The Approach to the Problem of Transition to the Two-level Education System in Russian Engineering High School from the Perspective of the "Learning" Organization Theory

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The paper analyzes the transition to the two-level education system in Russian engineering Institutions of Higher Education from the perspective of the "learning" organization theory. It highlights that many issues, connected with the transition, are not so much caused by the factual reformation of education nature, as by their unwillingness to change their views on modern graduates. There brought forward some ways that will let us change steady attitude and thus successfully carry out new education system in Russia.

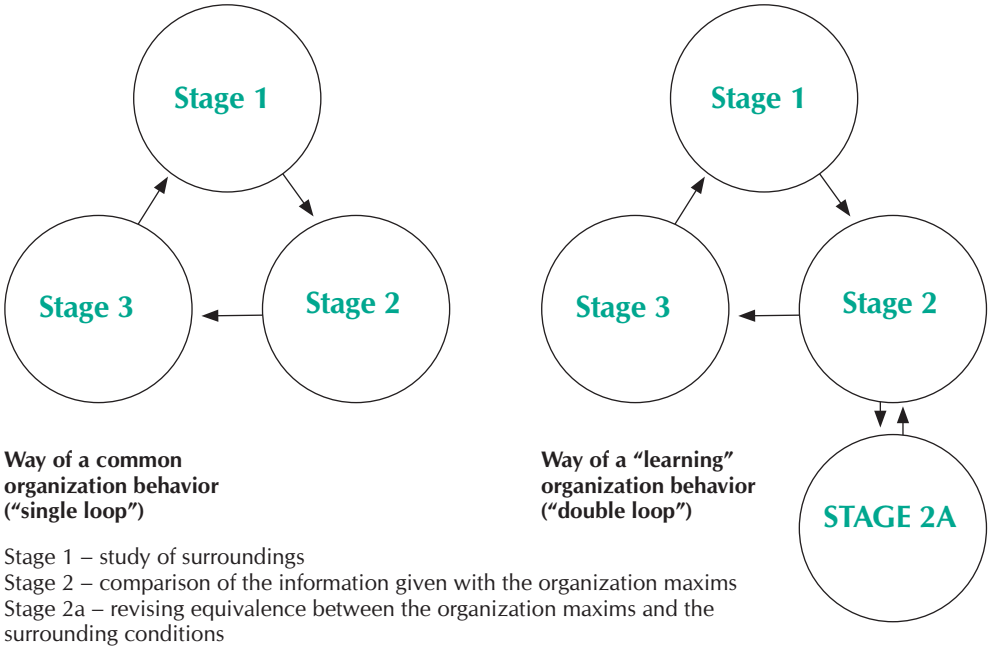
Key words: *engineering education, learning organization, "Bachelor- Master" system of education.*

In modern organization theory there is a term "learning organization", defined as an organization, where each employee and the whole organization itself not only follow certain values but also observe certain rules for taking decisions. However, it is capable to modify them in accordance with surrounding changes [3, 4, 5, 6].

P. Sengue enumerates 5 disciplines which are to be mastered theoretically and practically by every would-be "learning" organization [4, 5]:

- **personal skill** includes both the staff need of their permanent skill development and creative approach to achieving target goals and creating the atmosphere encouraging workers to do it in the organization;
- **mental models** – re-thinking, specification and improvement of the external world perception and understanding its influence on the organization decision-making and actions. It is not as easy as you might think [1]. While acting people acquire certain behavioral stereotypes in particular situations (mental models). The more often these stereotypes lead to success ("single loop"), the more often they are used and the more difficult it is for people to analyze the failure reasons and find new rules of behavior ("double loop"). It is much easier to accuse other people (colleagues, authorities, government) of these very failures.
- **common perspective** – common for all the organization members' vision of the future, some kind of a "common dream" of all the workers who have it as a personal aim. This vision is accompanied by principles and behavior rule of thumb people may use to achieve the dream.
- **team learning** – combination of a discussion (opinion confrontation) with a dialogue (searching for the purport) [2], when a team gathers collective intellect which exceeds

Figure 1. Common and "learning" organizations.



Way of a common organization behavior ("single loop")

Way of a "learning" organization behavior ("double loop")

Stage 1 – study of surroundings
Stage 2 – comparison of the information given with the organization maxims
Stage 2a – revising equivalence between the organization maxims and the surrounding conditions
Stage 3 – making and implementing relevant decisions

arithmetical sum of the team members' intellects.

- **system thinking** within the context of "learning" organizations means:
  - problems perception generally (without their fragmenting and structuring);
  - learning how to respond quickly to changes of surroundings and make changes in the organization;
  - learning of understanding the way our actions influence us and the surroundings;

On the one hand, mastering these disciplines requires establishment of organization culture capable for changes, on the other hand, it appears to be this very culture on its own.

As a rule, in the process of making changes caused by dramatic transformations of external conditions in the organization, new aims brought objectively by external conditions do not correspond to the current organization culture. If implementation of these aims is performed rapidly (mainly in a dominative way), there appears a very strong opposition to innovations within the limits of the current organization culture, which leads to the critical delay of achieving aims and in the worst-case scenario – to the organization breakdown. On the other hand, trying to add new aims to the current organization culture will lead to fast neglect of these new aims and to return to the familiar life, which means the organization languishing death in the context of changed surroundings.

As organizations, universities are also able to master the above mentioned disciplines and turn into the "learning organizations".

As an illustration of the "learning" organization theory application in universities we can study the transition to the two-level system of higher education – Bachelor and Master – in accordance with Bologna declaration signed by Russian government in September 2004.

This system has both advantages and disadvantages. There are the following possible disadvantages:

- volume reduction of technological knowledge in Bachelor education compared to Specialist one (the reason – reduction of academic hours);
- there are some fields which require a great number of technologi-

cal knowledge. It is impossible to use Bachelor degree there (aviation, mining, medicine, navigation, atomic energy industry, etc.);

- production sector is not interested in Bachelors because employers underestimate Bachelors' skill level.

These drawbacks are really serious if we deal with educational system and its interaction with business and society within the limits of existing and long-standing image, values and maxims, i.e. within the limits of the "single loop" scheme (Fig.1). These rules include many well-established believes, such as: the idea that a person has to study at the university only once and gain as much knowledge as possible; the idea that a person has to be devoted to the profession he/she has chosen early in life; the idea that career development and professional growth are chiefly dependent on gaining experience, etc.

- Let's try to study the situation alternatively – changing values and maxims in accordance with the "double loop" scheme (Figure 1). For example, the third disadvantage - the problem that production sector is not interested in Bachelors because employers underestimate Bachelors' skill level. Indeed, a lot of organization heads and personnel department officers consider Bachelors to be "unprepared" specialists who are not trusted to do skilled work. However there is much less skilled work demanding from a specialist total volume of knowledge and skills gained from the university than it seems at first. In addition to that, employers, speaking of need in highly educated specialists, often mean not so much of specific knowledge, as of employees' defined level of thinking, i.e. they confuse learning – mastering specific knowledge – with education – learning plus mastering methodological education in cognitive, axiological and communicative activities.

We can see it well from the training results (Tomsk Polytechnic University, the end of 2007). There took part about 30 TPU instructors and 20 employers' representatives on the level of heads and chief officers from the leading branches of industry, including nanomaterials and nanotechnologies, modern energy sector and energy saving, oil and gas industry, IT systems and technologies, etc.

The training objective was to work out technical skills set of TPU graduates. Based on the training results, these competences were formulated as follows:

1. Knowledge of fundamental disciplines.
2. Knowledge of principled foundations and latest achievements in certain professional occupation.
3. Ability to apply knowledge to analyze problematic situations, set goals, formulate and solve problems, create/ make up engineering models in certain professional occupation.
4. Ability to carry out engineering design using innovative methods.
5. Ability to use scientific and engineering literature effectively, knowledge of normative and technical documentation and its technical writing.
6. Ability to conduct scientific researches, particularly carrying out individual experiments in workshops and laboratories ("hand craft skill"), challenge and analyze measured data and draw relevant conclusions.
7. Ability to apply knowledge from different branches of engineering to solve integrated engineering problems.
8. Knowledge of engineering practice and particular production.
9. Knowledge of ethical, legislative, economical and ecological peculiarities of engineering in certain professional occupation.

Observing this list of skills set, one can see that the universities have always tried to implant such skills to their graduates to some extend, regardless of transition to the multi-degree educational system. That is why transition to the two-level degree education system (Bachelor's and Master's programmes) is not so black as it is painted and represents the differentiation of the above-mentioned skills.

The universities can set the goal to help society in forming new need – in Bachelors and Masters. It will appeal to modern management policy in successful companies which do not follow customers but are followed by them [3,

8]. It is the more especially as this goal is encouraged by social changes connected, as it was mentioned above, with turning the society into the one built upon knowledge and where universities play a key role [7]. To solve this problem universities have to work out other educational standards and principles of forming curriculum for Bachelor and Master students which will meet newly formed demands. At present they are worked out, as a rule, by means of mechanical transformation and repetition, but in modern parlance, by means of standards and curriculum in engineering education.

- Educational standards are to meet newly formed needs. School and university curricula are to be interconnected. The university subjects identical to the school ones are to be excluded from the curriculum, even if they upgrade school knowledge quality. We should not aim at including into the educational standard all the knowledge which can be necessary for graduates to use. The educational standard system is to encourage graduates to their permanent skill development. A lot of knowledge is seldom used by Bachelors in their working process; when this knowledge becomes necessary after a person's promotion - a Bachelor forgets it. It would be efficient if we established such an educational system when everybody would have an opportunity to gain necessary knowledge at just the right time but not in advance (education throughout the life). To do this we have to develop the extended education system in every possible way and tie it clearly with other educational systems. Now there is no such a tie. For instance, at the present day it is really hard to clear up what quality of knowledge one can document with a professional retraining diploma and to what extent this quality of knowledge equals the one documented with Bachelor's or Master' degrees. Requirements for high standard of knowledge in some branches (aviation, mining, medicine, navigation, atomic energy industry, etc.) are in fact not so much requirements for knowledge itself as requirements for responsibility and experience of the people working in these very branches. The system "Bachelor-Master" can appeal to these branches:

- Firstly, by means of complexity differentiation of production targets and thus differentiation of job specifications for Bachelors and Masters;
- Secondly, we may divide Master's degree into two categories: first category – Master of Science (MSc in Mechanical engineering, in Geology, in Chemistry, etc.) – for those who intend to dedicate themselves to scientific work and teaching; second category – Master of certain production branch (Master in Mechanical engineering, in Geology, in Energy production, etc.) – for those who intend to dedicate themselves to production activities. We may also rule the following: to gain the other category within the limits of the certain branch of learning, all the candidate has to do is to write one more master thesis on the corresponding (scientific or production) theme.

Summing up, change of maxims and transition from unreflective compliance with the employers' elastic requirements to cooperative taking decisions corresponding to surrounding conditions can result in successful development of universities in brand new conditions.

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