

THE APPLYING OF MIND MAPS AS A TOOL FOR DEVELOPMENT OF SYSTEM THINKING IN THE STUDYING OF MATHEMATICAL DISCIPLINES

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Анотація.

Розглядається питання впровадження інтелект-карт під час вивчення математичних дисциплін студентами в університеті, як інноваційний засіб розвитку систематичного мислення. Проведений аналіз засвідчив як позитивні, так й негативні сторони використання різноманітних інтелект-карт в учбовому процесі та виокремив подальші шляхи проведення такої роботи.

Ключові слова:

Системне мислення, інтелект карти, математичні дисципліни, розвиток аналітичних здібностей, свідоме (значуще) навчання

Abstract.

The article deals with the introduction of mind maps during the study of Mathematical Disciplines by students at the university, as an innovative tool for developing system thinking. The analysis showed the positive as well as the negative aspects of various mind maps usage in the educational process and also allowed to outline the further ways of carrying out such work..

Keywords:

system thinking, mind maps, Mathematical Disciplines, development of analytical skills, meaningful learning

The statement of the problem

The modern world is saturated with information of different levels of complexity and requires the use of new approaches for its processing, storage and analysis. A young specialist who gets into such a high-speed information flow cannot always handle it skillfully, so there is a need to find other teaching technologies to help him. Among a variety of scientific approaches aimed to optimize the learning process, researchers more often pay attention to the opportunities hidden in our brain, thus giving preference to meaningful learning.

Such training contributes to the development of creativity and the formation of systemic thinking, which later becomes an effective assistant in the intellectual self-improvement of the professional's personality.

Aim of this publishing is to elucidate the use of mind maps as an innovative didactic tool to promote the development of system thinking and improvement of the quality of the mathematic training of a modern specialist.

The presentation of basic material

The system thinking, as far as we know, is a very important practical approach for perception of the world accelerating such thinking processes as an analysis, a decision-making, a search of solution, as it is rooted in practical experience, building a lasting background for our further creativity..

Creativity can be regarded as the achievement of a high level of meaningful learning, an inseparable part of which is identification of cause and action relationships due to the integration of new knowledge with existing knowledge of students [1]. If the available knowledge is not enough in the "memory store", then the process of building associations, and also the whole process of further memorization, the establishment of new connections, "the absorption of new knowledge", will proceed slowly and ineffectively [2]. Thus, we need to look for more reasonable tool which will be able to help us to improve our capacities to memorize, understand and recognize new knowledge.

Such a tool, according to many researchers (Ausubel D. P., Ballester A., Buzan T., Novak J. D. and others), is mind maps. These maps are a kind of guide in the way of the development of a variety of thought systems in our brain. They help to visualize hidden thought acts, turning into a graphic interpretation of the whole process of a radiant thinking, and reveal us "huge possibilities of effective application of our intellect"[3]. A hierarchical representation of information; an inclusion of cross-references or links between concepts; specific examples of events or objects of the study are named by Novak J. D. and Cañas A. J. among the main properties of maps. Using maps in educational process promotes a more conscious

perception of the studied material, which is important aspect in the context of meaningful learning. Because these maps not only contribute to the structuring of new knowledge, but also help to establish more stable and deeper relationships with the past experience. Thus, the gained knowledge is stored longer in a memory, creating the background for the further filling of their content or restructuring them, which positively influences on the formation of a system approach to the solution of various tasks.

As you know, the solution of any tasks (occupational or mathematical) is the process of the performing certain actions, associated with thought operations and aimed at achieving a result as a solution to some problem situation [4]. The effectiveness of the solution of the task depends entirely on the application of an integrated approach, which implies the ability to system thinking and the making decisions based on a comprehensive analysis of data. Undoubtedly, the cycle of Mathematical Disciplines, studied by the future specialists in universities, is an excellent springboard for the solution of such problems through the implementation of the principles of meaningful learning and the formation of system thinking. The principles of meaningful learning, which will be able to realize this learning, are: “open work enables all learners to learn; motivation helps to improve classroom environment and it makes learners interested in their tasks; means must be related to the environment of learners; creativity strengthens imagination and intelligence; concept mapping helps learners to link and connect concepts; educational curricula must be adapted considering learners with special needs [5, 200]”.

Summarizing the foregoing, it should be noted that the primary task of professional training of a modern specialist is the formation of capacity for a comprehensive perception of the stated task. Such perception presupposes the existence of a students' formed system thinking that allows us to operate with different approaches for the synthesis and analysis of the input data in the process of finding the solution of the task. The formation of such thinking should be carried out rationally, basing on the mathematical modeling (including mathematical laws and mathematical tools) and performing a system analysis of objects under investigation [4]. For this purpose, we should use mind maps in the educational process to visualize individual acts of research and search for solutions, as well as to improve the memorizing of theoretical material, which, as a rule, causes the greatest difficulty for students.

Therefore, taking the above mention into account, we have organized work on creating mind maps with students on the specialty "Electrical engineering and electromechanics". The work was carried out in the process of studying theme "Analytical geometry in a space", and in the future our mind maps will be supplemented while studying the topic "Straight line on the plane". The result of our collaborative work is shown in Figure 1.

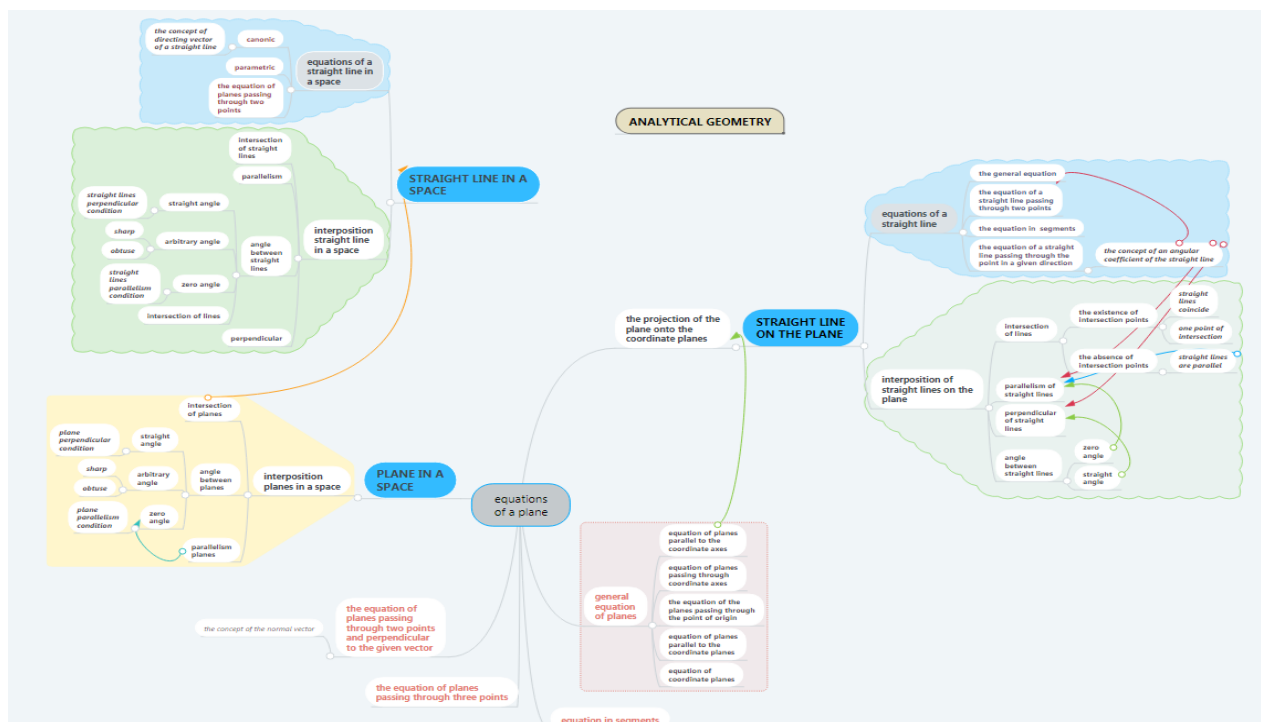


Figure 1. An example of a mind maps in the study of some Analytical geometry topics

This work was performed by students in the framework of introduction of project technologies into the educational process. Students were offered to systematize the theoretical material during the study of the topic "Analytical Geometry", which, as we know, is not always easy to memorize for them. One of the freely accessible online servers as MindMeister has been used to create a mind maps. The main task for the students was to create an auxiliary tool that could be successfully used by them both in preparation for the modular control, and as a visual reference (a small quick reference book), helping them to solve tasks.

In the course of the work, the students gained a practical experience of collaboration between each others, had being allowed them to independently collect and analyze the theoretical knowledge they received. Moreover, the requirement to fill, and modify the creating mind maps not only stimulate students to reread the theoretical material, but also made them to be aware of the material being studied constantly. Due to such regular work, the material was in active processing (in RAM) and it was not necessary to conduct the actualization of knowledge at the lectures. The search for the optimal construction of the mind map and its design was created by the students and it is represented their own vision of the connections between concepts, equations and theoretical points.

On completion of work, a colloquium was held, where all the positive and negative sides were discussed. Among the negative aspects were highlighted: tight contact hours; a small amount of the considered complex tasks with a professional context; functional restriction on the used online service (wider range of available are requires payment); a low activity of some members of the group; the lack of experience of self-organization. However, these few disadvantages, given by us, cannot reduce the positive effect of this type of work. Thanks to this type of learning activity, students have proven themselves as creative and resourceful future professionals. The implementation of a non-standard approach to the study the Mathematics significantly increased the activity of students; they have gained valuable researching experience and have enriched their communication skills. They have learned to a comprehensive approach to the solution of tasks (which undoubtedly contributes to the formation of system thinking) which helps them to be more flexible to make decisions, look for other way to solve and analyze our mistakes. The level of trust between the project team members has grown; they started to be more attentive to other students, trying to listen thoughtfully to.

Conclusions

In conclusion, it should be emphasized that this work was our first step towards the introduction of such tool as mind maps, application of which will demonstrate more advantages than disadvantages. Such alternative form of work with students harmoniously correspondent to the context of introducing innovative pedagogical technologies, the main aim of which is the formation of a complex vision of the tasks studied and the creation of a multilateral trained young specialist with a developed system thinking. Thus, the implementation of mind maps requires the further development, research and analysis of the results of the students' progress when using this tool in the educational process, in particular, studying Mathematical Disciplines.

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