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<https://periodicos.ufpa.br/index.php/revistamargens/article/view/14698>

<http://dx.doi.org/10.18542/rmi.v17i29.14698>

Margens: Revista Interdisciplinar | e-ISSN:1982-5374 | V. 17 | N. 29 | Jul-Dez, 2023, pp. 239-255

Submissão: 15/05/2023 | Aprovação: 01/011/2023



THE STRUCTURE OF LEARNING QUESTIONS FOR THE PURPOSES OF GROWING STUDENTS' COGNITIVE META-COMPETENCES

a estrutura das questões de aprendizagem PARA FINS DE CRESCIMENTO DE META-COMPETÊNCIAS COGNITIVAS DOS ALUNOS

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Abstract: In the article, based on the meta-competence and institutional-culturological approaches developed in the school of general methodology of conceptual constructs of system-thought-activity modeling, the goal is to develop technological solutions for the formation of students' cognitive meta-competences. In educational activities, a hierarchy of educational processes is defined: the main one is the creation of educational texts by students, the auxiliary one is work with literature, the service one is classroom activity. Based on the structure of educational processes, three roles of a teacher are defined: an assistant in mastering a professional language, a source of professional opinion, and a model of professional ethics. The role of classroom taking notes and asking the teacher of educational questions in the formation of cognitive meta-competences is shown. The differences between educational and non-educational questions and the structure of educational questions are given: for understanding, task, problematic, systemic and causal. The proposed technology of educational activity allows it to be applied in the formation of students' cognitive metacompetences, in the design and evaluation of educational literature, the creation of intelligent systems for the design of educational activities and the assessment of students' cognitive metacompetences.

Keywords: Meta-competence. Cognitive abilities. System-thought-activity. Modeling. Institutional-culturological approach.

Resumo: No artigo, com base nas abordagens de metacompetência e institucional-culturoológica desenvolvidas na escola de metodologia geral de construções conceituais de modelagem sistema-pensamento-atividade, o objetivo é desenvolver soluções tecnológicas para a formação de metacompetências cognitivas dos alunos. Nas atividades educativas é definida uma hierarquia de processos educativos: o principal é a criação de textos educativos pelos alunos, o auxiliar é o trabalho com literatura, o de serviço é a atividade presencial. Com base na estrutura dos processos educativos, são definidos três papéis do professor: auxiliar no domínio da linguagem profissional, fonte de opinião profissional e modelo de ética profissional. É mostrado o papel das anotações em sala de aula e das perguntas educacionais ao professor na formação de metacompetências cognitivas. São apresentadas as diferenças entre questões educacionais e não educacionais e a estrutura das questões educacionais: para compreensão, tarefa, problemática, sistêmica e causal. A tecnologia de atividade educativa proposta permite a sua aplicação na formação das metacompetências cognitivas dos alunos, na concepção e avaliação da literatura educacional, na criação de sistemas inteligentes para a concepção de atividades educativas e na avaliação das metacompetências cognitivas dos alunos.

Palavras-chave: Metacompetência. Habilidades cognitivas. Atividade de pensamento do sistema. Modelagem. Abordagem institucional-culturalológica;

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INTRODUCTION

A meta-competence-based approach is necessary at all levels of education, in which the main abilities formed in students will be: cognitive, communicative, coordination, and leadership abilities. The essence of the meta-competence approach is the transition from subject education to methodological education, which means that the main subject of study is not knowledge about the subject, but knowledge about how to work with this knowledge (Savelyev, 2011, 2014, 2015a, 2015i; Savelyev & Savelyeva, 2015; Savelyev, Savelyeva, Pushina, Gruzdeva & Savchenko, 2021; Savelyev, Savelyeva & Savchenko, 2022). Among such cognitive metacompetences, first of all, it is necessary to name the ability to carry out cognitive processes of educational and professional activities: primary thinking, problem solving, problem solving, systemic and object thinking.

The meta-competency-based approach contradicts the ideas of Western multicultural globalism in general and the global universalization of education in particular. metacompetences ensure the assimilation of the specifics of local cultures, due to their general cultural orientation, contribute to the traditionalization of education, and do not serve the tasks of training qualified consumers and specialists in cashing out any idea. The meta-competence-based approach requires a fundamentally different idea of multiculturalism - traditionalist, which provides the opportunity for the development of each culture from societal values to scientific concepts and further to institutions and strategies. This task corresponds to the institutional and cultural approach to the design of knowledge systems (Savelyev, 1999, 2015a, 2015b, 2015c, 2019a, 2019b; Popov, 2015; Tatarkin, 2016), conformist view of political and economic development (Savelyev, 2015a, 2015e, 2015f, Tatarkin, 2016; Savelyev, Polyakov & Savchenko, 2020), which reveals the patterns of implementation of any culture, especially socio-economic institutions (Savelyev, 2015a, 2015f, 2015g, 2015h, 2016a, 2016b, 2019a; Popov, 2015). These patterns have been confirmed econometrically (Savelyev, 2020a) in the course of macroeconomic studies (Savelyev, Pushina & Savchenko, 2020; Savelyev, Pushina and Bryndin, 2021; Savelyev, Golovastov, Golovastova, Savchenko and Galiakhmetov, 2021; Savelyev, Kozyrev, Perevedentsev, Savchenko, Koretsky, & Polyakov, 2021), microeconomic modeling (Savelyev, 2020b; Savelyev, Savchenko, Koretsky & Koshcheeva, 2022) transactions, organizations (Savelyev, 2015a, 2015g, 2015h, 2016a, 2016b, 2016c) and business processes (Savelyev, 2015a, Polyakov, Savelyev, Perevedentsev, Titova & Galiakhmetova,

2020; Polyakov, Savchenko, Alekseeva, Panteleeva & Savelyev, 2020).

Similarity of the methodological foundations of the competency-based and meta-subject approaches (Asmolov, 2008; Gromyko, 2010-2011; Gromyko, 2001; Khutorskoy, 2012) contributed to the fact that meta-subject technologies and the categorical apparatus of the meta-subject approach are becoming more widespread in higher education.

There are a number of methodological directions in the interpretation of the key concepts of the metasubject approach. As a basis for the formation of meta-subject learning outcomes, the formation of universal learning activities that ensure the assimilation of inter-subject concepts based on mastering the ability to independently replenish knowledge (the ability to learn) is considered. Yu. V. Gromyko and the followers of the scientific school of thought-activity pedagogy developed the concept of independent meta-subjects (“Knowledge”, “Task”, “Problem”, “Sign”, “Situation”, “Meaning”, etc.), within which students learn techniques formal logic through generalizations and schematization. This approach is designed to solve the problem of disunity of scientific knowledge within different disciplines. A.V. Khutorskoy sees the essence of the meta-subject content of education in the student's self-realization. Metasubjects in the scientific school of A.V. Khutorsky are built around fundamental educational objects by highlighting meta-subject meanings and providing meta-subject activity, the result of which is productive personal results.

Meta-subject competencies are often identified with "meta-professional personality traits", "professional meta-competences", "supra-professional competencies". In foreign studies, the term "meta-competencies" (meta-competencies), as well as "soft skills" or soft skills (Heckman & Kauts, 2012). The sphere of metacompetences includes “management skills” and “leadership metacompetences”, “cognitive metacompetence”, “motivational metacompetence”, etc. (Mathews, 2013).

According to the data presented in the dissertation research by MT Morpurgo, the competence model of a modern specialist includes a whole range of over-professional metacompetences, such as: communication skills, teamwork, persuasion, ability to "see a wide context", the ability to innovate, willingness to solve problems, analytical and critical thinking, creativity, willingness to take risks, learning, reflection, ethnic tolerance, etc. (Morpurgo, 2015).

MATERIALS AND METHODS

In psychology, there are various classifications of cognitive abilities. The domestic school

of general methodology (Anisimov, 1989, 1991a, 1991b, 1999, 2001a, 2001b, 2002a, 2002b) as a result of the development of system-thought-activity modeling, determined the following levels of complexity of thinking:

- primary thinking - the search for a ready answer;
- problem solving - choosing a solution algorithm and applying it to the available data;
- problem solving - development of a new algorithm;
- systems thinking - understanding the place of each algorithm in some interconnected integrity;
- object thinking is the ability to meet requirements regardless of external influences.

We applied this conceptual construct to design pedagogical tools that form cognitive meta-competences.

The purpose of the study: to design pedagogical tools for the formation of cognitive meta-competences. Research objectives: to determine the tools for the formation of cognitive meta-competencies for each level of thinking. Research method: system-thought-activity modeling.

RESULTS

Meta-competence methodology says that in classes and classrooms, students should first of all not take notes on what they heard, but ask learning questions to the teacher and other students. The ability to formulate questions refers to meta-subject cognitive abilities. Unfortunately, many teachers do not pay due attention to this most important metasubject aspect of learning.

The meta-competence-based approach assumes that the student's activity procedurally consists in three processes:

- Independent creation of educational texts (oral and written) is the main process;
- The study of literature is an auxiliary process that is implemented when the student has difficulties during the implementation of the main one;
- Communication with trainers is a service of the auxiliary process, which is called upon when there are difficulties in the auxiliary process.

From this point of view, the most important meta-competence is the formation of skills in working with text. At the same time, it is necessary to understand that there are three types of educational literature of a professional level:

- Textbooks for technical schools, colleges, vocational schools and undergraduate

studies, where some algorithm of professional activity is given;

- Textbooks for applied universities with several algorithms of professional activity and criteria for their selection;
- Textbooks for theoretical universities with the logic of knowledge development.

The same hierarchy is observed in secondary education: basic, profile and olympiad level. The basic and technical school level is based on primary and task thinking, the specialized and applied university level is based on task and problematic, sometimes systemic thinking, the Olympiad and theoretical level is based on problematic, systemic and causal thinking. Textbooks, by virtue of their purpose, are eclectic and make it possible to form, at most, only the rudiments of systemic thinking. For the actual mastering of a professional language, it is necessary to work with auxiliary educational literature.

Auxiliary educational literature includes:

- Dictionaries and reference books ;
- Scientific texts (journals, monographs, collections);
- Applied professional texts (methods, public and local norms);
- Methodological Texts .

It should be borne in mind that dictionaries and reference books usually reflect the point of view of a single scientific school and definitely do not contain the latest scientific results. In fact, they reflect the prevailing stereotype of a certain professional community. A more or less real picture of reality arises in the mind of the student only when working with scientific and applied professional texts. Methodological texts make it possible to consolidate the rudiments of systemic thinking and technologize the causal. Methods for working with text are presented in Table 1.

Table 1. Methods of working with text

Methods	Description of the method
Conceptual-categorical research	Search for words in dictionaries or other sources, their categorical relationships with adjacent, more abstract and more specific concepts.
note-taking	A short note of the source.
Referencing	Brief information from sources on the topic.
Comparative analysis	Identification of common and different in sources, typology.
Abstracts	A brief summary of the main ideas.
report, report	An essential message on the issue based on sources.
Review	Concentrated information from a large number of sources on a topic or period.
Anthology	Collection of texts of a small volume on certain grounds.
Reader	A collection of the most important texts for study in a particular discipline.

Source: Compiled by the authors.

It should be taken into account that the learning elements have the following ordinal quantitative ratios (see Table 2). Proceeding from this, only a certain tolerable knowledge of several professional languages can be the real highest level of education.

Table 2. What can be learned at the university

Learning element	Quantitative characteristics
Professional situations, norms	trillions
Techniques	Billions
Methods	Millions
theories	thousands
Professional languages	Dozens

Source: Compiled by the authors.

In this situation, the activity of the teacher is to create conditions for the self-development of the student, because You can't teach anything, you can only learn. Learning is the activity of the student, not the teacher. Therefore, in this model, three roles of the teacher can be found:

- An assistant in mastering a professional language through educational communication - here, obviously, only interactive teaching methods work;
- The source of the opinion of a professional about the knowledge and professional abilities received by the student;
- Sample of professional ethics (professional values).

Based on these role relationships, classroom lessons should be based on independent (without dictation!) Recording the results of communication with the teacher. When a student writes, three types of memory work: auditory, motor and visual. But in order to write meaningfully, the student needs to ask questions about their learning difficulties. When a student formulates a training question, he is forced to think two thoughts:

- The question itself;
- Hypothesis to answer your question.

All this significantly increases the efficiency of spending study time and the quality of mastering the material. In this regard, it is necessary to formulate the requirements for the educational question (see Table 3).

Table 3. How to ask questions to the teacher

The following are not educational questions for erudition:	Beginning of the study question:
What? Where? When? How? Which? etc.	“In the course of training, I learned (the minute of the lecture recording, the number of the slide, the Internet link to the page of the textbook, manual, article, monograph, reporter's message, factual data is indicated) that ...”; Further, your version of the acquired knowledge is presented and a question is formulated.

Source: Compiled by the authors.

The types of training questions are presented in Table 4.

Table 4. Types of training questions

Question type	Acquired meta-competencies
For understanding task	Orientation skill in the knowledge system Ability to independently set and solve professional problems
Problem	The ability to find discrepancies between knowledge and reality or in knowledge itself, as well as new ways of solving problems
Systemic	Knowledge of relationships between elements of professional knowledge
Causal	Research Skill

Source: Compiled by the authors.

An example of the structure of the simplest training questions - comprehension questions is presented in Table 5.

Table 5. Comprehension questions

Question Sample	Question Results
"Did I understand correctly that..." The following is your version of the acquired knowledge regarding some situation or practical activity, or the knowledge being studied.	Your understanding may be: <ul style="list-style-type: none"> • or specification of your new knowledge; <ul style="list-style-type: none"> • or their abstraction; • or by comparing them with previously obtained ones.

Source: Compiled by the authors.

A sample structure of task questions - the basics of any training are presented in Table 6.

Table 6. Task questions

Question Sample	Question Results
"Based on what I learned, I decided that..."	The following is your version of a solution to a problem: <ul style="list-style-type: none"> • or applied ; • or theoretical . Asking about the correctness of her decision

Source: Compiled by the authors.

An example of the structure of problematic issues - the compulsory level of specialized secondary and higher education - is presented in Table 7.

Table 7. Issues of concern

Question Sample	Question Results
"Comparing this knowledge with others, I found..."	The following is the discrepancy you identified: <ul style="list-style-type: none"> • or between two theoretical opinions; • or between knowledge and practical situation. If the following is your solution to this problem, then the quality of the question is still improving.

Source: Compiled by the authors.

An example of the structure of systemic issues - an increased level of competitiveness of a future professional - is presented in Table 8.

Table 8. System issues

Question Sample	Question Results
In a system question, you compare some knowledge system with another knowledge system, fixing their inconsistencies with each other:	Also welcome here: <ul style="list-style-type: none"> • or your solution to this systemic inconsistency; • or your criteria - based attachment to one of the

or in the criteria for constructing these systems; or as part of system elements; or some phenomena from real life.	identified system views.
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Source: Compiled by the authors.

An example of the structure of causal questions - the basis of scientific activity - is presented in Table 9.

Table 9. Causal questions

Question Sample	Question Results
In a causal question, you compare some sequence of proofs of the truth of the acquired knowledge with another sequence of proofs, fixing their inconsistency with each other: or in the criteria of proof of the findings; or as part of the evidence itself, taken from real life (data gathering).	Also welcome here: <ul style="list-style-type: none"> • or your solution to this causal inconsistency; • or your criteria - based attachment to one of the identified causal evidence.

Source: Compiled by the authors.

DISCUSSION

Certain aspects of the considered problem of the formation of meta-competences are reflected in the following modern studies.

Various points of view on the concept of "methodological culture" that have taken place in pedagogy from the middle of the last century to the present are presented in the work (Ibragimov, Vasiliev, 2019). It also indicates that one of the most important means of improving the quality of professional training of undergraduates at the university should be research work as a way of forming the methodological culture of students.

The logic of organizing the professional and personal development of bachelors based on the effective formation of their methodological culture is shown in the work (Khodusov, Khodusov, Zhabskiy, 2020).

The Russian model of a manager as a transforming leader is based on the dependence of the formation of an organizational type of leadership on both continental cultural traditions and the specifics of the ethno-national culture of the organization (Stegnii, Kurbatova, Vnutskikh, Antipyev, Viatkina, Kurbatova, 2018).

A review of Bitsilli's works (Shchedrina, 2020) points to the particular relevance of the methodological strategy of the philosopher and historian, namely the interdisciplinary nature of his research.

The influence of information culture on the perception of information technology by a manager is explained by differences in perception in different cultures: a national information culture provides the necessary methodological support for the contextualization of cross-cultural research (Chen, Zhang & Li, 2019). A conceptual generalization of these differences

can be found in (Lewis, 2001, 2006)

The school of general methodology was formed in the Moscow Logic Circle (MLK) created by A.A. Zinoviev (Zinoviev, 2000a, 2000b, 2000c, 2000d, 2002, 2003, 2005) and took shape in the Moscow Methodological Circle (MMC) under the leadership of G.P. Shchedrovitsky (2005, 2006). Among the most famous followers of which can be called the Moscow Methodological and Pedagogical Circle (MMPC) under the leadership of Professor O.S. Anisimov (1989), who is engaged in new technologies for teaching teachers and managers, and the school of a professor at the University of California at Irvine V.A. Lefebvre - Russian and American psychologist and mathematician, creator of the concept of reflexive games and "calculable psychophenomenology " (Lefebvre, 1992, 1998).

The following works are devoted to the problems of managers ' metacompetences. Management uses intuition and life experience to a greater extent, theoretical knowledge and skills remain practically unclaimed or require adaptation to the specific needs of the company and corporate culture (Inyasevsky, 2008; Shemyatikhina, 2009; Tarasenko, 2018; Abramov, 2005). The requirements for competencies of innovative behavior are imposed on the level of training of managers (Shemyatikhina, 2011; Pimenova, 2020). In the context of employers' ongoing claims to the quality of training, it is important to learn how to shape not only the competitiveness of the future manager, but also his competitive sustainability in the context of the dynamic development of the labor market (Perevozova, 2015a). The competitiveness of a manager in the conditions of rapid obsolescence of the acquired knowledge is determined by the ability to find the necessary information (Proshkina, 2013; Lesovskaya, 2019). Among the professional qualities of a manager, the practical-psychological orientation of the mind, a sense of proportion in relationships with people, the ability to energize, exactingness and criticality stand out (Umansky, 2001), as well as the need to form the intellectual potential of future management personnel (Kiselev, 2019). The availability of technical education is considered as a factor in ensuring the competitive sustainability of managers Byuraeva, 2010). Mathematical competence: the ability to correctly formulate a problem, identify and evaluate the most significant data, choose a method for solving a problem, anticipate the desired result before the decision is made - at the heart of managerial competencies (Loginova, 2017). Management education requires multidisciplinary, increased cooperation between scientific disciplines and management practices (Shemyatikhina, 2011). The diffusion of humanitarian, natural and technical knowledge requires the integration of various competencies within one complex discipline (Lesovskaya, 2019). The Federal State Educational Standard limits the

competitive sustainability of a manager to a compressed list of competencies that form only 30% of the required competitive sustainability of a graduate (Perevozov, 2016). Educational and cognitive activity is implemented in simulated conditions of future professional activity, which fills learning with personal meaning, motivates for activity and involvement in the process of cognition and transformation of reality (Sarfanova, 2015; Babeshko, 2020).

Methods of training managers are often radically opposite in their content and goals. Some propose to reconsider the methods and principles of training in the direction of separation and simplification of complex project tasks with the aim of their high-quality development and implementation by future managers (Rezanovich, 2005; Perevozova, 2015b). Others are developing systems thinking skills in future managers: multifactorial dynamic and non-linear thinking is opposed to outdated analytical thinking, when a manager tries to understand the system by isolating its individual parts and studying these parts separately (Tarasenko, 2018).

The paper (Bukhantseva & Dudina, 2016) proposes a concept for resolving the contradiction between the requirements of the labor market for the competencies of specialists and educational programs. A project of an intelligent information system as a tool for managing educational programs is proposed.

The study (Lomovtsev, Romashkova & Ponomareva, 2018) proposes a toolkit for decision support in the management of educational organizations.

Solutions have been developed for building individual educational trajectories of students, focused on improving the educational process through the formation of a personalized set of recommendations from disciplines of choice (Kupriyanov, Agranat & Suleimanov, 2021). Data mining and machine learning methods were used to process both numerical and textual data. For each student, a set of recommendations was automatically generated, and then the quality of the constructed recommendations was assessed based on the proportion of students who used these recommendations.

In (Pyrnova & Zaripova, 2019), intelligent education management systems are classified as follows:

- Automatic evaluation. An artificial intelligence-based computer program that mimics the behavior of a teacher grading essays written in an educational setting. She can assess students' knowledge, analyze their responses, give feedback and draw up individual learning plans.
- Intermediate training interval. The program checks already acquired knowledge.
- Virtual assistants are assistants for teachers who are able to respond accurately and

quickly to student inquiries.

- Chat Campus. This project is able to help students who have just come to the campus to get comfortable (how to get to the right office, how and where to submit the necessary documents).
- Personalized learning refers to a variety of educational programs in which the learning pace and learning approach is optimized for the needs of each student.
- Adaptive learning - suggests that AI is able to track the progress of each student and either correct the course or inform the teacher about material that is difficult for a particular student to understand.
- Distance learning - involves conducting remote exams. However, it is necessary to ensure that the student writes the exam given to him independently. For this, AI-based protection systems come to the rescue.

CONCLUSION

Summing up, we can say that the main educational task is to independently master professional languages and ethics. To do this, you need to form the most important educational cognitive meta-competence - to learn how to ask questions. The proposed samples of educational questions can serve as a basis for designing and evaluating educational literature and learning tasks, as well as for creating intelligent systems for designing educational activities and assessing students' cognitive metacompetences.

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