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Application of the Connection Diagrams "Mind Maps" at Training of Students of Technical Specialties

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Abstract: The study deals with the model of "mind maps", describes their advantages and disadvantages of the introduction into the educational process are the main steps and algorithms development "mind maps" that lead to the most effective solution of tasks assigned to students.

Key words: Mind maps, connection diagrams, education, TPACK, TRC, application

INTRODUCTION

The penetration of information technology in various sectors of society requires a revision of the formal approach to the methods of education. In modern society, every person has access to a wealth of information but its value has been steadily declining due to easy availability. Previously, the main purpose of the training was to teach students to memorize the basic theses and postulates but now more applicable is the concept "to teach students the correct use of information sources and structure this knowledge".

Reducing the value of information this is not the only change that has occurred in recent years. Significant changes have occurred in the education concepts. The theory of "intelligent education" (Ausubel, 1968) has been further developed that led to the emergence of a constructive theory of education (Tracey, 2009). In turn, further changes were due to the advent of psychodidactic approach (Skoda and Doulik, 2011).

The above changes have led to the development of the theory of connection diagrams "mind maps" developed by psychologist Tony Buzan. Diagrams connections realized in form of a tree which depicts words, ideas, concepts or other problems related to the branches extending from the central concept or idea. Is one of the tools for personal knowledge management which is enough for a pencil and paper (Buzan, 1989). In recent years, it produced a huge number of works that reveal the potential of connection diagrams (Fisher, 1990; Chang *et al*., 2002, 2001; Novak, 1990). However, despite the fact that the connection diagrams are well described concept, there is virtually no information about the application of this method in the chemical formation.

"TPACK" Model: PCK Model (Pedagogical Content knowledge) (Shulman, 1986), later transformed into a model TPACK (Technical and Pedagogical Content Knowledge) (Mishra and Koehler, 2006) was developed to describe the modern education system. Trask model describes the integration of pedagogy, learning content and technologies. The model says that the effective use of technology for teaching specific content or subject matter requires understanding and study the relationship between the three components: Technology (TC), education (the PK), Content (CK).

Knowledge of the Content (CK): This knowledge includes knowledge of concepts, theories, ideas, structures, knowledge of the evidence as well as current practices and approaches to the development of such knowledge.

Pedagogical Knowledge (PK): Deep knowledge of the processes, practices or methods of teaching and learning. These include among others, general educational purposes, values. This is a common form of knowledge which also relates to the understanding of how students learn management skills, lesson planning and assessment of students. This knowledge in itself is a necessary but not sufficient to achieve the learning objectives.

Knowledge Technologies (TC): Knowledge of the methods of work with equipment, tools information technology. It includes a broad understanding of the nature of information technology in order to use them productively in the workplace and in daily life being able to recognize when information technology can help or hinder the achievement of educational goals. Coma of this knowledge helps you quickly adapt to information technology changes.

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Pedagogical Content Knowledge (PCK): This pedagogical knowledge used to teach specific content. The central place in this area this is how the teacher interprets the subject finds several ways of presenting information, adapting training materials. This knowledge of how to make the subject understandable for students.

Technological Content Knowledge (TCK): Understanding of how technology and content influence and restrict each other. Teachers must have a deep understanding of how the object can be changed by the use of certain technologies. This knowledge of how the technology can be used to provide new ways of content. For example, digital animation allows students to understand how the electrons are distributed between the atoms when chemical compounds are formed.

Technological Pedagogical Knowledge (TRK): Understanding of how teaching and learning can be changed under the influence of technology. This includes knowledge of pedagogical affordances and constraints of the spectrum of technological tools.

Technological Pedagogical Content Knowledge (TPACK): Refers to the knowledge and understanding of the relationship between CK, RC and LC using technology for teaching and learning. This model includes an understanding of the complexity of the relationship between students, teachers, content, methods and technologies.

MATERIALS AND METHODS

The method of "connection diagrams": The literature describes two basic types of connection diagrams: "mind map" and "conceptual map". The basic concept of the method "mind map" is the presence of "benchmarks" or "the central words", around which depicts the words, ideas, tasks or other concepts related branches (Buzan, 1989). "Conceptual maps" are two-dimensional representation of cognitive structures, taking into account the hierarchy and relationship between them. Connection patterns are typically represented as a network consisting of a plurality of interconnected nodes.

The main difference between the types of "connection diagrams" is that when using the "conceptual maps" produced visualization concepts while the method of "mind maps" further visualizes the relationships between them.

Advantages of "connection diagrams": The main advantages of the method "connection diagrams" in the learning process are:

- Allows you to see the difference between the conventional "delusions" and true "analysis results"
- Makes possible to develop new approaches to solving common tasks
- Makes possible to develop a universal concept which is the key to a number of different tasks
- Makes possible to develop a basis for further discussion
- Allows you to see the diversity and complexity of science
- Improve the efficiency of information interactions
- Increase the student's understanding of the theme
- Develop a list of tasks to achieve the result

Another important advantage of the "connection diagrams" is the ability to combine the strengths of the various intelligence of students. For example, a student who draws well (in this case it may be difficult to understand the chemistry) is a structure diagram and the student is well versed in the subject which has a mathematical mind, selects and sorts the right "arguments" for "the central word". An important result of this approach is that both the studen's weaknesses complementing each other to achieve results and gain experience in solving this problem.

RESULTS AND DISCUSSION

Disadvantages of "connection diagrams": In the literature (Chang *et al*., 2001, 2002) lists the following disadvantages:

- Nuisance control work students master in the preparation of charts
- Preparation of the expanded structure diagram this is a difficult and complex process, it is usually difficult for the student
- Diagrams of connections composed of students with the help of pen and paper in case of errors is difficult to remake
- The >50% of the surveyed first-year students say that "connection diagrams" method is too complex to master

Creating a "connection diagrams": Primarily formed team of students who own questions on the topic under discussion. Next, the teacher formulated the problem to be solved and the result which should be achieved. Defined links that bind the individual factors that influence the problem and is based chart connections. Next, the team should discuss charting connections and identify the main factors influencing the problem.

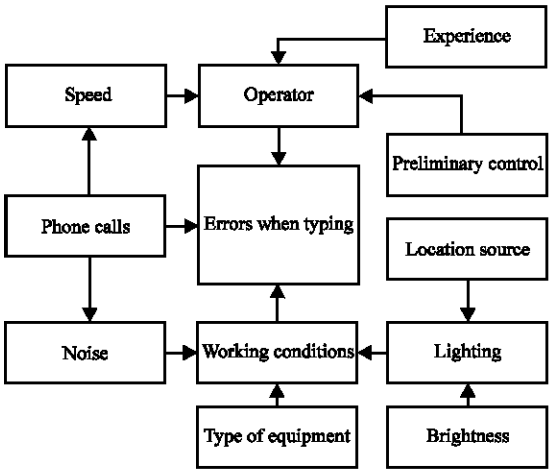

Fig. 1: Example of connections diagram

In practice, by constructing and analyzing the relationship diagram is a logical tool to try to clarify and improve the clustering of data affinity diagrams which in itself a creative tool. This is due to the fact that in the presence of a large number of objects (from a few tens) of our associative abilities start to give the tools of logical analysis. Figure 1 shows an example of the chart links on the example of disclosing the cause of errors when typing.

The main rules to create "connections diagram": Every problem to write on the card. In the center of the sheet should be placed a card with the wording of the problem to be solved by highlighting it in any way. Further on the same page it is necessary to place the main reasons affecting the results. Related causes should be placed next to each other.

Then, should identify the links between causes and results, asking the question: "Is there between these two events is the connection?" If there is, it should be clarified: "Why is this event is the cause of another event?" When considering the problem of having a large number of reasons you must first establish links between related causes. In the event that causes the problem is not so much between all causes and formulation of the problem dealt with in a random order.

All identified communication indicated by arrows showing the direction of influence. After identifying the relationships between all the events, counting the number of arrows emanating from each and included in each event. The event with the highest number of outgoing arrows is starting. Usually, there are two or three initial events and decide which of them should focus first and foremost. This takes into account a variety of factors for example, existing limitations, resources and experience.

"Connections diagram" editors: To create a connection diagrams, students can use specialized software. Studies have shown that the chart by a group of students on a computer is much more intuitive, efficient and logically complete than those made "by hands" (Royer and Royer, 2004). Also, the advantages of diagrams made on your computer are: durability, the ability to quickly spread, editable. From the list, containing >25 editors on the basis of popularity among students has been selected three:

- Spiderscribe (http://www.spiderscribe.net/)
- MindMeister (http://www.mindmeister.com)
- Bubbl.us (https://bubbl.us/)

Presented editors are designed to operate on both desktops and laptops as well as on tablets and smartphones software package database interface is easy and intuitive. A very important factor is the ability to change fonts and colors which makes the chart more visible. All three editors are effective tools not only to deal with any technical problems.

CONCLUSION

Excessive amounts of information leads to overload students studying the problem. Sort and search for information laws are the basis for finding solutions to the tasks. The method of "charts relations" developed by Tony Buzan can effectively sort the data arrays based on mechanisms similar to human perception. The effectiveness of this method is confirmed by a large variety of studies. It is important to note that the use of the method of connection diagrams allows equally effectively organize and store information obtained as practical and in the lectures.

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