

# Professional thinking as a leadership factor in pedagogical education

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**Abstract** Transformation of pedagogical education and the educational policy of the European Union (EU) encourage innovative pedagogical processes aimed at the training of teachers of the new nature and competences. As a result, the main activity of universities today is the satisfaction of the individual's need for knowledge, which allows them to be a competitive leader and successfully adapt to the modern world. Leadership in education requires general cultural and professional training, an orientation towards self-development and self-improvement. In the current context of rapid obsolescence of knowledge, occupational mobility of leading teachers is determined by personal qualities. An integral personal quality of a leader in education, which stimulates the need for self-improvement, is their professional thinking.

Presently, the concept of "teachers thinking" as a factor of leadership in education is being further developed. We describe its seven main functions that are of special relevance. Our study examined ten problems, the solution of which in university training facilitates to the teachers' formation of the professional thinking. Chemistry teacher as an agent of leadership in education. At the same time, students are introduced to the problem statement as well as analysis of contradictions, and hypotheses, their validation and corroboration in explaining natural-science phenomena.

This study presents the multifunctional and stage-by-stage process outlined above. We develop and present a classification of chemical and pedagogical problematic situations. Moreover, we outline the technique of teaching students of pedagogical faculties the general methods of reasoning during the analysis of the typical, most frequently encountered chemical, as well as pedagogical problematic situations.

## 1 Introduction

In the current context of rapid obsolescence of knowledge, occupational mobility of leading teachers is determined by personal qualities. An integral personal quality of a leader in education which stimulates the need for self-improvement, is their professional thinking. In the present day, there is a need to move towards the ideas of a non-classical, synergistic vision of the world and its phenomena arose and, as a result, the need to develop among the students of pedagogical faculties the mindset of a teacher as a factor of leadership based on the current circumstances in the context of educational transformation.

This paper focuses on the professional thinking as a leadership factor in pedagogical education using the examples of the teachers and lecturers in such field as chemistry. The paper studies the pedagogical prerequisites of a good lecturer and teacher and the problem analysis as well as the problem management that might occur in the everyday professional life of every pedagogical professional.

## 2 Professional thinking of a teacher as a leadership factor

There are many studies dedicated to the development of professional thinking (Kulyutkin 1986; Vilkeev 1997; Kashapov 2000; or Vilkeev 2001). However, according to Andreev (2015), students largely develop so-called “one-sided academic mentality” when “*the result of cognitive activity is most often reached by using one method or approach*” (Andreev 2015). Nevertheless, it becomes apparent that the professional activity of a leading teacher requires a set of methods and approaches (Gafurov and Kalimullin 2015; or Valeeva and Gafurov 2017).

Teacher's thinking is ancestral towards a group of form of thought indicated in literature which are connected with group of professions or a particular profession: mathematical or engineering (Gilmanshin and Gilmanshina 2017; Gilmanshin and Gilmanshina 2016), pedagogical (Gilmanshina et al. 2015), legal, etc. Its peculiarity is revealed in activities and is determined by the problematic situations, content of tasks, solved by a professional at various stages of their work life. In short, it represents a content-related side of teacher's thinking.

Depending on the role of a teacher, as well as on the subject that the teacher lectures in the educational system, the issue of a deeper specialty of teacher's thinking is being solved. Teacher's thinking as a factor of leadership in its object aspect based on the nature of the activity is the most important part of the mechanism of the teaching profession.

This thinking ensures the connection of the principal types of pedagogical activity (e.g. educational, nurturing, organizational-communicative and research). Consequently, in respect to the key property of teacher's activity (studying of a student's identity, motivation, defining goals, selecting content, searching for pedagogical means which are adequate to the goals, self-reflection of the result), teachers' thinking can be viewed as a strategic competence of a sociocultural, humanistic, and value-oriented teacher which stimulates a person's need in leadership and self-improvement. The following understanding of teachers thinking presents an interest for our study

Teacher's thinking is a specific mental activity of teachers-scientists and teachers, in the process of which there is a reflection and creative transformation in their psyche of the phenomena of education and upbringing as social functions, as well as subjective construction of the pedagogical process in accordance with the social goals of education (Vilkeev 1997).

The feature of the teacher's thinking as a factor of leadership is caused by the peculiarities of the functions of this kind of thinking. Performing some functions, the teacher's thinking is practical-situational and intuitive, performing others – research and even theoretical.

The thinking of the teacher of natural science has its own characteristics, structure and ways of its growth, due to the features of the activity of a teacher in the process of teaching a specific school subject and the organization of a logical culture and scientific worldview of students. The feature of the professional activity of a leading teacher, connected with the particularities of a subject, is manifested in their didactic activity – explaining the entity of natural science phenomena, laws, theories with attraction of environmentally-friendly experiments. The value of scientific reasoning in the didactic system of developmental education in the conditions of the new developmental environment and transformation of education is analysed by Gilmanshina et al. (2016a), or Khalikova and Gilmanshina (2017).

## 3 Formation of professional thinking

Creation of professional thinking of the teacher of natural sciences as a factor of a teacher's leadership needs solving the following tasks, studied in great detail by Gilmanshina (2005):

- formation of a formal logical thinking;
- teaching methods of scientific thinking: the procedures for isolating the subject of knowledge, description, explanation;
- methods of modeling, hypothesis, confirmation etc.;
- creation of scientific thinking on the material of fundamental physical and chemical theories and laws, systematic thinking on the basis of studying the systems of chemistry, biology, physics, and by the students;
- formation of qualified research skills and abilities, of the culture of natural science and pedagogical experiment (Gilmanshina et al. 2016b);
- teaching students to transfer psychological and pedagogical theories, categories, principles and laws into particular pedagogical situations in order solve professional tasks;
- development of intuitive creative thinking based on psychological, pedagogical and fundamental natural-science knowledge;
- nurturing dialectical thinking: teaching how to see and understand dialectics of educational process, as well as dialectics of physical, chemical and biological forms of the movement of the matter;

- developing the ability of professional introspection;
- developing students' proficiency in conducting internal dialogue as a premise of intellectual discussion and successful external dialogue with students;
- developing ecology-oriented thinking as an essential component of the formation of ecological culture (Gilmanshina et al. 2018) among the young generation in the current period of aggravation of the environmental situation and a new mentality (Gilmanshina and Gilmanshin 2015) connected with the views on ecologically safe and stable development (Collins 2017).

Solving these tasks with the aim of forming among students enrolled in the “Pedagogical education” field of studies, the teacher’s thinking as a factor of leadership in the university education process is a lengthy process of step-by-step implementation of a number of interrelated intermediate goals. Today, within the framework of the competence approach, an invariant of the system of intermediate goals is the requirement of a gradual transition of mental activity of future teachers from the reproductive level to the level of creative activity, self-development and self-improvement. Such a transition requires students to be familiarized with analysing contradictions and posing problems, proposing hypotheses, substantiating and proving them in explaining natural science phenomena.

This multifunctional and gradual process, described in detail by Gilmanshin and Gilmanshina (2016), involves the gradual use of explanatory, illustrative, problem-based, partially searching (heuristic) and research in the training of undergraduate students of pedagogy.

In this case, as a unit of analysis of teachers thinking as an attribute of leadership of the future teacher of chemistry can be considered quite reasonable allocation of chemical-pedagogical problem situation Gilmanshin and Gilmanshina (2016) have substantiated five types of antilogism that occur in the work of a chemistry teacher in the process of interpretation chemical laws, theories and phenomena. First and foremost, it is a discrepancy of a chemical experiment (a discrepancy between two or several experimental data). Secondly, the discrepancy between experiment and theory (agency and generalization). Thirdly, the discrepancy between the old and the new (less and more complete) theories. Fourth, the discrepancy between two coexisting one-sided theories. Fifth, the discrepancy between objective and subjective agencies in a concrete system in the process of explaining a chemical phenomenon or a chemical and environmental problem (Gilmanshin and Gilmanshina 2016).

Each group of the aforementioned problematic situations which appear in the process of education, is interconnected with the peculiarity of a chemistry teacher in professional activity. During the university preparation of future leading teachers for their professional life, it is important to introduce students to general methods of reasoning when analysing typical, most frequently encountered chemical and pedagogical problematic situations.

Particular attention towards creating among students a leading teacher’s mindset, as noted above, requires conducting problematic lectures in which students become familiar with various techniques for analysing problematic chemistry situations, with the logic of posing pedagogical and chemical problems, as well as with the ways to solve them.

The following types of combinations of teachers’ and students’ methods of work with a gradual increase of students’ unsupervised work are possible in the course of teaching future leading teachers’ scientific explanation in the field of chemistry, for instance:

1. The teacher's use of the explanatory-illustrative method at the level of students' understanding and memorizing in the course of teaching them the ways to solve educational chemical problems.
2. The problematic explanation of the theoretical chemical problems by the teacher, while encouraging students to solve it.
3. The teacher explains the key issues of the topic under study, formulates the theoretical problem. Students independently study the easier secondary aspects of a particular topic with subsequent solution of the problem.
4. The teacher formulates the theoretical problem, introduces the students in general terms to the chemical phenomenon under consideration, indicates literary sources and invites students to familiarize themselves with the task and solve it independently.
5. When studying a particular theoretical chemical problem, the teacher applies an inductive-deductive method of explanation, combining various methods of explanation with various independent (theoretical and experimental) work of students.
6. The teacher formulates the theoretical problem, indicates the types and methods of cognitive activity, contributing to its solution. Students independently solve the problem (theoretically or experimentally), draw conclusions, while the teacher draws conclusions.

Thus, the teacher, employing teamwork, can bring students towards an independent scientific explanation of chemical, physical and biological phenomena - the disclosure of the essence of the facts and laws under study,

based on well-known theoretical knowledge and practical skills, as well as logical explanatory techniques – deductive, inductive and inductive-deductive explanation (Gilmanshina et al., 2015).

Laboratory and practical work are all of great importance in forming the thinking of a leading teacher. Laboratory practice conditions are particularly favourable for the formation and development of natural science concepts, since in this case the substance and its properties, as well as chemical transformations, can be represented in a visual form, easily accessible for perception. In addition, in the laboratory classes students learn about the instruments, experimental equipment and methods of particular experiments, reinforce, deepen and expand the knowledge gained at the lectures, form the ability to perform certain types of professional activity and solve certain types of professional tasks.

Considering the educational chemical experiment as a method of forming and developing scientific concepts with a view of creating a leading teacher's mindset among students, we consider it expedient to adhere to a system that assumes the variability of each laboratory work with the obligatory implementation of a research task that develops intuitive and creative thinking in the organization of laboratory and practical university work. The variability of the experimental part is possible due to the selection of an invariant that combines several particular problems.

Students' laboratory work includes the following steps: the selection of chemical concepts that must be addressed before performing theoretical exercises and experiments; acquaintance with the theoretical material necessary for the performance of laboratory work and the generalized method for solving an experimental problem; familiarization with the exercises for unsupervised work of students, including specially-designed exercises for the development of logical thinking (tasks can be presented in several versions of different degrees of difficulty); performance of a research assignment that develops intuitive and creative thinking; preparation of a report and defence research results. In those cases when, for one reason or another, the experimental fulfilment of a research task is obstructed, students are invited to theoretically substantiate and explain the predicted results of the study.

In the issue of the implementation of the system, not only does the theoretical level of practical training increase, but also the management of the educational process is approaching the formulation of academic research, stimulating the students' need for leadership and self-improvement.

## 4 Conclusions

In a conclusion, let us summarize the main findings and outcomes. The introduction of future natural science teachers to creative mental activity as a factor of leadership in pedagogical education is carried out by means of analysis of discrepancies and the problem statement, hypothesizing, as well as justification and validation of these hypotheses in explaining natural science phenomena and solution complex educational and cognitive problems.

This multifunctional and step-by-step process includes the development of the following leadership skills: analysing and summarizing the experimental data, drawing conclusions; logical explanation of natural science concepts and theories; formulation of hypotheses, speculation on the settlement of the problem, theoretically and experimentally proving hypotheses in order represent a natural science phenomenon; solving complex, methodical, educational and cognitive experimental and calculator natural-science goals on the basis of interdisciplinary connections and implementation of a critical self-assessment of the completion of the task.

Moreover, teaching students the usage of scientific methods, particularly hypotheses, is also gradual and includes describing the essence of the hypothesis as a form of theoretical thinking through examples from the history of science, explaining the essence of the uncovered contradictions; teaching various methods of hypothesizing, the development and proof of these hypotheses; preparation for the formation of students' potential to practice hypotheses in school education.

Overall, the above aspects and conclusions represent just some of the findings of the study of the stages of the development of teachers thinking as a factor of leadership in pedagogical education which is targeted at the undergraduate students under the conditions of the transformation of natural-science education.

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