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Developing System of Concepts in Polytechnic Education in Modern Conditions

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Abstract. The current world situation connecting with intensive development of mobile technologies actualizes the problem of training of engineering staff. The engineer of the future should not only to know the experience accumulated by previous generations, but also be able to analyze, develop and apply it in new conditions. The problem raises the questions connected with development of students' system thinking in educational activity. System thinking is the product of educational activity, namely, the activity by consciousness and comprehension of learning concepts in their entirety properties. The main directions of educational process for solving this problem are presented in the article. In particular, it is proposed to broaden out notion about practice-oriented education in the system of higher technical education. As a matter of fact, educational process in the current conditions should represent large-scale practice. The traditional forms of educational process such as lecture, problem solving (practice, seminar), and laboratory work change and become the basic constituents of this educational practice. The main method that allows for educational practice to take place is dialogue.

1. Development of polytechnic education

The robotization and informatization of many economic and social processes actualize the problem of training of engineering staff [13]. Nowadays, a graduate should not only be able to answer on relevant challenge of society, but also be ready for answer on future demands of changing world that are connected with the intensive introduction of mobile technologies to life [14] or a change in the register of significant professions (both quantitatively and in fact). Accordingly, it is necessary to call attention to the development of student's reflex abilities in the university environment [4]. At the same time, the constant renewal and expansion of the information component in the world narrows the possibilities of creativity [2], embarrass cognitive process that seems easier than it is in reality. This situation necessitates development of student's ability for full self-realization here and now, in condition educational space of university. The marked contradictions between the requirements of information society to a graduate and existing methods of educational activity directing to the development of knowledge, skills, experiences actualize the problem of the research. *The scientific problem* consists in identifying methods for promoting qualitative student's self-realization in conditions here and now in educational activity.

The ability for self-realization is many-sided ability depending on many others: in particular from the indicated ability for the constant updating of their knowledge (their comprehension and systematization), the ability for creative search and action. The development of the abilities depends on the student's insight degree of educational material. Namely the understanding promotes the development of



interest to studied material; it is reason for its subsequent comprehension, sets in motion the mechanisms of self-understanding and self-knowledge, awakens the processes of self-realization, and triggers the evolution of subjectivity. It means that the problem of understanding in an educational activities can be considered in several planes:

- in plane comprehension of *what is it* (comprehension of significance and scientific meaning);
- in plane comprehension of *how is it* (comprehension in practical meaning - how it works in life);
- in plane comprehension of *for what is it* (comprehension in spiritual meaning, i.e. in meaning of the formalization of own life path of development).

The purpose of the article is identification of conditions promoting for the development the student's comprehension of educational material in modern conditions. *The research methods* base on analysis and interpretation of philosophical and educational psychology literature, and own pedagogical experience.

The current situation of society development is characterized by uncertainly situation, the situation of transition from «the metaphysical thinking model» to «the post-metaphysical thinking type» (I. Initshev). The immersion in the existence (the situation «here and now» is important), non-reflexivity of individual components (the realization of practical knowledge in reality), spontaneity and dependence on the concrete conditions, probability and complexity (the devolution of lingua centrisim) characterize this thinking type [6]. The above-mentioned thinking peculiarity of modern man (his being) that have priority of a monologue over a dialogue, information over knowledge, theory over practice, reproduction or productivity over creativity make to revise the traditional approach significance in education. A technological component prevails in traditional approach in technological education; it promotes student's learning of knowledge without a true comprehension (V. Zinchenko) and thereby the individual experience development is impoverishing; the contexts of understanding remain undisclosed.

It should be noted that the comprehension process is closely connected with the work of consciousness possessing its peculiarity [7]. Firstly, it is the multidimensionality and the ambiguity of conscious phenomena. This peculiarity means the multiplicity of possible conscious effects begotten by the response, the word or the action of a pedagogue. Secondly, the subject's thinking activity dependence on both concrete, emotional, mental actual conditions and the attitude to studied problem. Thirdly, the person's thinking activity dependence on the area of educational interaction, creating by a pedagogue and its participants. In the fourth, the fundamental relation of conception and word in utterance so it is fraught with its return «to temple of shadows» [4], if student's thought is not expresses by himself.

The enumerated peculiarities of consciousness as well as many phenomena in social life actualize educational content such activities as lecture, practice and laboratory work. Thus, it is necessary not only to approach theory to practice (all the more every technological knowledge become out of date), but to individualize the education-training in the direction *from* the student. This means priority to the dialogue nature of the interaction, the accent on knowledge received independently, the reference point to teamwork and creativity should be in an education. The denote priorities allow to speak about strengthening practice-oriented nature of education. In other words, today it is necessary to speak of higher education as a scale educational practice in which:

- a lecture should be considered as the practice of the comprehension of scientific concepts. In this case, the lecture presents the search of the scientific meanings of the concept along with the student, but not the teacher's monologue;
- a practical work can be regarded as the practice of interpreting of the selected meanings in the field of their direct application;
- a laboratory work becomes the practice of externalization (re-creation) into reality or a practical research.

In the context of the foregoing, we suppose the development of the student's conceptual structure at the lecture takes place within the framework of comprehension *what is it*, and in practice and laboratory work along the lines of comprehension *how is it*.

A special role is given to concepts in the educational activity. So, any science contains a number of the most important notions-concepts, mastering of which is impossible without comprehension. In

addition, a true understanding of the text of reality is stipulated by the knowledge of the niceties. This means the educational problem will be fullest assimilated, if it is considered in different planes, for example, in the scientific, practical, historical, social, human, life plane.

Relying on the works of L. Vygotsky, let us consider how the work on mastering the concept is strengthened and developed. According to his research, two conscious processes are closely linked with the formation of concepts: *consciousness* and *acquisition*. *Consciousness* is based on the work of reflexive mechanisms of human consciousness. Whereas *acquisition* is fixed by skill and lies in the plane of external action. For example, it is quite possible a student performs some action in the process of the main activity, but he can not perform (or repeat it) independently (at will). Literally this situation means he "does not know what he possesses" [4, p.291]. To resolve this situation, it is necessary to transfer the work into a plane of *consciousness*, which is achieved by converting the concept from the plane of action into the plane of the language or "recreating it in the imagination". [4,p.250]. Pedagogically this means the need to use the following methods: statement, proposition, interpretation that is of those that require the student to present and represent the image of the concept. Moreover, such methods are necessary, first of all, for the student himself, since there are no other ways to know *what* he himself understood.

On the other hand, the process of consciousness triggers the mechanisms of the concept acquisition. Therefore, we can talk about the interdependence of the two processes: consciousness of activities provides for accent on identifying what has not previously been seen and leads to acquisition from new positions - conscious acquisition. The relations of similarity and difference, an object to action arise again and built in the process of consciousness. Such activity of consciousness is the developing activity. In the L. Vygotsky's opinion, the development of conceptual structure consists "of ... a progressive consciousness of the concepts and operations of one's own thought"[4,c.260].

Meanwhile, the activity of consciousness will be different, depending on which concept is being studied: scientific or everyday. So, according to L.S. Vygotsky, the scientific concept is a concept existing in the context of an abstract theoretical situation not conditioned by the student's personal experience. The everyday concept is a concept that exists in the context of the student's personal empirical experience which he encounters in everyday life. Most often, the formation of a scientific concept begins with a ready-made term with a theoretical abstract situation that is not related to personal experience. While the formation of the everyday concept is due to this experience, richly imaginative representation and subjective sensation. These differences cause the main difficulty in the assimilation of concepts. The scientific concept is theorized, presented in student's minds in the form of a scheme, a formula. That is why it reveals a difficulty in practical use or in acquisition. The everyday concept is rich in practical content; therefore its main difficulty is connected with the consciousness or translation of empiricism into the language of highlighting the essential connections and regularities. It can be assumed that the everyday concept develops "down up", whereas the scientific concept "top down". In Figures 1 and 2, the way of becoming concepts from consciousness to acquisition (or vice versa) is shown. So, in the formation of the everyday concept, the process of acquisition goes before consciousness, then, as in the development of the scientific concept, the process of consciousness generates acquisition, which in turn favors secondary consciousness, but on a new basis. This once again proves that the path of cognition is in principle infinite, since the reflection of the processes of consciousness and acquisition is unlimited.

Meanwhile, learning of the concept cannot occur on an empty place. Studies show that for the acquisition of the concept it is not enough to have developed psychic properties to a certain extent. More precisely, the very "inclusion" and development of these properties are based on a certain foundation. This foundation is the entire subjective experience of the student, including the experience of the development of mental properties, cognitive experience, feeling experience, emotional experience. The endured and actualized experience determines area of students' actual development, contributes to the discovery of area of proximal development and predetermines the formation of area of potential de-

velopment. The principal difference between the above-mentioned areas is the degree of reflection of the structural content of subjective experience already altered by concrete cognition.

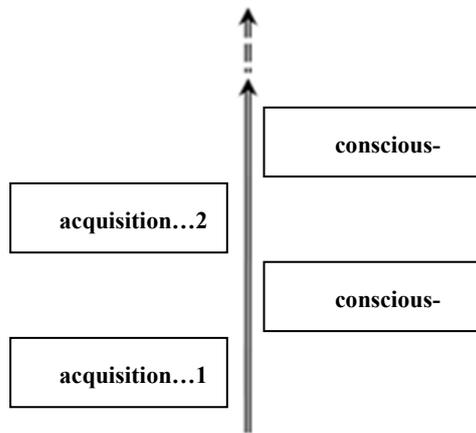


Figure 1. Formation of everyday concept.

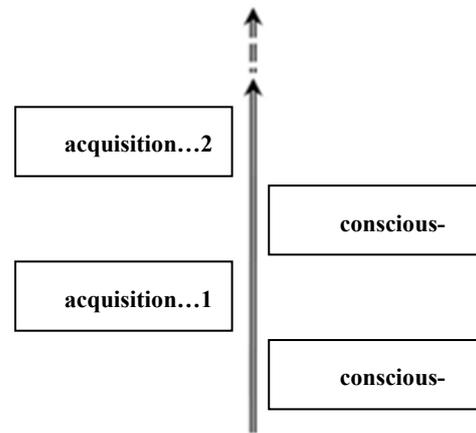


Figure 2. Formation of scientific concept.

In the conditions of higher technical education, a student has deal both with scientific concepts and with everyday concepts. In humanitarian disciplines there is an consciousness of everyday concepts, whereas in the conditions of technical disciplines there is a acquisition of scientific concepts. Accordingly, different goals are pursued by different methods. Thus, the study of everyday concepts (beauty, conscience, good and evil, brother, fatherland) is advisable to start with speech practices: a joint search for meanings, which in traditional education is designated as a lecture. As for scientific concepts (previously unknown), for a student, they may not be, because one way or another he has already met with them: at the previous stage of training or in the experience of life events. Therefore, we believe that we can talk about a contextual concept that is already familiar to the student by both phonation and short content, but he has no experience of using it like the everyday concept. In this case, it is advisable to begin the study with the practice of acquisition (laboratory research), then, subsequently fasten the effect of the practice of consciousness by the search for meanings and their interpretation. Thus, in the context of multicultural technical education, the following models of education-education can be used: from the practice of research to the practice of consciousness (in the study of everyday or contextual concepts) and from the practice of consciousness to the practice of implementation into reality (when studying previously unknown concepts).

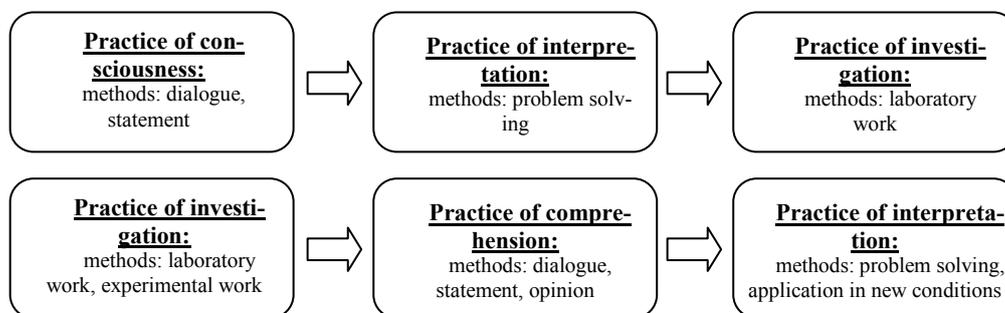


Figure 3. The organizational chart of the development of concepts in the learning process: 3a (upper) - the scientific concept; 3b (lower) – contextual concept.

2. Conclusion

For citations of references, we prefer the use of square brackets and consecutive numbers. Citations using labels or the author/year convention are also acceptable. The following bibliography provides a sample reference list with entries for journal articles [1], an LNCS chapter [2], a book [3], proceedings without editors [4], as well as a URL [5].

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