

# Pedagogical Factors Stimulating the Self-Development of Students' Multi-Dimensional Thinking in Terms of Subject-Oriented Teaching

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## Abstract

The main aim of this research is to disclose the essence of students' multi-dimensional thinking, also to reveal the rating of factors which stimulate the raising of effectiveness of self-development of students' multi-dimensional thinking in terms of subject-oriented teaching.

Subject-oriented learning is characterized as a type of learning where self-abilities and self-processes are systematically actualized. Among them the abilities and processes of students' self-development in different learning situations are systemically important.

52 students took part in the pedagogical experiment. In order to evaluate the students' competencies of self-development of their multi-dimensional thinking the 10-point grading scale and the special suggested criteria of self-assessment of multi-dimensional application of systematic, creative, critical and reflexive thinking were used. The obtained results were subjected to statistical processing.

**Keywords:** multi-dimensional thinking, self-development, subject-oriented teaching

## 1. Introduction

In terms of global and system crisis which covered all field of human activity including education, it is very important to actualize attention of high school pedagogues to priority issues which resolution would increase the intellectual and creative potential of modern students—the future professionals. Therefore, the problem of researching the pedagogical factors oriented at stimulating the self-development of students' multi-dimensional thinking is relevant.

The relevance of this problem from theoretical point of view is determined by the fact that modern student as future young specialist must understand the complexity, multi-dimensionality of the environment and of the modern professional problems which cause the contemporary crisis and which decision requires the multi-dimensional approach, also requires the multi-dimensional thinking.

The relevance of this problem from practical point of view is determined by the fact that the modern pedagogues of high school while being in the situation of crisis conditions are almost not ready for purposeful subject-oriented approach in stimulating the modern student's abilities for development and self-development of multi-dimensional thinking as our work experience in retraining courses for university pedagogues shows. And all this is not casually. There are no reliable and effective methods in modern pedagogical science and leading pedagogical practice. Also there is no answer to the question: what is multi-dimensional thinking?

## 2. Background

In order to give the meaningful answer to this question, let's preliminarily pay reader's attention to the following: modern pedagogical theory and practice of high school pass the complex way from application of classical science to application of post-non-classical pedagogical science.

If we will retrospectively analyze the evolution of pedagogical science about the development of the quality and efficiency of educational systems, we will define three types of scientific rationality according to the terminology of Russian philosopher V. S. Stepin: classical, non-classical and post-non-classical (Stepin, 1989). Each type of rationality is characterized by its important peculiarities which are not always recognized.

Classical approach to the development of pedagogical theories and methods of educational activity was mostly

oriented at the activation of cognitive, creative, educational, extracurricular and any other activities of students during the process of teaching and educating them.

This approach was mostly based on the concepts, regularities and principles of mostly one-dimensional, linear determinism in the development of educational activities. The main point of this activity is the following: the activity will be more productive if the education and teaching will be more active. The example of didactic theory development and of teaching methods classification based on classical approaches could be one-dimensional model of teaching methods classification developed in Russia and explained in the scientific work of M. N. Skatkin, I. Y. Lerner and other didactic scientists in 60-70-s of last century. However, it should be noted that high-qualified teachers of 60-70-s of the last century owning the techniques of this type of training and educating have achieved good results in secondary and higher education.

Non-classical pedagogical theories and technologies of educational activities are mainly based on the ideas of a binary approach, on the development and application of pedagogical management and self-management of learners (students) during their education. These ideas of a binary approach to classification and meaningful justification of teaching methods were developed in the research of M. I. Makhmutov, T. I. Shamova, M. M. Levina and other Russian pedagogues. Moreover, there was a basic idea in the non-classical theories of educational technology to lead and transform pedagogical theory to the level of educational technology.

Technological approach to improvement of the quality and effectiveness of educational activities is typical for researches of V. P. Bepalko, M. V. Clarina, and many others. These researches are systematized in the scientific work of G. K. Selevko (2006). However, pedagogues–researchers and pedagogues-practicians became to increasingly discover that it is not always expedient to manage the creative processes in the activity of the teacher and students also to technologize it.

Post-non-classical type of pedagogical theories and educational technologies considers education as an open, self-developing system, as a system of multi-dimensional determinism of educational activities subjects.

Theory and practice of post-non-classical type of education is more focused on the development and practical realization of mostly subject-oriented approach to improvement of the quality of education, it even guarantees this quality if education transforms into self-education, education, and if the development transforms into the creative self-development and self-realization of the personality.

As we can see the multidimensionality, multi-dimensional approach to solving the contemporary problems of improving the quality and effectiveness of education is one of the basic characteristics of post-non-classical scientific and pedagogical knowledge, also of knowledge about the development and self-development of multi-dimensional thinking of the modern student. It should be also noted that the multi-dimensionality is a fundamental property of nature, society and human activities. It is most often manifested as one of the fundamental characteristics of a highly developed human thinking. As for multi-dimensionality in understanding the nature, the one-dimensionality of space and thinking was replaced by multidimensional view in non-Euclidean geometry proposed by the outstanding Russian mathematician, rector of Kazan University N. I. Lobachevsky in 1826.

If someone will study ordinary human thinking, it is most often manifested and implemented as a one-dimensional thinking. The one-dimensionality of ordinary human consciousness, thinking and behavior is extremely persuasively and convincingly revealed in the book of one of the greatest philosopher of the twentieth century Herbert Marcuse “One-Dimensional Man: Studies in the Ideology of Advanced Industrial Society” which was firstly published in 1964 in the USA. Herbert Marcuse views outlined in this book can be expressed by the following provisions. Most people are essentially the same in modern society since most of them are one-dimensionally thinking; therefore they have the same desires, aspirations, needs.

Due to the fact that ordinary thinking, human behavior is principally one-dimensional, therefore, in accordance with the theory of Herbert Marcuse, modern man is often imposed by false, “standard” ideas, values and needs (Marcuse, 1991). In order to positively change the society, according to Herbert Marcuse point of view, there is a need in “Great Refusal” to many false and also one-dimensional determined human needs. For example, it would be necessary to change the direction of human needs from the exploitation of nature towards harmony with it, turning their desires and feelings to high spirituality, morality and culture.

In our opinion, one of the basic reasons of the modern systemic crisis in society, science and education is connected and determined by the one-dimensionality of the human consciousness, thinking and behavior in different spheres of human activity, including education.

Our research shows that one of the basic characteristics of a highly human thinking is its multi-dimensionality.

The essence of multidimensional thinking is disclosed and defined by us in the following way. Multidimensional thinking is a generalized characteristic of such type of human thinking, which is characterized by multiple strategies and tactics of thinking; it is a search and use of a variety of approaches, methods for solving various, especially creative, tasks and issues, selecting and implementing the most appropriate and effective solution on this basis.

From a psychological point of view due to the theory of three-dimensional model of intelligence of American psychologist J. Guilford—the multidimensionality of human thinking is particularly clearly manifested and realized in the process of divergent thinking when while solving creative tasks and issues, the several strategies are simultaneously generated and implemented, when the search of several ways of solving the creative tasks is conducted in parallel. Thus, the multidimensional human thinking is realized (Guilford, 1965).

While developing the theory of problem-based learning in the 70 -s of the last century the three-dimensional model of the main classes of problem situations and the basic characteristics of various kinds of creative thinking were presented and justified in the monograph of A. M. Matyushkin. A. M. Matyushkin recognized and understood the importance of searching not one, but many ways to resolve educational problems and problem situation (Matyushkin, 1972, p. 38).

Thus, although D. Gilford and A. M. Matyushkin did not use the concept of “multi-dimensional thinking”, they realized and actualized in their studies the crucial role and importance of the multi-dimensionality of the strategies and tactics of creative thinking in solving problems in terms of solving different types of problem situations.

Ideas of multidimensionality, polyfunctionality of students’ thinking development in educational activities were often implicitly the subject of researches both in Russia and abroad. Let’s mention some of them. For example, an American scientist A. Targowski believes that it is possible to teach the development of human wisdom for students in high school (Targowski, 2011). In order to realize this process it is important to stimulate all the basic functions of thinking: logical and intuitive, creative and critical, systemic and reflexive, theoretical and practical thinking. A. Targowski has developed for this purpose a special course for students, which is called “The development of thinking and the basics of wisdom”.

Important results in identifying psycho-pedagogical conditions for the development of critical thinking of students in educational activities can be found in the research of Halpern (2002). There are also other original pedagogical approaches to development of different types of students’ thinking during the educational process in American and European universities (Robert, 2012; Beyer, 2008; Jakel, 2013; Scheer, Noweski, & Meinel, 2012; Loes, Umbach, & Pascarella, 2012). Kim (2010) studies the dimensionality of creativity as an important factor for understanding the mind’s cognitive functioning. Harkins and Fieber (2005) in their article describe the infinity thinking as multidimensional thoughts processes in idea formation, give the explanation to the Infinity Thought Model. Wongwanich and Chaiyapornpattan (2013) study development of a multidimensional thinking styles scale based on theory of mental self-government for sixth grade students. The researchers investigate the quality of the developed scale and study profile of styles of sixth grade student and a relation of profile of styles of student in each dimension. Another interesting research was carried out by King, Goodson, and Rohani (1998) who gave the definition to higher order thinking skills. The researchers suggested the teaching strategies which help students to develop higher order learning skills of students (scaffolding, rehearsal, elaboration, organization, etc.), and the classroom and statewide assessment of higher order thinking skills. Many scientists in their researches set the task of multi-functional approach to activation of the creative thinking development (Sternberg, 2006), or critical thinking (Sun & Eadaoin, 2012), or reflexive thinking (Lohman & Finkelstein, 2002).

After reviewing the researches we can conclude that there is a need to deeper study the pedagogical task to orient students at self-development of their multidimensional thinking in educational activities. This problem is not studied enough deeply and widely despite the fact that there are many researches on the problem of students thinking skills development.

The students’ thinking in the real pedagogical practice is realized, revealed and developed not as mono-functional, but as multidimensional thinking. Our modern researches in this field show that someone can distinguish the following types of multidimensional thinking:

- 1) Multi-dimensional systemic thinking, including such approaches and techniques as systemically-oriented, systematic and structural, systemic-functional and systemic-cluster.
- 2) Multi- dimensional creative thinking, which is determined by the use of various multi-directional heuristic

methods for solving creative tasks and problems (brainstorm, synectics, empathy, random associations, analogies, and many other methods and strategies of creative activity, multi-dimensional methods and techniques of TIPS - Theory of Inventive Problem Solving by Genrich Altshuller and others).

3) Multi-dimensional critical thinking based on a variety of strategies and tactics of critical judgments, on the use of various approaches to substantiation of critical reasoning relying on multiple criterion-evaluative judgments.

4) Multi-dimensional reflective thinking which is directed at awareness and understanding of the advantages and disadvantages of man, his/her interests, motives and needs, individual characteristics of thinking and action, communication and behavior.

Multi-dimensional reflective thinking is particularly manifested and developed through such abilities and processes as self-actualization, self-cognition, self-management, self-determination, self-perfection, creative self-realization and self-assessment in different types and forms of educational, especially in project-creative and research activities.

### 3. Study

Due to the mentioned goal of research the following methods were used:

1) Theoretical (analysis of psychological, pedagogical and philosophical literature, comparison and synthesis of modern educational theories and teaching technologies was carried out).

2) Empirical (pedagogical experiment was carried out. A variety of creative, research tasks and assignments were systematically given during one semester to Master students while studying the course "Pedagogy of High School" at the Faculty of Mathematics. Tools and methods stimulating students' self-motivation and the desire for self-development of multi-dimensional (systematic, creative, critical and reflective) thinking were systematically used).

The students' ability to use different types of multi-dimensional thinking in situations of creative solutions, research tasks and assignments were assessed by ten-point grading scale in the beginning and at the end of the pedagogical experiment.

The results of pedagogical experiment in stimulating self-development of students' abilities to use appropriate ways of thinking are the following:

Systemic thinking (Mean of students' abilities to apply techniques of systemic thinking was assessed by ten point scale. The mean before pedagogical experiment = 5.85; after experiment = 6.88; probability to positively change abilities = 0.77).

Creative thinking (was determined by the assessment of students' abilities to generate new ideas (by ten point scale). The mean before pedagogical experiment = 6.69; after experiment = 8.12; probability to change abilities = 0.81).

Critical thinking (was assessed by the degree of validity of assessment and critical judgments of students in discussion situations (by ten point scale). The mean before pedagogical experiment = 6.04; after experiment = 7.35; probability to change abilities = 0.73).

Reflective thinking (was assessed by the degree of students' self-analysis and self-esteem of their strengths and weaknesses while solving educational and research assignments (by ten-point scale). The mean before pedagogical experiment = 6.04; after experiment = 7.00; probability to change abilities = 0.65).

### 4. Discussion

Our research shows that all types of multi-dimensional students' thinking play an important role for the successful development of different types of multi-dimensional thinking in educational activities. However, we would like to outline the multi-dimensional reflective thinking. Activation and intensification of self-development of all types of students' multi-dimensional thinking is achieved, especially in terms of self-actualization, self-cognition, self-management, self-improvement and self-realization of the student during subject-oriented educational activities.

Our research is directed at the promotion and intensification of self-development of multi-dimensional thinking of students - future pedagogues in Kazan Federal University (Russia). This research showed that it is possible to define a number of factors which actually contribute to this process.

You can see below the ranking of factors contributing to self-development of students' multi-dimensional thinking (according to the opinion of Master students-future pedagogues):

- 1) Knowing and understanding the essential characteristics, methods, techniques of multi-dimensional thinking (for example, knowing and understanding the essence of system-oriented, systemic structural, systemic functional, systemic-cluster, creative, critical and reflective thinking).
- 2) The systematic application of a large number of various creative, research tasks and assignments which requires a multi-dimensional approach, multi-dimensional thinking in the process of solving them.
- 3) Urging students to multi-dimensional creative reflection of their abilities (self-actualization of personal and professional significance of the problem, the ability for self-knowledge, self-management, self-improvement, self-actualization, self-control).
- 4) Creating a big number of problematic, controversial situations in a learning process, which resolution requires a multidimensional creative and critical thinking of students at the same time.
- 5) Systematic involvement of students in a variety of research, design and creative activity with subsequent review and evaluation of its effectiveness through multi-dimensional criteria evaluation.

## 5. Conclusion

Generalization of the results of our theoretical and experimental study allows us to make the following conclusion.

-Productivity of development of modern educational theories and designing educational technologies can be greatly raised if they will be based on the idea of multi-dimensional thinking of all subjects of educational activities, especially on the idea of development and self-development of multi-dimensional thinking of pedagogues and students.

-In the modern period of development of educational systems the development of the theory and the improvement of teaching practice of subject-oriented education is becoming more relevant. It allows not only to focus students on understanding their personal significance of multi-dimensional reflective thinking, but also to include mechanisms of promoting and intensifying abilities which are directed at comprehensive creative self-development and creative self-realization of students especially in the design and creative work.

-It is important to have additional development and practical application of a big number of tasks, assignments for organization of creative, project-creative and research activities of students in the educational process in order to systematically activate and intensify multi-dimensional (systemic, creative, critical, reflective) thinking of students.

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