

Cognitive Psychology

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Learning and teaching process content as semiotic heterogeneous text: schema and background interaction

During recent decades cognitive and meaning components of consciousness have been analyzed rather discretely, but in a number of home researches the possibility of introaction of these approaches was shown (Agafonov A., Petrenko V.). Comparison of methodological foundations of cognitive science and Leontiev's home disciples shows their similarity, especially as connected with comprehension of culture text components, with the idea of categorizing role of language in conscious structuring and human being existence. Schema as the pattern of psychological construct synthesizing cognition and meaning in united architecture of individual consciousness, in a single subjective semantic space, allows to see didactic values of adopting teaching material by a student as semiotic heterogeneous text. Schema synchronizing outer and inner fields of a student produces a universal scaffolding defining the margins of all the psychic contours, that is intentions of meaning building, consciousness and self – consciousness development.

Key words: *personal meaning constructs, meaning building, integral meaning regulation, meaning-centered approaches in didactics, semiotics, text, context, schema, types of schema, schema characteristics, cognitive models, information approach, introaction, teaching process goals, representation of teaching process contents, operationalization.*

Content of the process of comprehensive learning takes an important place in its general structure. All the facts within the teaching and learning process can be interpreted to a certain extent as transformed content shapes. Teaching process content defined by educational goal as system forming factor, is implemented in all the other components of teaching process, such as a teacher and students dialog is considered not simply as educational technology in teaching theory and pedagogic psychology, but as a dialog of contents, project is qualified as teaching technology (project method), i.e. as a way to acquire a certain fragment of content. However,

meanwhile the method itself is acquired and is considered as learning process content.

Changes in the content cause other spheres and parameters of education changes. The source of many innovations, characteristic for current teaching process can be found in content, and it is fair that initial point of coming transfer to 12-year education is the new content.

What do we understand by educational process content? In traditional didactics it was defined as something that should be acquired: knowledge and skills. Such notion was supported by psychology, first of all, its cognitive branch.

Even within the frames of psychological concepts of developing education (Davydov V.V.) it was interpreted the same way. In such understanding of content there is a certain sense. Knowledge, for example, can be considered as the way of a person's behavior. At the same time they have a different character as concerning a human being, as they are the main structural units of content in cognitive paradigms of education and can not reveal all the peculiarities of human existence. Under conditions of humanistic tendencies of society, considering human personality and individuality the main value, the quality of such content can not be evaluated as high.

Current understanding of educational process content should be taken out of its priorities as they are defined in the humanistic pedagogy and implemented to a different extent in educational systems. Turning to goals as determining factor we used a well-known classical statement that the goal usually defines the activity character. After we figured out our general pedagogical goal, we immediately define content as it is understood as special phenomenon of educational process.

Psychologists and teachers consider that modern education strategy is directed to a child's development, as it is the main condition of human life. Humanization of education, its orientation to personal are considered the most actual for modern society tendencies. In different didactic models with orientation to initiation of personal, such as "personally oriented" (Serikov V., Yakimanskaya I.), "personally active" (Zimnaya I.), "personalized" (Bespalko V.), "developing" (Davidiv V., Elkonin D., Zaporozhec A.), "innovative" (Lyaudis V.), "humanistic, childhood centered" (Orlov A.), "meaning didactics" (Abakumova I., Ermakov P., Fomenko V.), with all their variety based on traditional education critics and having transfer from "adaptive-disciplinary model of unifies education to person oriented children centered model of variant education" as their goals (Asmolov A.); the person integrity and individual trajectory of life,

psychological safety of all participants in educational interaction are valued.

The global aim of the teaching process as a central part of education is personal and spiritual development of a learner. In the terms of psychology development means new psychic formations, subjectivity development, self-development of inner, natural, universal qualities of a person, shaping of his life concept components, and integral meaning orientation of a person. In the theory of self-developing systems it looks as regulation, harmonization chaotic human states, integration of a number of random features and relations. Naturally, axiology sees its own meanings in development interpreting it as formation the value system of a person. In phenomenology development is considered as getting out the limits of own "I".

In the terms of semiotics development means a different thing – it is a transition of an individual from one sign system to another, and in this approach to development there is something that psychological perception of development lacks. It is this initial methodological construct that directly leads us into the text topic, as in the semiotics the text is defined as a unit of culture, and as it is well-known the unit bears all the features of the whole. Consequently, if we declare culture as initial basis for educational process and the beginning of semantic shaping of learners' activity, so we can do the same to the text as its "cell", its structure which possesses all the features of this same culture, also having meaningful nature.

If teaching process in the unity of its components (goals, content and ways of their operationalizing) is in the centre of culture and is its mechanism of transfer from the past to the future, and the culture itself has "porous" text structure, the unity will become a mechanism of texts translation. Moreover, as education and its main method which is teaching, is special form of culture in the sense that it is compressed to the minimum and structured in a certain way, the whole of the educational process, but not only its content can be understood as complicated, multistructural text in its dynamics of revitalizing and development.

Thus, essential components (sign structure) and ideal structure are found in the text. However, only approximately we can say that the text ideal side is presented by information. Information correlates with the real existence, its forms, processes, features, but the text has "information" of a different kind. The text on the one hand bears the image of the outside world; on the other hand, it bears the image of a man, who has created the text about this world, his attitudes to it called personal semantics. Philosophers characterize the text as "the spirit imprisoned by signs". "Semantics of the meaning consists in what directs existence". The

personality of the author is given to us as meaningfully important structure and as phenomena of the same order with the essence of a human being” [8].

Semantic field of the learner consciousness has its particular primary architecture, formed under the influence of meaning actualization degree, its verbalization degree, the level of semantic “vertical line” formation (from personal meaning to life perception strategies). Any problem understanding initiation, learning problems as well, from controlled to acknowledge is specific according to the structure of the problem; the primary semantic pattern is activated as a response to this schematic anticipation. The idea was first expressed within the frames of cognitive psychology, however not in the information models (Simon G., Anderson G.), where the attempt was taken to describe the mechanism of text comprehension as the whole representation of the situation and operations over this representation, but not in the connectionists models considering information processing and denying substantiality of elements representing these or other pieces of knowledge (knowledge is kept by the whole net as a whole on the interaction of elements level), cognitive and semantic contours were not correlated.

Closer to this problem was Piaget in genetic epistemology notwithstanding some difficulties in the number of empiric facts explanation. For the problem of comprehension in the teaching process, accepting the text as perception context, the notion of schema introduced by Piaget in connection with sensor-motor intellect is rather valuable.

In this connection schema was considered as a mechanism of producing similar actions, but not as rigidly fixed as under reactions in the form of reflexes [10]. In current researches of neo-structuralism representatives, the field of schema application is extended and includes representative intellect as well, but schema interaction is understood as defining the dynamics of cognitive processes passing. According to a number of authors, Ushakov D. in particular, in comparison to information approach the trend developing the notion of schema allows to describe phenomena of mental development more adequately [11].

How can schemas be realized in the conditions of multiple choices put in front of a learning subject? In everyday life people use certain rules or scenarios for real life interpretation. New information is processed according to how it matches these rules, called schemas as primary cognitive patterns. Such schemas can be used not only for explanation of what has already happened, but also for forecasting different situations in the future. Schema theory explains that we use schema stored in our

memory to infer what our interlocutor is going to say, based on the similar situations in the past.

The information that would not match schemas already existing in our memory can be partially understood or would not be understood at all. This is the reason why some readers spend so much time for reading comprehension, if they are not familiar with the text topic, even when the meaning of separate words is understandable.

The essence of the text reading (and in the learning process it is content) is semantic tuning, defined by the general level of personal development and semantic actualization. And it is semantic tuning that defines text as a whole, gives it specific sound value and in general its outer shape. Consequently, we can say that it fulfills the role of the so called “inner shape” of the language, defining peculiarities of emerging psycho-semantic image.

When a person performs the role of a listener the word actualizes tuning, shaped as a result of multiple influences of the same word in the past. On the basis of this tuning a person has a corresponding psychic content which he recognizes as the word meaning. It means that the word is understood. The word is always individual as it is realized by the tuning.

This concerns not only foreign languages, but native language as well. The same is true about listening comprehension. If the topic of the conversation is familiar to both speakers the understanding is achieved even if not all the words are audible or understood. In case when the topic is not familiar to one of the speaking partners, even familiar words in unfamiliar context can cause miscommunication or there will be no communication at all.

Before we consider how to practically use schema as the basis for different learner’s hierarchies in education, it is necessary to give definition of the terms comprising units and elements used in schema description.

Schema (schemata) is a unit used in schema theory defining generic knowledge, generalized descriptions, plans or cognitive structures systems, which are stored in memory, i.e. abstract representations about events, things or relations in the world. Schema theory suggests the picture as it is organized in human memory in the form of generalized knowledge. It states that this knowledge is organized into mental structures called schemas. “As long as people are learning they build knowledge, creating new schemas or binding together already existing schemas, but in a new combination” (Anderson) [3, p. 54].

Background knowledge is also an important concept in the system of theory scheme, as it defines generalized knowledge of the world which has been acquired by a learner. New experience is usually compared to the one

already existing in the memory; it helps understand what is going on. Understanding is a united function of the text aspect of student's knowledge where text features and student's knowledge exist on the same level of abstractiveness.

The main statement of the schema theory is that the majority of sense that a reader gets from the text is not in the text itself, but in a reader's memory, in his background knowledge. Whatever he understands from the text (oral or written) is the function of a certain schema which is activated during the text processing, that is reading or oral comprehension.

The process with the help of which schemas affect understanding is called reproduction or recreation. It refers to general schema representation which a reader brings into assignment when he is involved in the creative process between the schema and the given text message.

The majority of schemas which everybody has are idiosyncratic. Everyone has his, different from the others, impressions and life experience, that is why everyone forms his own point of view and opinion about the world. However, all people have generalizes knowledge, too. That is why many schemas which are formed in the individual memory are common. They compile the most important part of common cultural knowledge and form the foundation for successful communication and interaction between people.

The goal of any foreign language teaching is to acquire oral communication skills and comprehension skills in writing. When people communicate they actually refer to schemas common to all of them. For the students to be able to participate in intercultural communication, a teacher has to make sure they share the same set of schemas which can be considered as common background knowledge a priori and used for their further successful learning.

Schema is an interdisciplinary concept which can be used both in psychology, anthropology, teaching science, besides as a concept it is open, not completely shaped and can be corrected, supplemented and interpreted in different scientific fields. Researchers within the frames of different disciplines came to a conclusion that adequate description of culture symbols from word level to the level of cognitive systems require definition of major cognitive schemas behind these stimuli. Schema theory is the main scaffolding for the more complicated organizations.

But what is schema? First, schema is not a mental picture. Rather it is a cognitive structure inside which the interpretation of the world occurs. The main characteristic of schemas is the fact that they allow a certain range of possibilities.

The other characteristic is that schemas use what is called absent values – positions to be filled, even if they are not felt or completely absent, it is that feature that shapes personal meaning structures. The most important of schema features is that they can be constructed using other schemas.

Cognitive models, called schemas, are concept abstractions, stored in human mind that serve as connection between receptors of the sense organs and behavioral reactions as it was stated by Wallace.[16] These are abstractions which serve the basis for all human information processes, for example perception and comprehension, categorizing and planning, recognition and response, problem solution and decision making.

Schemas are structures and processes simultaneously. Cognitive schemas represent our conceptual knowledge. They build our knowledge of objects and situations, events, actions and their consequences. Main and invariant aspects of concepts can be represented on the higher levels in semiotic structures while variables (or slots) connected with specific elements in the outside world can be represented on the lower levels. Schema is a procedure man uses to interpret information. Cognitive schemas suggest direct connection of cultural and psychological processes.

Culture is the main source of human schemas, and schemas play central part in most psychological processes. Thus schema is a way to connect culture with other psychological processes which influence people's activity. The fact that communication and mutual understanding between people speaking different languages and belonging to different cultures is possible proves the existence of universal basis which is human life invariant and also the high degree of interpenetration and interaction of different people's cultures.

Meanwhile, the presence of “cultural relativity” of the world picture of this or that ethnos, great variety of categorization forms are conditioned by the system of meanings, including in a converted form specific vital activity and culture of a given social and national community.

The initiative of concept of schema and schematism introduction is assigned to Bartlett [4], who first mentioned it in his research of memory. Before that the word “schema” was used for reflecting the human idea about his own body or the body relations to the world.

Bartlett used the notion of schema to show how a certain organizational structure of knowledge which correlates with new knowledge and experience can be created. This very understanding of schema was introduced by Rummelhart [14].

R. Skemp explained that schemas play an important part in relative understanding functioning: “Understanding of anything means its

assimilation into an appropriate schema” [15, p. 43]. By this he explains that such an understanding of schema represents its interrelated hierarchical relationships. Our goal is to analyze such notion.

Since the term “schema” appeared, many other terms were used to describe it, including frame, scene, scenario, text, also model and theory. The key theoretical development of the schema theory was done in several areas, including linguistics, anthropology, psychology, artificial intellect. The pick of development for the schema theory was reached in the 70s. One of the main driving forces was artificial intellect development, especially attempts directed to computer reading of natural texts. It was found out that the most part of the information in an average newspaper article was impossible to understand without referring to a great amount of information not mentioned in the same article. For example, let us consider a simple text cited by D’Andrade [5]:

John wanted to do well on the exam, but his pen ran out of ink and his pencil broke. He tried to find a pencil sharpener, but there wasn't one in the room. Finally he borrowed a pen from another student. By then he was so far behind he had to rush, and the teacher took off points for poor penmanship.

In order to understand this story, it is necessary to have a complete schema of written exams in Great Britain and America. Otherwise the text itself doesn’t make clear the connection between the fact that John ran out of ink and his inability to pass the exam.

The schema of the writing action is a good introduction to the idea of schema in general. Filmore contrasts “relations of text correlation” included in the English verb *to write* and Japanese word *kaku*. These two words are translated as synonyms, but the schemas behind them are different. Both schemas include the scene where somebody moves a pointed tool across the surface leaving a track. Such a scene involves a writer, a tool, a surface on which the marks are left and the result of such action. Neither of the schemas specifies what kind of a tool is used: it may be a pencil, a pen, a piece of chalk, a typewriter, a stick or even an airplane leaving some kind of track in the sky. The same is true for the surface: it may be a piece of paper, a board, wet sand or the sky. The result of the action may be any text from one letter of the alphabet to the huge manuscript. The only difference is that the English schema for writing considers this writing to be a text (words, numbers, and linguistic symbols). In the Japanese schema it may vary from a scrawl to a perfect picture. Thus the English writing schema is one particular kind of a wider Japanese schema of *kaku* [6].

Gestalt psychology considers system features in the study of mental organization. Gestalt ideas are used especially concerning visual perception. “Additionally, or even instead visual images there exist general types or schemas from the point of view how a subject has constructed his responses. Schema itself is becoming more and more dominating, with initial visual images disappearing, details from the original are forgotten and reproduced incorrectly, though even the last reproduction usually shows steady movement to depicting this or that type of schema, which was initially thought” [17, c. 75].

Quoting Bartlett’s classical work “Remembering”, the term schema refers to “active representation of the last reactions and knowledge”. The word “active” was to highlight the constructive, reproducing character of remembering in contrast to passive “fixed and lifeless” memories, in other words active versus passive remembering.

Schema theory is the theory of knowledge, its representation and application. According to schema theory all knowledge is packed in certain structures which are called schemas. Besides knowledge itself there is information how this knowledge should be used. Schema is a data structure representing general notions kept in memory. There are schemas representing knowledge about all concepts, objects, situations, events, their sequence, actions and their results.

Background knowledge part in language comprehension was formalized for the first time in the schema theory. Any text, written or spoken, does not have meaning by itself. According to the schema theory it rather supplies directions for the reader or listener how to recreate or create the meaning, based on his own background knowledge. This background knowledge when structurally shaped is call schemas. According to schema theory text comprehension is an interactive process between the background knowledge of a reader (listener) and the text (oral or written). Effective comprehension requires the ability to connect text material with existing knowledge. Words, sentences and even whole texts understanding requires more than linguistic knowledge, it includes all the previous individual knowledge of the world.

Numerous examples can be found in literature. For example, researchers offered subject readers a passage that was not clearly connected with any particular situation (laundry) and was pretty difficult for understanding and interpretation. But after the hint that it was about doing laundry, the subjects with the help of the appropriate schema could easily comprehend the given text. It was interesting that most of the subjects called the passage incomprehensible, but there were some who found their own alternative schemas and interpreted the passage according to them,

very originally. The most impressive was one clerk's interpretation who found it very similar to his work and using a familiar schema described business paper circulation in the office. He was very surprised to know that it was not right. Here we had the case when a reader "understood" the text, but not the author's intention.

Bartlett claimed that the central notion in his theory was "referring to own schemas". Since then the word is used in psychology very often. It is the most neutral and general of the terms, it can be referred to any kind of knowledge. However, a usual schema is not individual knowledge, but a mosaic pieces of which correlate with each other. Schemas are systems for information and knowledge interpretation, storage and reproduction.

In this approach to schema theory it is rather important for us to consider the following ideas: cognitive schema binds human culture and psychology, interferes into human psychic and the process of socialization, and leads the human actions. Cognitive schema is unconscious means of events interpretation, it make a person see the outer world under a certain culturally determined angle and act according to his culturally determined interpretation of the current events.

When the new information does not match cognitive schemas of the person, the information can be denied or the person can reconstruct his schema so that it would better match his new knowledge. The education theory considers organizes, structured knowledge as a complicated net of abstract mental structures which represent the person's understanding of the world.

R. Anderson, however, expanded on the word notion: schema can be considered as the expectation set. Understanding occurs when these expectations are filled with the specific information, which are provided to the person's sense organs. Information that meets these expectations can be stored in memory, later the appropriate schema cell can be activated when needed. Information that does not match expectations is not coded in memory or can be distorted so as to match existing schemas. Gaps in the information can be filled later with the inference in order to coordinate it with the expectations. Later the same expectations that were used to code information can be used to reproduce and reconstruct events and facts [2, p.241].

Later, R. Anderson reformulated the notion of schema: "Every act of understanding includes knowledge about the world" [3, p.369]. Schemas interaction means either that two schemas can be addresses simultaneously solving different parts of the problem, combining the results into one problem solution. Or the two of them can be addressed at different times,

each of them processing its own part of the assignment. Except for interaction two schemas can represent absolutely different solution of the same problem, and the final decision should be made according to its appropriateness in the particular situation. Schemas can enter each other on different levels of abstractiveness.

Relations between them look like a net rather than hierarchical, due to this fact one schema can interact with many others.

From the point of view of G. Rischar, we can choose four main features of schemas. The first one is blocks of knowledge that are on the one hand, are indivisible and reproducible in the memory as they are; on the other hand, autonomous as to the other knowledge.

The second feature is that schemas represent complex objects. It means they are constructed out of their own elements, i.e. concepts, actions and relations or out of more generic schemas.

The third feature is that schemas are generic and abstract structures applicable to a different number of situations. Consequently, schemas consist a number of variables or slots designed to be filled with specific elements of the situation presented by the given schema. Some schemas are relatively specific (they are called scripts), others, such as schemas describing the structure of some story – climax, evaluation, moral, and they are relatively typical.

The fourth feature is that schemas express declared knowledge connected not with particular application, but those which can be used for different purposes: understanding, implementation, and conclusion. This happens because they describe the part-whole organization [13].

Schema as a pattern of psychological construct synthesizing cognitive and semantic into united architecture of individual consciousness, allows to see didactic angle of the student's acquiring of the teaching and learning content as semiotically heterogeneous text. Schema, synchronizing the outer and inner fields of a learning subject, becomes a universal scaffolding defining all the psychic contour limits, thus intentions for consciousness and self-consciousness development. "Any world is able to understand another, so to expand its own image of this world" (Bakhtin M.)

Teaching curriculum content as semantic field of "crystallized" values of acquired culture and the student's consciousness as semantic substance are correlated due to emerging correspondence of schemas set in texts to be comprehended and in the individual student's consciousness, and this provides cross-section of "semantic fields" and "culture dialog" of a learner and learnt, curriculum content and student's personality.

During the last decades cognitive and semantic components of consciousness were analyzed rather discretely, but in a number of home

researches the possibility of interaction of these approaches is shown (Agafonov V., Petrenko). Comparison of methodological foundations of cognitivism and domestic disciples of Leontiev A. shows their similarity, especially in problems connected with text components of culture with the idea of the language role in structuring of consciousness and human existence.

According to Leontiev, the substrate of consciousness is the system of its meanings given in the unity with personal meanings and senses. Meanings are converted form of activity. "In the conception of Leontiev's scientific school, cycle reasoning is realized where cognitive structures are formed during phylogenesis and ontogenesis in mutual activity of a child and an adult or teacher-student, and then they structure individual activity in actual-genesis of image or behavior". Schema as the category of psychology of cognition and comprehension gives the opportunity to develop didactic semantically centered approaches and systems of operationalized study of text as the teaching process content in the context of semiotics – the science of heterogeneous sign systems providing different human activity, specific communication and outer world understanding in all its appearances.

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