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Mind Mapping as one of the Ways of Creative Thinking

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Abstract: Patterns of the thinking process affect not only the success of students at school, but, more importantly, they affect the success of a person in his or her professional and personal sphere. According to the fact that today the availability of information and their volume grow geometrically, it is extremely important to learn how to deal with overloading of information. From this point of view, it is desirable to human nature to be identical to human cognition, which unambiguously exceeds only the ratio itself. Human wisdom is externally demonstrated by the culture of thinking. The ability of impartial judgment, the ability to predict, observe, assess and evaluate phenomena belong to the basic characteristics of thinking culture. One of the primary prerequisites for the quality of complementary thinking is the ability to uncover relationships, compare them in connections and generalize them appropriately. This "versatile" assessment, which is denoted as critical thinking, can be learned through the application of mind or cognitive maps. The article presents the experience of authors with the preparation of future teachers of technical subjects not only with the application of these maps in the process of teaching, but also with their elaboration by the students.

Keywords: Education, Mind map, Information

Introduction

One of the basic strategies of today's school is to address students' self-regulation. Autonomy of students, responsibility for organizing their work is one of the decisive prerequisites not only for quality and effective work of students in the educational process, but also, and above all, a prerequisite for success in the professional performance of contemporary students in perspective. An important determinant of success in the future is permanent, lifelong learning. Want to learn and know how to learn effectively is more important from the perspective of the future than what the student learned at school during the educational process. Therefore, learning-related competences - learning competences - belong among the key competences of school leavers today.

Many variables, which precise or exhaustive identification is more or less impossible, influence the quality of the work of students. Nevertheless, every good teacher can identify the factors that constitute the modus operandi of the meaningful and successful work of the student in the reality of the educational process. Factors essential to the success of students include:

- Ability to identify problems and strategies for solving them
- Ability to take into account degree of own past experience
- Ability to put things into context and organize own intellectual capital
- Consciously accept responsibility for own learning
- Meaningfully organize own learning process.

In this context, arises the question- in which area of competence can teachers make a significant contribution to their improvement. How should be the teacher-student interaction, how should the teachers grasp it so that its result will be the enhancing the quality of students' learning skills? Learning skills are a set of partial activities that a student applies during learning process. They can be considered as universal skills – the ability to

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independently acquire process, evaluate and apply information as a basis for performance, success and later professional expertise. In the spectrum of learning skills, the scientific literature identifies three basic areas:

- Skills related to preparation for learning – e.g. selection of information from various sources, creation of optimal conditions for learning,
- Skills related to the actual implementation of learning – to process information, to be able to make notes, to memorize, to rationally learn from text, to solve algorithmic, but especially problem tasks, etc.
- Skills related to control of learning – preparation for exams, handling hectic and stress in the examination period, having a real picture of the quality and quantity of own knowledge and skills, etc.

The fact that learning skills are a decisive factor in the success of students is evidenced by the multiple literature reviews that poor quality learning skills or incorrect study methods and habits are not only the cause of study problems, but also the cause of complete failure and early school leaving. The most of the problems occur in the first year of study, while intelligence is of little significance for early school leaving. Good students of engineering are distinguished from less good ones by, among other things, effective learning habits, e.g. the more successful they were, the less work they postponed and the success in the study in the first semester was dependent on the way in which the lectures were written and the time schedule of the study, time management.

Research confirms that learning skills, learning habits, or subjective study methods are partly a prerequisite for success. Some researchers even consider good learning habits essential for study success. They found that the relationship between study methods and learning outcomes was closer to those who thought about their learning styles (according to Laucken, Schick, Höge, 1999, p. 185). Students who voluntarily participated in the program, which led them to an effective and meaningful change in their learning habits or skills, ranked better than before and better than other students in the following semesters.

Results and Discussion

We are convinced that even at university, it is not possible to leave students with their study problems on their own. This conviction leads us to find such ways of teaching that help students to develop their learning skills. One of the meaningful ways is to apply mind maps that develop students' ability to put terms or facts into relationship and help them to meaningfully organize their intellectual capital.

In addition to this feature, mind maps open an attractive, fun and meaningful way of learning. Why?

If the teacher motivates the student to knowledge, by introducing the knowledge as a value itself, the attitude of students to such knowledge is lax, indifferent, or even refusing. And even if one realizes that knowledge gives chances for a true picture of reality. However, if the teacher mentions knowledge as a mode of power or force, at that moment the attitude of the learner's changes because they realize that by knowing one can grasp reality and give it the desired contours. If knowledge gives the chances of power, the learning process (which results in knowledge) is given a positive attitude.

Mind maps are thus a suitable bridging and unifying factor of two attributes of the educational process - learning as a process and knowledge as a result. If the teacher is able to "insert" the mind map into the teacher-student interaction, the mind maps become at the same time an extremely strong motivational charge.

In the subjective consciousness of students, mind maps create suitable chances for penetration of a substantial and functional. Variability or relational dependence in consciousness is open during the mind mapping, they are accessible to modifications, and continuity is almost without any fixation. This makes mind maps not only the source of student's activity and independence, but above all the source of discovering with the dominance of student creativity. Moreover, the aesthetic message of mind maps is an added value of cultivating the student's personality.

The above analysis of conceptual maps can be specified in the following statements:

- They allow divergent thinking
- They enable speeding up the slow way of "talk" with reality
- They are a progressive experiment in the subjective world of knowledge
- They are the driving force of bidirectional projection: from themselves to reality and from the reality of the world to themselves

- They give a subjective dimension of individuality of person to thinking
- Activate not only cognition but also emotions, dreams, effort, vision, imagination, generosity, courage etc.
- They are articulation of that, what we cannot say accurately
- They allow such a modality of knowledge, in which the elements of description), explanation) and prediction are intertwined
- They bridging between conscious and unconscious cognition, i.e. they are using both hemispheres of the brain (which is extremely important for the technically oriented students)
- They are a magical way of learning
- They enable to exceed contours of rationality
- They elevate knowledge to a positive value
- Their outcome is not only the quality of critical thinking, but also the power of creative intelligence.

In the framework of the supplementary pedagogical education, after which engineers-technicians acquire pedagogical competence as technical subjects teachers at secondary schools, we applied mind mapping in the subject *Innovation in the field of study*. It is a subject in which the content of technical subjects is interconnected with contents of subjects from pedagogy, psychology and didactics of specialized subjects. It is a subject that is primarily based on the significant penetration of two different worlds - the world of rationality and emotionality.

The results of mind mapping can be summarized as follows:

- The line of vertical and horizontal relationships between terms will change
- There is a transfer of concepts from one hierarchical level to another
- Qualitatively new conceptual links are established
- Relationships of superiority, coherence, inferiority absorb new concepts
- Working with mind maps raises a gradual integration that creates thought compliance
- What seemed to be incompatible and contradictory, to the learner is gradually and logically interconnected by the application of mind maps
- Structure of concepts, conceptual network becomes coherent (internally consistent)
- Improving differentiation and discrimination
- Refinement of the technical and pedagogical-psychological-didactic line
- The subjective knowledge structure is cleared (crystallized), becomes more sophisticated and versatile
- More sensitive distinction of meanings of terms in different contexts
- Finding new connections between declarative and procedural knowledge
- Unconscious and meaningful linking of explicit and implicit knowledge - metacognition
- Strengthening of thinking elements that externally represent clarity, accuracy, certainty, substance, depth, width and logic.
- Strengthening critical thinking quality elements
- Gradual transformation and interiorization of the contents of the concepts of technical sciences and pedagogical-psychological-didactic sciences into a mutually consistent subjective system

Conclusion

Man is constantly changing, in something he adds, in something he rejects. Assimilation and adaptation is one of the important conditions for the functioning of every human being. We believe that learning skills as one of the essential components of key competences can be accepted as a significant determinant of the degree of assimilation and adaptation of an individual to the environment. In addition to professional, technical disciplines, a wide range of subjects and factors are involved in shaping the technical skills of future engineers. i.e. the subjectivity aspect, starting with the development of perception, cognition, continuing memory, through language, creativity, communication, to social hierarchy and identity creation. Mind maps are strong and meaningful contribution to the subjectivism aspect, with the dominance of the desirable transfer. Their final result is a positive reinforcement of the student in his continuity and dynamics.

The need of a true, authentic essence of each teacher's culture and expertise of every teacher is evident from the time we live. "The plain fact is that the planet does not need more successful people. But it does desperately need more peacemakers, healers, restorers, storytellers, and lovers of every kind. It needs people who live well in their places. It needs people of moral courage willing to join the fight to make the world habitable and humane. And these qualities have little to do with success as we have defined it." (David W Orr). The realization of this profound thought needs a teacher, without poetic and heroic acts. A teacher who does not forget to ask questions. The answers to the questions are sometimes straightforward and simple, sometimes

complex, difficult and sometimes painful. And some questions remain unanswered. Perhaps the absence of answers in the future will be a spark of long-term resonance (flow), positively determining the views, thoughts and attitudes of its students. Students whose *modus vivendi* is a change in the values of this world.

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