ATLANTIS PRESS

*Advances in Social Science, Education and Humanities Research, volume 273*

International Conference on Communicative Strategies of Information Society (CSIS 2018)

# *Logical Training in the Information Society*

## *Objectives and structure of the training course*

Vladimir Laluev
Department of Philosophy and Culturology
Siberian Transport University (SGUPS)
Novosibirsk, Russia

Andrey Lesovichenko
Department of Philosophy and Culturology
Siberian Transport University (SGUPS)
Novosibirsk, Russia

Natalya Martisina
Department of Philosophy and Culturology
Siberian Transport University (SGUPS)
Novosibirsk, Russia

***Abstract*—The article contains an analysis of the problems of the logical thinking formation that arise in the information society. The necessity of a practically oriented logic course in the system of modern higher professional education is justified. A program of logic course adapted to the new purposes is proposed.**

***Keywords—application logic; logic teaching; requirements for training; rational-critical thinking***

## I. INTRODUCTION

The ease of access to the most diverse information resources, the ability to quickly obtain virtually any currently required information are the characteristics of the information society, which defining its essence. But there is a flipside of this new reality – the change in the relative complexity of the self-reflection act and the search query: an increasingly frequent attempt to find the necessary readily available information seems to be faster and easier. The sphere of everyday situations, where you need to think, compare, and conclude, is constantly being reduced in the information society due to increasing information support. Resort to information resources is gradually replacing earlier common simple intellectual skills: for example, in recent years people have lost their ability to use road maps and large-scale plans independently, as a result of the distribution of navigation systems that give the result of orientation in the form of step-by-step instructions. The growth of this trend ultimately threatens the destruction of the very nature of creative thinking, which requires a flexible and non-stereotypical application of the available data. Meanwhile, one of the main requirements for the training of a qualified specialist in the field of technology and management nowadays is precisely the formation of the ability to intelligently apply standard techniques, but also to search for new solutions in cases where these techniques do not work.

One of the ways to break the common habit to replace an independent search for a solution by stereotypical moves is the development of educational disciplines, specifically aimed at developing rational-critical thinking. Such training courses can be created on the basis of the disciplines that traditionally used for logical and methodological specialists training. At the same time, such courses should have a strict practical orientation and training nature. The authors have successful experience in adapting the discipline of logic to the modern demands of higher education and in this article propose the concept and program of such a course.

Similar tasks challenge various humanities. We have already interpreted the approach to the courses of philosophy and cultural studies from common positions [1, 2, 3]. However, rethinking of the course of logic is may be even more significant, as it gives a stricter cognitive operations matrix than the above-mentioned, and provides the best conditions for the independent thinking mechanisms formation among students. We recall that G. Hegel, referring to the priorities of the initial study of philosophy, considered it necessary to start from the fundamentals of logic: “The teaching could be extended to the doctrine of the concept, judgment, inference and their types, then the doctrine of the definition, division, evidence and scientific method” [4, p. 570].

## II. THEORETICAL BASIS

The proposed concept is based primarily on the idea of the differences between information and knowledge and, consequently, the differences between the information society and the knowledge society. If information is a set of structured and organized data, then knowledge is data, containing the means to interpret and understand the direction of use. Information turns into knowledge after answering the questions “And what does this mean?”, “And what follows from this?” “Why do we need this information?” [5]. Knowledge is the aggregate of representations arising from the transformation of information, which serves as the basis of activity. As M. Zeleny writes: “Human knowledge does not contain any static descriptions or “sets” of facts... What do they mean when say that a person knows or owns the knowledge? Implicitly, that he is capable of coordinated

actions in order to achieve certain goals or solve problems" [6].

The concept of the information society records the information transformation into a key source of social action. The main information society characteristics are: the use of information technologies in all spheres of public life – industry, social management, culture and life; a fundamental increase in the mass of information circulating in society; implementation of any local actions with access to global information resources; the formation of appropriate standards of behavior, norms and values. The education system in the information society is designed to teach people to work with information: to navigate quantities of information, quickly master new layers of data and new subject areas, search for new information, choose the needed one, concurrently perceive a range of informational messages, and finally, quickly shift one set of acquired information data to others.

The society of knowledge concept in this context records more than the globalization of information processes. It means a society where better understanding of the nature of occurring processes, allowing making informed decisions, appears to be the basis of social action. In such a society, scientific knowledge is considered not as a description of reality, but as a factor of the social ability to solve specific problems, a source of innovation [7]. In such society a professional should be able to find theoretical information or examples appropriate to the situation quickly, but also understand the general logic of the processes in the sphere he deals with, the purposes and methods of modifying existing ideas with reference to specific conditions and problems, the practical importance of theoretical provisions. The education system in the knowledge society is designed to "not only provide professional knowledge, but also to create ... learning models that would allow students to more broadly understand economics, entrepreneurship, global perspectives and the need for appropriate behavior" [8].

One of the disciplines of a general (non-core) nature, focused on the formation of the intellectual skills of the knowledge society, is logic. The subject of logic study is thinking, in a narrow sense – it is the mental operations technology. The ability to analyze new data, to structure problems, propose and evaluate possible solutions, draw conclusions – these are traditionally distinguished components of the individual logical culture; under modern conditions, they became the skills, necessary to a specialist to master new forms of his professional activity on the basis of a growing body of knowledge. I.Griftsova notes, "The relevant task for modern logic is an understanding of our own practical role" [9]; we believe, the practical role of logic can be defined in this way.

Theoretically, it is assumed that a set of logical competences is formed in a person during the educational process in the context of subject mastery, in the background, since working with the content material of any subject requires (and hence exercises) basically the same logical skills. At the same time, practice shows that with such reliance on the automatic emergence of the necessary skills, the students' logical competence, firstly, demonstrates a considerable variation in level, and secondly, it remains mostly to be low. Students, often even at senior courses, experience difficulties with even relatively simple cognitive actions, such as analyzing a given question (need to understand what the problem is, determine the direction of the answer, even if they have the necessary information for this) ; emphasizing main thesis and arguments, assessment of the sufficiency of the data used to draw conclusions, even in the finished discourse proposed for consideration; building a scheme of the work they must to do, even if the character and theme of the student's work are marked; a search among the arguments about the meaning of some kind of a formulation that can be used as its working definition, etc. In other words, in the most diverse educational and, what especially striking, practical situations, the most difficult seems the informational adaptation, the application of general knowledge for the specific problems solution with the appropriate interpretation of general provisions. Moreover, a significant difficulty for the student has the level of work with scientific terminology, necessary for professional thinking, which requires that very strictly defined meaning to every term and that the term should be used within the established context precisely in the assigned meaning without slipping to other interpretations. As a rule, the ability to identify discrepancies and contradictions in the available information is poorly developed – students are more often tend to an eclectic combination of data, obtained from various sources, even when it comes to competing concepts of "big science". Even more uncommon ability – is to construct a generalization independently, a hypothesis based on the available facts, to identify the way of checking this hypothesis and how the verification process itself should be controlled – problems with the logical competence of this level have been already revealed at the level of the first experiments of scientific work. To form the specialist's readiness for professional actions of this kind, it seems necessary to specifically allocate for consideration the mentioned and other technologies of transforming information into knowledge as universal techniques, relatively independent of content, and to consider them in their pure form, from the point of view of general rules for their implementation, within separate discipline - logic.

The best way to teach logic, which will allow overcoming stated objective in the multy-level training system for specialists, appears to be the combination of a short course at the beginning of the education and extensive training, associated with the methodology of subject at MS levels. Then we'll try to demonstrate the main topics, which should be included in this transformed course and what it have to contain, to define the practical skills, which should be mastered at the end of logic studying.

## III. RESULTS

### *A. Concept of the logical form of thought*

As any other academic discipline, the study of logic begins with the definition of purposes, objectives and the subject of the study. The main skill formed during this section study is the ability to separate the actual content of the thinking and its logical organization, relatively independently evaluate the

actual and logical correctness. At the baccalaureate level students are working out the following tasks: understanding the essence of the logical form of thought, the ability to identify this form in an abstract form, establish the essence of the logical operation implemented in the reasoning and compare the form of the proposed reasoning with the standard requirements for the logical form of the operation in reasoning logical units. At the level of the magistracy, special consideration is given to methods of identifying the logical form of thought, the difference in descriptive and logical terms, the system of formal recording of the structure of thinking and the evaluation of this structure in a formalized form. The exercises on this topic of the following main types are proposed: to reveal the form of judgments and conclusions in the examples given by the teacher; write in a partial (for bachelors) or fully (for masters) formalized form; to evaluate the connections and correlations of terms fixed in judgments and conclusions; determine the level of certainty of ratio, fixed in the conclusions; independently make both correct and incorrect thinking with the content with the proposed logical form and evaluate the correctness and reliability of the form itself.

### *B. Work with terms*

In logic, the concept as the mental designation of an object, a phenomenon, a property, a relationship is considered as the basic mental unit. The main skill formed in the study of this section is the ability to accurately choose concepts to express any idea, use concepts in accordance with their theoretical content, fixed in science and culture. At the baccalaureate level, students learn the very principle of representing reality in concepts and pay attention to the variability of this process. The following tasks are also carried out at this level: understanding of the meaning of formulations in the scientific text, which explain the content of the used terms, and understanding of the differences between the exact wording, revealing the meaning of the term and separating the class of described objects, and expressions that only look like definitions; ability to follow the strict scientific definition of a term in a professional text, i.e. use this term only in the indicated sense and do not add another interpretations; understanding of the inadmissibility of mixing scientific and professional terminology with the everyday interpretation of concepts and the ability to see the features of the professional terminology use. At the level of the magistracy, the logical requirements for the term, various methods of determination are specifically considered, analysis and comparison of various defining formulations with assessment of their quality are carried out; practicing the technique of comparing different variants of the definition and independent formulation of the working definition; the procedure for identifying the core concepts for a specific text is considered. The exercises on this topic of the following main types are proposed: to highlight components (genus and species difference) in the structure of the definition; evaluate the logical correctness of the definition; choose the best of the proposed definitions of the same term; formulate a brief definition on the basis of the detailed description of the term, which would reflect the nature and specifics of the phenomenon; while completing the previous task in the format of group discussion, listen to the definition developed by another group and answer the control question on the content of the term (in case of difficulty, point out the shortcomings of the definition).

### *C. Logical division*

The logic specifically considers the procedure of structuring an object (class) according to the chosen basis. This procedure has got a number of modifications applied in the form of independent intellectual actions - designing an algorithm and a plan, developing a site, formation of a typology and classification, etc. The main skill obtained during this section study is the ability to choose the best way to divide the group of objects into subgroups so that all categories are presented and each element has its own place in the overall structure. At the baccalaureate level, students master the basic principle of learning task accomplishment through structuring and the methodology for dividing a learning task into its component parts and determining the sequence of actions. The skill of logical division is developed and implies to the task of drawing up a plan, and students master the logical techniques of drawing up a plan, when write an essay or a course work. Also at this level, students must understand the logical principles of building typologies and classifications and the scientific significance of these forms of thinking, logically analyze the classifications used in the disciplines according to their specialty, learn to identify the information that the classification contains. At the level of the magistracy, students specifically address to various types of plans applicable in educational, scientific and practical activities. They master how to make a work plan on a given topic and how to transform it to a detailed plan, plan – work scheme, theses of a report or presentation; they examine the logic of developing the site, determining its headings, form an understanding of the logical backgrounds of the site with easy navigation; study the methods of construction and analysis of typologies and classifications; learn the examples of practical applications of logical division operations (for example, seating arrangements with regard to the audience composition). The exercises on this topic of the following main types are proposed: search for the base and division of the given concepts; identification of the basis and stages of classifications implementation on the proposed examples; correction of errors made in the proposed examples of division; drawing up a plan for a given topic.

### *D. Question and answer*

In logic, the question and answer are interpreted as information exchange tools that perform the function of requesting and providing the required information. Interrogative logic is devoted to the conditions of a logically correct question constructing and a relevant answer. The main skill formed in this section study is the ability to formulate questions accurately and build answers that exactly correspond to the topic. At the baccalaureate level, students learn the principles of logical assessment of the quality of questions and answers in terms of their information functions, contrary to the etiquette characteristics of the question-response dialogue; master the technique of analyzing the question structure and identifying its premises, the ability to extract information from the question, constructing the answer. Special attention is paid

to the categories of questions, which formulation complicate the correct answer and the behavior when such questions arise. Conditions for the relevant answer are also determined, and the ability to give an answer that is as close as possible to the question is trained, and understanding whether the answer gives a real increase in knowledge compared to the question is developed. At the level of the magistracy, the importance of correct questioning in terms of the scientific knowledge development and pragmatic is discussed; the types of question and their different meaning in knowledge and practice are examined; the task and the issue as a form of thinking, the conditions for the correct solution of the problem and the correct formulation of the problem are specially analyzed. The exercises on this topic of the following main types are proposed: to reveal the positive question's prerequisite, to identify this prerequisite modification in the changes matters of the question process; allocate the types of question on various parameters; detect incorrect formulation of the question. Also on this topic a business game dedicated to the use of creative thinking techniques in solving logical problems and puzzles can be held.

### *E. Logical consistency*

Logic considers a consistency as an indispensable condition for the correctness of reasoning and is governed by the laws of consistency and the third exclusion. The main skill formed in this section study is the ability to identify and adequately assess the contradictions in the arguments, including hidden ones. At the baccalaureate level, students learn the concept of logical contradiction and must understand the importance of identifying contradictions within a message to assess its truth, as well as master the basic techniques of identifying contradictions and the third exclusion relationship between judgments. At the level of the magistracy, the correlation between formal-logical and dialectical contradictions is specially discussed, the meaning of the "third is not given" correlation in defining solutions, methods for resolving contradictions and using the third exclusion relations in the decisions making process. The exercises on this topic of the following main types are proposed: to understand whether there is a relation between a given judgment and a relation between the third exclusion; find a logical contradiction in the proposed text.

### *F. Logical conclusion*

Logic has an extensive developed system for both the general principles of logical conclusions and various schemes of strict and presumptive conclusions. The main skill that is formed in this section studying is the understanding of the difference between real necessary derivation from the available data and the assumption based on them, the ability to distinguish between necessary and probabilistic conclusions and build either one or the other. At the baccalaureate level, students study the structure and basic schemes of the main types of syllogisms, methods of building a hypothesis based on incomplete induction and analogy, ways to avoid the typical mistakes occurring in making conclusions. At the master's level, students conduct the general analysis of the movement from the source data to the conclusion in thinking process, and train the construction of syllogisms and the identification of assumptions that do not allow a rigorous conclusion; the concept of a hypothesis, the place of hypotheses in science and practice is formed; the ways of the analogy appliance in scientific knowledge and technical creativity, special types of induction, the method of abduction are discussed. The correlation between basic patterns of establishing cause-effect relationships and mathematical methods for processing observation and experiment data is being studied. Students learn the formulation of general scientific requirements for the hypothesis and the conditions of its validity. They also train to make hypotheses in situations where the source information does not provide a rigorous conclusion. The exercises on this topic of the following main types are proposed: determine whether the conclusion from a given set of prerequisites is possible; if it is possible to make a rigorous conclusion, otherwise justify the impossibility of unambiguous conclusion; determine which hypothesis construction method is implemented in the proposed reasoning; formulate a hypothesis based on the given information. Hypothesis training is also being conducted on this topic using brainstorming technology.

### *G. Justification and retraction*

The logic studies only one of the sides of the argumentation of the propositions made, but this is the leading one, as logic focuses on the rational component of the argumentation: the techniques of emotional and suggestive influence are naturally qualified as non-logical. The main skill that is learned from this section is the understanding and implementation of the coercive power of logical justification and retraction. At the baccalaureate level students examines the ratio of justification and evidence, evidence and retraction; the typology of incorrect arguments is proposed, and the ability to detect them and, accordingly, assess the strength of the evidence is trained. At the level of the magistracy, general strategies for constructing evidence and retractions, various substantiation methods are considered, the degree of their acceptability in science and practice is discussed. Students train the ability to identify the structure of argumentation in the texts. They learn the tactics of the dispute, the correct methods of argumentation, behavioral strategy in situations of incorrect techniques implementation. There is also a training the debates conduction. The exercises on this topic of the following main types are proposed: the definition of a thesis and arguments in a given argument, the formulation of an antithesis and counter-arguments, the search for errors in the proposed arguments. There is also a program discussion held on this topic. Students in subgroups preliminarily prepare some arguments for alternative positions in the proposed topics for discussion, and the results are summed up taking into account changes in the audience's opinion after public discussion.

## IV. DISCUSSION

The proposed program of a training course of logic is significantly differs from the traditional organization of this course. First, it does not include some of the descriptive material, which logic, as always happens with disciplines with a long history, has gained during its development. These are

detailed classifications of concepts, judgments, definitions, descriptions of all structural units of thought, syllogism figures, etc. This the traditional teaching of logic with its emphasis on this substantive component, turns logic into another discipline giving the student, in addition to all other subjects, a certain amount of information that he must learn and subsequently reproduce. We believe that in accordance with the purpose of study indicated at the beginning of this article, such logic teaching simply loses its meaning. If we consider logic as a tool for turning information into knowledge, so it should be taught as an operational discipline aimed at training the skills of intellectual activity, and the main emphasis should be made on the practical application of the considered intelligent techniques.

Our system of teaching logic to a certain extent goes against the main tendency of its development as a science. Modern logic as the field of scientific knowledge is intensively formalized, and even its traditional sections are appears in the logical calculus systems form. But, being a high-level theory, such formalized logic gives little to a student from the point of view of practical application of logical knowledge to optimize ordinary logical operations that he performs in educational and scientific work. Relatively speaking, it is more important for a student to understand the ways of the necessary components of the abstract determination and keywords identification in the first handwritten abstracts than to learn how to calculate first-order predicates as the art of solving another type of problem that is not related to his daily work. And assuming once again that the basic level of logic study should not be focused on a high level of its theoretical abstractions, but on the analysis and practical development of techniques for implementing the most common cognitive actions, we believe that this material should be in the system of specialized training in the field of cognitive disciplines and not in the basic and massively taught course logic.

Thus, the proposed system of logical training is based on a rigid selection of material aimed at the most consistent implementation of a practice-oriented course. On the concept of integrating logic into the system of basic specialist training, see also [10].

## *References*

[1] V.Y. Laluev and A.M. Lesovichenko, “The spiritual and moral potential of humanities in modern higher education institutions,” Analytics of Culturology, No. 1 (13), 2009.

[2] V.Y. Laluev and A.M. Lesovichenko, “The spiritual and moral potential of the course of philosophy”, In Formation of innovative thinking and professional responsibility in the university, Novosibirsk: Siberian Transport University, pp. 184-187, 2009.

[3] A.M. Lesovichenko and L.L. Nguyen, ”On the educational resources of the course of cultural studies at the university,” Formation of innovative thinking and professional responsibility at the university, Novosibirsk: Siberian Transport University, pp. 209-212, 2009.

[4] G.V.F. Hegelm, “On the teaching of philosophy in gymnasiums,” In Works of different years by G.V.F. Hegel, vol. 1, Moscow: Mysl, 1972. pp. 565-574.

[5] N.I. Martishina, “Knowledge as a value in the education system: risks of the information society,” Siberian teacher, Novosibirsk, No. 5, pp. 60-64, 2016.

[6] M. Zeleny, “Knowledge vs. Information,” Elitarium 2.0, 2018. Retrieved from: http://www.elitarium.ru/znanie_protiv_informacii/.

[7] I.V. Chernikova and A. A. Kartashova, “Formation of a new educational paradigm in connection with the transition from the information society to the knowledge society,” Bulletin of Tomsk State University, No. 389, pp. 92–97, 2014.

[8] V.M. Prikhodko and A.N. Soloviev, “How to be a modern engineering education?”, Higher Education in Russia, No. 3, pp. 45-56, 2015.

[9] “The cultural and historical consciousness of humanities scholars in the context of current trends in science,” Questions of Philosophy, No. 11, pp. 5-37, 2011.

[10] N.I. Martishina, “The basic level of knowledge as an object of rationing in the education system”, Higher education in Russia, No. 3. pp. 98-104, 2015.