child;
- to stimulate creativity;
- to broaden schoolchildren's professional orientation, etc.

Every teacher understands that pupils could achieve much more in the classroom if offered appropriate conditions such as the atmosphere of self-sufficiency, the freedom of action (choice), a lesser dimension of frontal work in the class and a larger amount of individual tasks. In terms of a pedagogic process, individual work with students is a pedagogy action considering the development level of a learner, the obtained knowledge of world science, individual psychic characteristics, the previous methods of training and teaching, life structure, the present situation, a dynamic stereotype and instantaneous psychic state established in the educational process and life (Laužikas, 1974). Laužikas distinguishes three main propositions in his assessment of the pedagogic-psychologic aspects of differentiated teaching: 1) to know pupil's personal values; 2) to own suitable sources and material for individual and self-sufficient stimulation of schoolchildren's activities; 3) individual forms of activities. Laužikas strongly emphasizes a psychic activity. He maintains that only an active pupil can properly develop his/her abilities (Laužikas, 1965). The recent research indicates that the schoolchildren aged from 7 to 10 cannot completely express themselves. A. Golubeva, S. Iziomova, M. Kabardov and others (1991) are convinced that:

- students' aptitudes and interests frequently disagree with their skills. Skills and aptitudes sometimes are indifferenced;
- the possible inborn preconditions of skills and aptitudes are hidden from teachers, parents and learners themselves;
- side effects, for example, devotion to teachers and classmates or school prestige are sometimes more significant than a need to apply his/her innate skills

Thus, according to the researchers, it is essential to perceive how realistic pupils' psycho physiologic abilities, skills, aptitudes should be reflected in the educational process at different age range. Therefore, the criteria of the usage of didactic differentiation in the educational process should be defined. The authors declare that permanent individual psycho physiologic and psychologic guidance is important to the student but does not come up with suggestions for practical implementation.

I.Jakimanskaja, G.Abramova and others (1991) assume that the mechanism of didactic differentiation has to be warranted by the wholeness of specific didactic means: educational tests, the systems of tasks and exercises, individual work, tests, etc. These means should be prepared agreeably to the basic consistent patterns of psychology and should try to seek the ensuing goals:

- to reveal the result of teaching ("learning", "completion", "employing", etc.) as well as the process of achieving the result;
- to check the stability of methods applied in teaching.

Laužikas suggests that didactic differentiation:

- allows children to be grouped rapidly and flexibly considering varied psychic qualities and the level of knowledge;
- affords to encourage and assign self-sufficient work to pupils;
- establishes suitable conditions for a teacher to teach a smaller group;
- helps to increase general activity.

Hence, the educational process has to be flexible, to assist everyone, including the weak and the bright student, to individually go forward and to study some subject when the learner feels fit to do it. The final goal is to achieve positive results at the end of teaching/learning as the stages of the latter process are insignificant (Dupont, 1993). When seeking impressive results, two tasks need to be completed:

- an effective system of didactic differentiation in the classes of natural sciences has to be produced;
- more diverse didactically differentiated teaching/learning material of natural science should be prepared (for example, tasks, tests, questionnaires, games, etc.) and the opportunities of practical implementation should be envisaged.

Thus, differentiated tasks encourage a pupil to intensively think (for example, makes an outline of a topic, highlights the key concepts, writes a summary, etc.). A.Smironov (1966) has proved that schoolchildren absorb the examined material spontaneously when a wish to be active is more important than a desire to remember something. The crucial methods of such an activity are conclusion, specification, classification, comparison and systemization. Consequently, the teacher must be perfectly familiar with didactics and psychology. The present psychologic-didactic research shows that the encyclopaedic knowledge of didactics and psychology is a qualification of rational teaching (Grudenov, 1985). According to Grudenov, the foremost point of the class is that a teacher should be able to create psychologic situations that made all schoolchildren to think more actively, differentiated tasks should foster learners' self-sufficiency and exercise skills of work with different sources.

Differentiated teaching is accepted as a particularly effective method in most of the countries. The differentiation of teaching, the diversity of tasks stimulates cognitive pupils' activity, interest in the subject as well as teaches follow integral links, relate different information into a certain wholeness. Cooperation between a learner and a teacher is widely discussed as it depends on how the teacher works with his/her students, how their self-sufficiency is encouraged, how established conditions influence their activities (Rajekas, 1994). The results of our experimental research

demonstrate that didactic differentiation really positively influences the efficiency of integrated teaching and is benevolent for pupils' differentiated evaluation (Lamanauskas, 1998).

Hence, it is clear that integrated teaching seeks the highest level of knowledge and differentiated teaching points out to every schoolchild. It is obvious, that the main aim of differentiated teaching is to create grounds for the child's structural type of thinking, to form possibilities for a learner to master knowledge according to the degree of abilities (individualized teaching) while teaching separate subjects (subject teaching). The application of differentiated teaching seeks to develop powers of learners. Differentiation can be comprehended and defined in the following two ways: first, as a result of splitting a particular whole into segments, levels etc. or, second, as the formation of new qualitative connections between the separate components of the system due to processes of integration. In the latter case the system acquires a new quality – it becomes more complex. Finally, I want to underline that differentiated teaching (or **personalized**, individual etc. teaching and learning) is a key component of future teaching/learning process.

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