

The relation between systematic technological thinking and technological culture

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Abstract

A man thinking is discussed as a mental cognitive and project activity. The project activity require consideration many factors which from systematic thinking. Development of high technologies at the beginning of XIX century put forward systematic technological thinking, based on man's technological culture.

The beginning of works on introduction of technological education in Russian Federation was connected with the analysis of such notions as human technological culture, technological literacy and technological competence [1-4]. During the last years the attention was paid also to systematic thinking in business [5, 6]. Nowadays it becomes clear, that certain attention should be paid to formation of systems technological thinking.

There exist several definitions of thinking in literature. The most constructive definitions are the following:

- a) Thinking is the process of cognitive activity of an individual. The best training for thinking is students' individual solving of cognitive, constructive-technical and other tasks [7].
- b) Thinking is the process of problems solving, which is represented by transition from conditions setting a problem to result achievement. The first type of thinking is expressed in different forms: orientation in situations based on common knowledge, mythological, philosophical, and scientific (theoretical and empiric). The second type of thinking exists in the form of problems solving during the process of a practical activity, and also in the form of planning of activity projects (development of resources system, that provides the achievement of a target objective).

Nowadays there exist concepts, which claim that project thinking substitutes the research thinking in general and a theoretical one in particular. Actually, the second type of thinking essentially involves the first one: it is impossible to plan activity without the knowledge about a real situation and without generation of opportunities to obtain the desired results by means of one or other resources [8].

In other words, thinking is a human mental cognitive and project activity, and like any other activity it involves a motive, objective, technology, plan (system) of actions and operations, a result and result control. The best known types of mental operations are the following: comparison, analysis, composition, abstraction, specification, induction, deduction, classification and generalisation.

According to the second definition, the project activity includes only mental activities: the choice (generation) of the best idea for realisation of a project topic and making a reasonable plan of actions.

In academic practice, in particular in educational area "Technology", a project stands for creative work, done by

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students or by groups of students under a teacher's guidance [9, 10]. This work includes not only a topic choice, information analysis (prototypes analysis), choice (generation) of the best optimum idea, but also its realisation and project presentation (think – invent – create – present). Mental activity is necessary at all stages of project implementation.

It was essential to take into account a variety of factors during project implementation: from the conditions of the project realisation (availability of materials and equipment, students' capability to implement the selected technologies) and up to ecological aspects of project execution and the conditions of its realisation. The notions "consideration star" and "design curve" were introduced to consider these aspects. Consideration of all these factors helps students to form systems thinking.

The notion "system" usually stands for an organised variety of elements of different nature, which are connected with each other and operate to achieve the general objective. Systematic thinking strictly takes into account all issues of systematic approach: comprehensiveness, interconnection, integrity and the influence of all relevant systems and connections, as opposed to infantile indiscrete subjective thinking, that considers subjects in isolation, not taking into account connections between the elements of a system. Assumption is that systematic thinking is an essential feature of dialectical thinking. However it is almost impossible and theoretically meaningless to define all the connections and take them into account. It is sufficient to identify only the most stable relations, which influence objective solution directly and considerably, and which are really valuable [6].

Since the second half of the XX century the next (third) technological revolution in human history, associated with the use of computers in almost all types of human activities, and the use of nuclear energy for warfare and civil purposes has begun.

New technologies are being regularly invented. It is expected that the next technological revolution will be defined by nanotechnology implementation. In this connection in human reforming activities technological thinking as a mental activity that is connected with the analysis of workability and creation of new technologies to solve practical tasks is being put forward. This definition of technological thinking is close to existing in literature one, its means a way of thinking during which goal-seeking process of collection, analysis and conversion of information is entirely perceived, comprehended and apprehended for optimum technological problems solving [11].

According to reference [12] technological thinking refers to an activity, connected with rationally organised conversion of an object. This type of thinking can be considered as a fundamental ability of any specialist. The structure of technological thinking in general includes such mental procedures as identification and understanding (analysis) of a problem situation and related contradictions, definition and formulating certain problems, tasks and search of possible variants of their solution in conditions of specific and alterable reality, the choice of the best variant, working out its testing and realisation. The following requirements refer to the essential conditions of effective technological thinking:

1. Obligatory identification and analysis of a problem situation, specification of contradictions and problem;
2. Variety (diversity) of possible decisions;
3. Considering supersystem influence factors, including first of all nature and dynamics of environment alteration;
4. Prediction and consideration of all possible consequences of activities.

Creativity refers to the most important abilities of a subject's technological thinking that allows to solve tasks in a variety of ways and to find new solutions that had not been implemented earlier.

It is clear that this definition of technological thinking includes the features of project thinking and systems thinking.

The given definitions of systematic and technological thinkings allow to define characteristic properties of systematic technological thinking. This type of thinking deals with identification of objective of reforming activities, condition analysis and dynamics of a alteration of a set correlated conditions and ways of realisation of this activity, the choice (generation) of the best optimum idea of the objective realisation and the relevant technologies, changing or developing of new technologies, implementation of objective and presentation of object of activity, if it is necessary. Systematic technological thinking differs from the project thinking in wider (ideally comprehensive) consideration of alterable conditions of realisation and use of objects of reforming activities. This is the manifestation of its consistence. Technological effectiveness of this type of thinking is defined by analysis and choice of possible technologies, alteration of existing technologies and development of new technologies of realisation of object of activity.

Systematic technological thinking is based on human technological culture [1-4]. Performed analysis demonstrated that in a society every person acts as a worker, a family man, a consumer, and maybe a businessman in the modern market system. There under, a person should master the following aspects of technological culture [1-3]:

- working culture, which includes planning and organising of working process, either reproductive or creative one, the choice of instruments and equipment, working place arrangement, and its safety, organisation of technological and working discipline, products quality control, which are necessary for social functions of a worker;
- graphic culture, which means knowledge, competence and readiness to use graphic and drafting resources to support technological process;
- design culture, which means knowledge, competence and readiness to use principles of ergonomics, aesthetics, design and art of material work to provide marketability of products;
- information culture, which means knowledge, competence and readiness to use principles of collection, storage, handling and use of information from different sources to support realisation of activities;
- business culture, which means knowledge, competence and readiness to analyse demands of people (market), organise and manage small group of people to meet these demands, to advertise products, fulfilling social functions of a businessman;
- human relations culture, which means knowledge, competence and readiness to perform conflict-free cooperation with people either at work, or in a family, in the streets, and in public transport;
- ecological culture includes ecological knowledge and understanding that nature is the source of life and beauty, the richness of moral-aesthetic feelings, which are born by communication with nature; responsibility for its protection, an ability to consider any type of activity with environment and human health protection, deep interest in nature protection activities and the competent implementation;
- home culture, which means knowledge and competence of home decoration, homemaking, healthy way of living and rationalise housekeeping, fulfilling social functions of a family man;
- consumer culture, which means knowledge, competence and readiness to behave thoughtfully at commodity and service market, fulfilling social functions of a consumer;

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- project culture which means knowledge, readiness to define the requirements and possibilities of activities in the process of project realisation, collection, analysis and use of helpful information, choosing of the best optimum idea, the research of this idea planning, organisation and execution of project work, including the acquisition of knowledge and skills, evaluation of project and its presentation.

All these aspects of technological culture of each student should be formed during studying of different school subjects, but Technology lessons and creative projects play the main role in this perspective. Based on aforementioned it is necessary to form students' systematic technological thinking at the lessons of Technology.

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