The Application of Mind Map in the Teaching of Organic Chemistry and Chemical Technology

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Abstract

Organic chemistry is an important component content in high school chemistry course, and the scattered and miscellaneous knowledge is also the prominent feature of this part of the content. This paper mainly studies the application of mind map in the teaching of organic chemical process. In this paper, teachers and students are trained in the study of mind mapping. The teaching of mind mapping is carried out by combining the preview and the specific lesson examples of new teaching. In the subject preview, students are prepared by combining the learning plan and drawing mind mapping independently. In the new class, the teacher guides the students to draw the mind map, which is combined with the class summary. The results show that students' academic performance has been significantly improved; Students' independent learning ability and cooperative learning ability have been improved to a certain extent, and students have obtained an effective learning method.

Keywords

Mind Mapping; Organic Chemistry; Chemistry Teaching; Teaching Strategies.

1. Introduction

In the era of network, a large number of software and APPs used for information exchange make information communication more convenient. It is no longer as difficult for people to acquire knowledge as in ancient times, but also more sharing than telephone, email and other communication methods, and the cost of acquiring knowledge is reduced. At the same time, with the development of cities, people's pace of life is gradually accelerating, and the demand of enterprises for professional talents is in conflict with the allocation of less time for people to study. Therefore, it is necessary to seek a more efficient learning method to promote deep learning. Unlike a computer, which can only think in a linear or sequential way, the thinking of a human brain is multifaceted and divergent. Mind mapping is constructed in a way similar to neural network, and the learning process of the organism is formed through the change of the relationship between neurons [1]. A complete mind map consists of a core trunk and secondary branches that extend meaning, each of which is interrelated to facilitate the understanding and imagination of the mind. The more complex the mind map is, the richer the connections between different levels of knowledge are, and the stronger the overall understanding of knowledge will be for students [2]. Students can transfer from the overall understanding of knowledge and form innovative understanding and application in the new situation.

In foreign countries, the research objects of mind mapping are mainly selected in universities and middle schools. Among them, with the development of high-end talents as the main purpose, whether the application of mind mapping for college students is conducive to cultivating their innovative thinking and logical thinking [3]. The research for middle school students focuses on how to improve students' learning interest and learning efficiency with the

help of mind mapping. With mind mapping gradually coming into public view, education researchers are trying to further improve the learning method system of mind mapping from theory to practice through empirical research, taking theory as the basis of practice, verifying theoretical hypotheses with data, and combining with advanced teaching concepts [4]. Many research conclusions all point to that mind mapping has a positive effect on the improvement of students, and has a significant effect on knowledge structuring and innovation ability. In the aspect of education, there are still great differences of school-based curriculum in some areas of our country. Uneven distribution of educational resources; Therefore, to explore the practical application of mind mapping in teaching in China, we should also combine these characteristics and conduct practical research in different levels and regions to promote the development of education [5].

Through practice, this paper summarizes the specific operational steps of how to use mind map to learn in new teaching, puts forward the general teaching strategies of mind map drawing in chemistry teaching, applies mind map to teaching, and provides the corresponding reasonable teaching cases.

2. Core Concepts Related to Mind Maps

2.1. Mind Map Concept

(1) Concept

Mind Map is a way of thinking expression to change the traditional way of memory, develop human divergent thinking and tap the potential of human brain. It imitates the working mode of human brain, takes a certain central word as the core of human thoughts, uses divergent thinking to spread from the center to the periphery to form a network system, and shows the relationship between keywords at all levels by means of different graphics, lines and colors [6]. Mind mapping makes full use of the characteristics of human's left and right brains, cleverly linking words, colors, images, etc., making notes no longer simple words, and showing thinking more clearly and specifically [7].

(2) drawing method

The first step in creating a mind map is based on effective reading. Mind mapping is an external form of thinking. Effective reading obtained through the understanding and mastery of learning materials is the internal support and the key entry to draw mind mapping. Only with appropriate and effective reading, can a mind mapping with clear hierarchy be drawn [8]. To read effectively, learners must be able to understand and grasp the material, process the information in the material and absorb its connotation.

When we read a piece of knowledge, in order to draw a mind map, we first need to read the piece of knowledge, understand the content and summarize its main hierarchy.

Step two, find the key words in the material. There is only one central word of mind map. First of all, we should grasp the central word of the learning material and put the central word in the central position of mind map. The mind map will spread out in a divergent form with the central word as the center.

The third step is to extract the key words and their important contents of the learning material as the sub-central words. There is no limit on the number of sub-central words.

Step 4: Draw branches around the central word. First of all, we should clarify the relationship between the central word and all levels of keywords, take the central word as the center, expand and draw the sub-central word and the lower branches of each sub-central word, and extend to different directions. Different branches are distinguished by different colors to increase the degree of distinction of each branch in the mind map and enhance the sense of jumping.

The fifth step is refinement. The name of each key word is simplified, the branch is refined, and then the graphics and colors are added to make the mind map more vitality.

2.2. Correlation Theory

(1) Brain Science

The functional unit and basic structure of the human nervous system are neurons (also called nerve cells). The neurons used to receive stimulation, transmit and integrate information form a complex and huge network structure with each other. This complex network constitutes the system of transmitting and processing information in the human body. The mind map uses keywords and simply expresses the logical relationship between knowledge, which mobilizes the rational thinking of the left brain. At the same time, the mind map also uses images, a variety of colors and different lines, which mobilizes the visual thinking of the right brain. This allows the left and right hemispheres to work together, making the brain more flexible and efficient.

(2) Information processing

According to information processing theory, the process of information processing can be divided into four stages: attention, encoding, storage and extraction [9]. The fundamental cause of forgetting in learning is the lack of clues related to the information to be extracted in the brain, which leads to the limited amount of information extraction. According to the characteristics of our memory, if we only memorize knowledge without thinking and processing, our memory reserve will be seriously affected and the level of long-term memory will not be reached [10]. When we use mind mapping to learn, we will first of all have an effective processing of information, clear the logical relationship between each part, in this process, information has been re-edited and stored in our brain, which greatly improves our understanding and memory level.

(3) Constructivism learning

Constructivism learning theory attaches great importance to the student-centered teaching, think that students are not completely blank, but have their own unique experience and ideas, the teaching should fully consider the student's experience, when using mind map teaching, from students' own knowledge structure, draw a mind map to the independent, are the activities of the students is given priority to. In this process, teachers play a guiding role, build "scaffolding" for students, and guide them to independently understand and construct the knowledge framework. Students can personally experience the process of knowledge construction when constructing mind maps, which will be conducive to the improvement of knowledge transfer level [11-12]. If students just blindly rote memorization, can only deal with the traditional exam, but not conducive to the improvement of ability and core quality development.

(4) Schema learning

When an individual encounters a new stimulus, if he can successfully combine the new stimulus into the original cognitive structure without changing the original schema, that is the assimilation process. If he cannot assimilate, he will change the original schema and construct a new schema to adapt to the new environment, that is the adaptation process. In fact, the drawing of mind mapping is also a process of schema construction. When drawing mind mapping, the original experience is taken as the center and the existing knowledge framework in the mind is based on the expansion of the surrounding to generate new concepts and principles. The intuitive way of image and the core keywords are used to form a new illustrated schema. As we all know, visual images in learning are more vivid and highlight the theme than simple words.

3. Application of Mind Map and Experiment of Chemical Technology Teaching

3.1. Experimental Ideas

Based on the purpose and focus of the experiment, the experiment was carried out along the following lines: First, two classes with basically the same overall situation were selected and divided into the experimental group and the control group; Secondly, before the experiment, the logical reasoning ability and chemistry level of the tested subjects were tested. Meanwhile, the study interest and problem-solving ability of the experimental students were investigated. Thirdly, the conventional and mind mapping methods were used to compare and review the two classes, and the learning effect was detected to compare whether there were significant differences. Finally, combining with the specific situation of students' application of mind mapping, this paper analyzes the role of mind mapping in the review of elements and compounds in the college entrance examination and the enlightenment brought by experiments.

3.2. Subjects

In order to compare the roles and effects of mind mapping in the review of elements and compounds in the college entrance examination, this experiment is intended to be carried out in a comparative way, that is, the Grade 3 class of the same school with small overall differences is selected as the experimental subjects.

This paper selects A high school in this city, and selects Class A and Class B in the third year of high school, whose overall performance is less different, as the experimental subjects. The number of students in Class A and Class B is 36 and 39 respectively. For the convenience of experimental analysis, we took Class A as the experimental class using the mind mapping review method, and Class B as the control class still using the traditional review method.

3.3. Mind-map Strategy for Chemical Technology Teaching Application

First of all, the new lesson is introduced, and the teacher draws the central theme of the new lesson on the blackboard (if there are conditions, the computer software can be used to draw) to determine the central content of the lesson. The central theme can also be determined by asking students to work out the central theme of the lesson through discussion among groups.

Next, according to certain teaching order, the teachers will be the content of the lesson first divided into several small pieces of content, known as branch, guided by the teacher's explanation, the students and teachers to draw out the branch of the lesson, on the basis of the previous perfect every branch of the process, teachers can guide students to find out the secondary and tertiary theme, discovered the mystery of the knowledge. Give "blood and flesh" to the mind map of the "skeleton", thus endowing it with life, namely the refinement and arrangement of knowledge.

Finally, at the end of each block of knowledge, a mind map in the form of summary will be presented, and at the end of the teaching of the new lesson, the teacher will present a complete mind map of the new lesson.

3.4. Questionnaire Survey before and after the Test

Before implementation, the students of experimental class and control class are tested. The pre-test paper of chemistry subject is made according to the content of chemistry textbooks, which is used to measure the initial level of students. The topic of the test paper is related to the chemical process.

3.5. Data Statistics

In this paper, SPSS20.0 data statistics software was used to code and input the valid data obtained from the knowledge level test paper, and further reliability and validity test,

descriptive statistics, t-test, correlation analysis and regression analysis were carried out. The t-test formula used in this paper is as follows:

$$t = \frac{\overline{X} - \mu}{\frac{\sigma x}{\sqrt{n-1}}} \tag{1}$$

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{\sigma_{x_1}^2 + \sigma_{x_2}^2 - 2\gamma\sigma_{X1}\sigma_{X2}}{n-1}}} \tag{2}$$

4. Analysis of Experimental Results

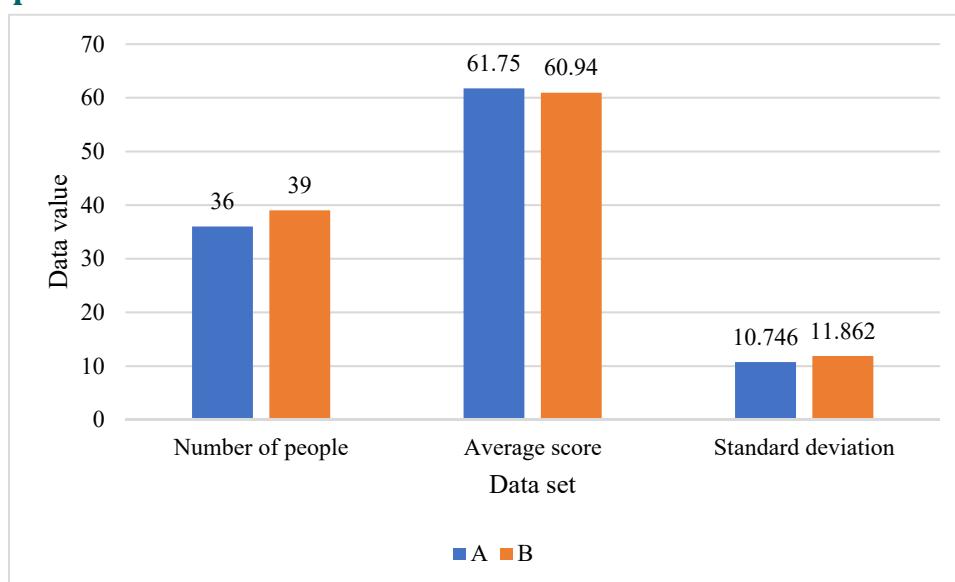### 4.1. Comparison of the Previous Test Results

Figure 1. Comparison of pre-test results between experimental class and control class

As shown in Figure 1, the average score and standard deviation of Class A in pre-test is 61.75 and 10.746. The pre-test score and standard deviation of Class B were 60.94 and 11.862. It can be seen that there is no significant difference between the two classes before the teaching experiment (T >0.05). And the number of students and the ratio of male and female is about the same, indicating that the experiment is of reference value.

4.2. Post-Test Results in Comparison

Table 1. Comparison of post-test results between experimental class and control class

	Number of people	Average score	Standard deviation	P value
A Class	36	79.12	12.4	0.02
B Class	39	73.03	13.7	

Figure 2. Comparison of post-test results between experimental class and control class

As shown in Table 1 and Figure 2, the comparison results of Class A revealed that the chemistry scores of the experimental class and the control class with or without "mind mapping" as the distinguishing standard changed significantly. On the whole, the mean score of Class B is lower than that of Class A, but its standard deviation is greater than that of the experimental class. The two classes show significant differences at the level of significance, which indicates that the use of mind mapping in chemistry learning has certain effect on the improvement of students' performance.

5. Conclusions

In this paper, empirical research and qualitative research are combined, and appropriate methods are adopted in different research stages to achieve better research results. In terms of research content, the research mainly focuses on the application of mind mapping in high school chemistry teaching. Based on the actual situation of the school and the characteristics of mind mapping, the case design is carried out in combination with the training objective of the discipline core accomplishment, and the practice is carried out in the classroom. Questionnaire survey and result comparison are used to analyze the effect of teaching practice, and then draw a conclusion and reflect on it. In general, mind mapping is useful to teachers and students in teaching and learning. It can improve students' interest in learning and thinking ability, and is conducive to their understanding and mastery of organic chemistry knowledge. In other words, the mind mapping strategy designed in this paper is effective.

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