Curriculum and Teaching Methodology (2022)
Clausius Scientific Press, Canada

DOI: 10.23977/curtm.2022.051317
ISSN 2616-2261 Vol. 5 Num. 13

Efficient Integration of Online Teaching and Visual Thinking Training in Junior High School Mathematics

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Keywords: Mathematics teaching, Online education, Visual hinking training, Efficient integration

Abstract: In mathematics teaching, teachers should attach importance to the cultivation of students' thinking ability. Especially under the current background of quality education, teachers should pay more attention to the construction of students' thinking logic. Visualization of thinking helps to strengthen students' understanding and development of knowledge, realize the processing and effective transmission of knowledge information, thus enhancing students' logical thinking and expression ability, and realizing students' all-round development. This paper takes the visualized thinking training of junior high school mathematics online education as the research object, proposes the methods and countermeasures for visualized thinking training of students in online teaching, realizes the understanding and effective transformation of knowledge, discusses the significance of the integration of online teaching and visualized thinking training, which can enhance students' logical thinking ability and expand their thinking ability, and provide valuable reference for online education and mathematics teaching.

1. Introduction

In recent years, online teaching has gradually become a mainstream way of traditional education. Under the impact of the epidemic, it has played an irreplaceable role. The online teaching mode ensures the continuity of students' knowledge education. However, online teaching also brings some problems. For example, during online teaching, teachers make textbooks into courseware intact. The lack of interest makes it difficult for students to concentrate and enter the knowledge situation [1]; The teaching form is relatively single; Online teaching is inconvenient to observe students' attention and interest, and has little binding force on students [2]. In the process of online teaching, the effective integration of thinking visualization and online teaching can intuitively show the process of mathematical thinking and the method of thinking for students by means of diagrams or combination of diagrams, attract students' attention, actively bring students into the context of knowledge, help students better master the law of mathematical calculation, realize the active construction of mathematical knowledge, and optimize the path of thinking development.

Visualization of thinking is a process of making implicit thinking explicit, showing it with graphics and other technologies, and making it clear. It includes a series of technologies such as presentation, dissemination, storage, interaction, sharing, and modification of thought graphics [3].

Presenting thinking in a visual form can more effectively promote students' understanding and absorption, thus improving the efficiency of information processing and transmission[4]. Visualization of thinking focuses on cultivating students' core quality. In daily teaching, visualization of teaching content and thinking rules is used as a means to achieve the goal of thinking with the same frequency and resonance. Common thinking visualization includes concept map, fishbone map, mind map and mind map [5]. A concept map is usually used to represent the structural relationship between concepts. A concept map is generally composed of "nodes", "links" and "related text annotations" [6]; Fishbone diagram, also known as causality diagram and Ishikawa diagram, is an analysis method used to find the essence of problems [7]; Mind mapping simulates the radiation structure of human brain neural network, which is a thinking tool based on brain science theory and visualizes divergent thinking [5]. Mind mapping shows brain thinking on specific topics in a graphic way to promote thinking development and improve teaching efficiency [8-9]; Based on semantics and cognitive psychology, mind map visualizes multilingual knowledge. It has various styles, that is, it can explore the concept of things themselves and compare different things, which is helpful to improve students' ability to solve problems [10-11].

The specific operation process of thinking visualization is shown in Figure 1.

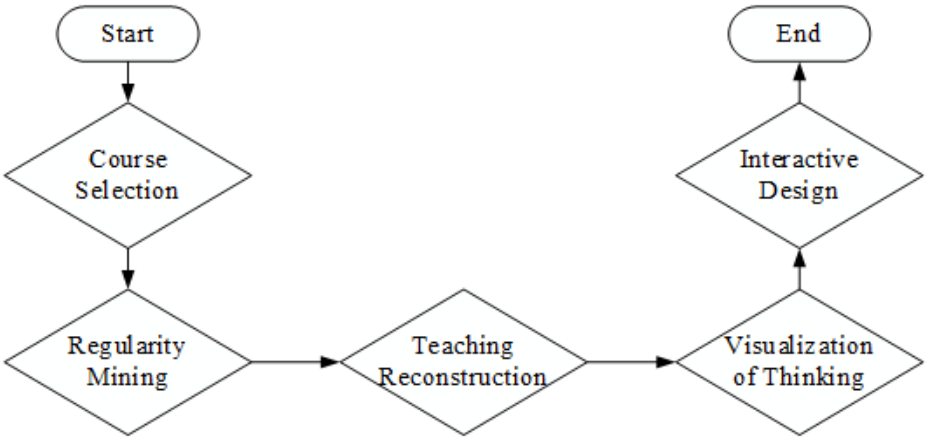

Figure 1: Flow Chart of Thinking Visualization

First, choose courses according to the content taught, and match the corresponding teaching strategies or methods, so that students can quickly integrate into the classroom teaching; Then carry out teaching reconstruction, gradually bring students into the problem situation, and lead students to actively explore; Dig out the rules, point by point, and know everything; Visual thinking, drawing students' attention, solving the problem of unsupervised online education and students' poor self-control; The last is interactive design. After students actively accept knowledge, they can guide students to actively analyze problems and deal with various difficult problems with confidence through interactive communication.

2. Exploration: the Realization Path of Online Mathematics Teaching

Visualization of thinking allows students to fully participate in the learning situation in a simple and easy to understand way, constantly improve their own learning level, actively resonate with the teacher's thinking process at the same frequency, so as to achieve twice the result with half the effort and reduce the burden and increase the efficiency.

2.1. Simplify the Classroom Teaching Process to Ensure More Accurate Classroom Teaching

In the online classroom teaching of junior high school mathematics, teachers often follow the

offline teaching mode when explaining knowledge to students, resulting in relatively complex teaching processes, unreasonable arrangement of knowledge points and other problems. This kind of teaching method seriously affects the learning effect of students and is not conducive to students' comprehensive grasp of knowledge points. Imprisoned by offline teaching thinking, some teachers will write on the blackboard in online classes, which will also consume a lot of classroom teaching time. In addition, online teaching lacks on-site supervision of teachers, so students are more likely to be distracted. The dull teaching method leaves insufficient time for students to think, and the effect of cultivating students' thinking ability is not ideal.

The use of visual thinking teaching mode transforms abstract knowledge into visual information, which reduces the difficulty of understanding mathematical knowledge, helps students understand relevant teaching content, constructs the connection between different knowledge points, and establishes the overall framework of knowledge, thus effectively improving the quality of teachers' teaching. By simplifying the relevant teaching process, the knowledge that originally required students to spend a lot of time and energy to understand can be mastered in a relatively short time, ensuring that teachers' online teaching is more accurate and effective, saving time to leave enough space for students to think, promoting students to improve their independent exploration ability, and exercising students' mathematical logic thinking.

2.2. Deepen the Communication Between Teachers and Students and Create a Teaching Environment Conducive to Thinking

The disadvantage of online education is that teachers and students cannot communicate in an all-round way, and online teaching leaves a limited time for teacher-student interaction, which leads to teachers having no extra time to ask questions of each student, and thus unable to accurately judge the mastery of students. This way makes teaching present certain limitations. Teachers should ensure the progress of the course, and explain the answers directly most of the time. The whole teaching process lacks the link of students' independent inquiry, plus the dryness and concatenation of mathematical knowledge. If the overall context of knowledge points is not formed, a little knowledge of understanding will certainly reduce students' interest in learning and the cultivation of thinking logic.

The use of visual thinking teaching can effectively change the plight of teaching. Through the analysis and application of visual mind maps, students can reduce the time they need to spend on understanding problems and provide more opportunities for communication between teachers and students; By analyzing the students' thinking ability, teachers can master the students' internal ideas, thus making the communication more clear and more directional, and creating a good classroom atmosphere and teacher-student relationship; In addition, teachers can also participate in the process of making visualization of students' thinking, answer students' doubts, summarize their views, and guide students to draw a correct visualization model of thinking [12].

3. Survey: Problems in the Teaching of Visual Thinking in Junior Middle School Mathematics

3.1. Attach Importance to Teaching Forms and Neglect the Cultivation of Students' Thinking Ability

Most educators have achieved great success in teaching learning content, but they have neglected to teach students how to think effectively [13]. They often spend a lot of time and energy on some mathematical experiments and operations. In more important thinking logic guidance, they simply introduce video and other aspects, directly transferring knowledge, the role that can really play in guiding students' thinking is not obvious. The lack of step-by-step thinking guidance for students

directly led to students' poor knowledge mastery, limited thinking ability training, and a single scene of understanding knowledge, which made it difficult to draw inferences from one instance.

3.2. Attaching Importance to Knowledge Conclusion and Neglecting Classroom Teaching Language Expression

Language is an important tool in teachers' teaching, and the application of mathematical language requires a certain degree of thinking guidance, so that students can follow teachers' teaching ideas, master knowledge, use skills flexibly, and cultivate students' good thinking quality.

Mathematics has three languages: written language, graphic language and symbolic language. In general, problem design is written language, but it is not conducive to problem solving. The answer is symbolic language, which is relatively abstract. And graphic language is the bridge between written language and symbolic language, and also the display screen of implicit thinking. However, in the actual online teaching, some teachers simply attach importance to the use of written language, and only mechanically repeat the explanation of knowledge. They rarely use some thinking guiding language (graphic language), which will reduce the quality and effect of students' learning, and will hinder the cultivation of students' visual thinking.

4. Practice: A Strategy for the Integration of Online Teaching and Visual Thinking Training

4.1. Systematic Construction to Promote the Structure of Scattered Thinking

Junior high school students have a lot of knowledge, but not all of them have strong learning ability and analytical application ability. Therefore, students usually show that their knowledge is not well mastered and there are knowledge breakpoints. Most of their knowledge reserves are fragmented and not systematic. It is difficult to form a closed loop between logical thinking and knowledge application. This requires teachers to provide students with unified education of mathematical thinking in the process of online teaching, so that students' mathematical thinking can be structurally developed, and the effect of visual thinking training can be improved.

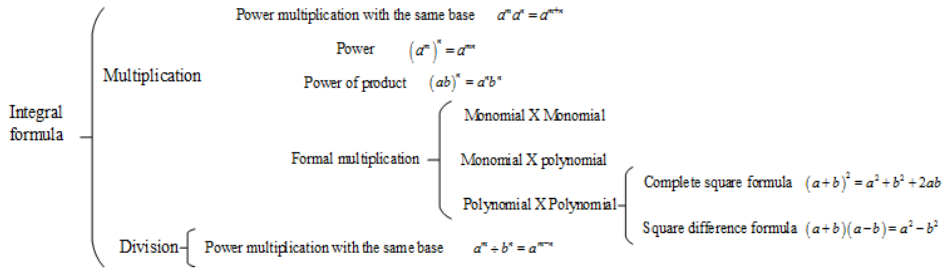

Figure 2: Integral Multiplication Mind Map

There are always close connections between knowledge points in junior high school mathematics textbooks. When teachers teach online, they should pay attention to the overall guidance of knowledge points and the horizontal connection between knowledge points to improve students' learning quality. After class, situational training on the knowledge that students understand can effectively enhance students' ability to expand their thinking. Take the chapter of multiplication of integral form as an example: there are many and similar formulas in this chapter. We can help students establish the relationship between various formulas, clarify the relationship between the superior and subordinate of various formulas, summarize and distinguish them, and visualize abstract knowledge, which can not only cultivate students' relevant thinking in learning, strengthen the foundation, but also enable students to further understand the internal relationship between

mathematical knowledge, A systematic operation knowledge system is constructed, and the integral multiplication mind map is shown in Figure 2.

In classroom teaching, after explaining all the knowledge points, teachers can also encourage students to draw their own mind maps, summarize the learned formulas, and list them in the way of mind maps. Considering the differences in the understanding and mastering abilities of students of different grades and levels, it can reduce the difficulty of drawing mind maps, such as guiding students to supplement the incomplete mind maps. The incomplete mind maps of integral multiplication are shown in Figure 3.

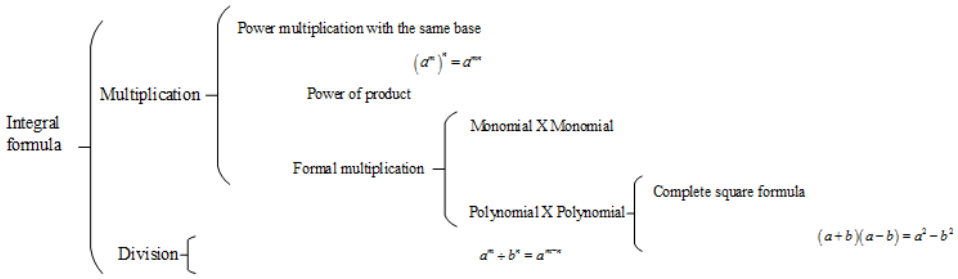

Figure 3: Integral Multiplication Mind Map

Under this teaching mode, students can effectively connect the knowledge they have learned and review it in time. It can also promote the calculation and thinking of new knowledge, cultivate students' thinking ability and strengthen the learning effect.

For another example, students are prone to conceptual confusion in the process of learning binary linear equations and unary linear equations. At this time, they can take out two kinds of equations to compare the similarities and differences. Select the double bubble chart in the thinking map, deepen the students' understanding of the concept by comparing the relationship between the two parts, and strengthen the establishment of the students' knowledge system by comparing new and old knowledge. The bubbles between the univariate linear equation and the binary linear equation represent the same points of the two; The bubbles on both sides represent their own characteristics. In this way, the similarities and differences between the two equations are clear. The double bubble diagram of the equation is shown in Figure 4.

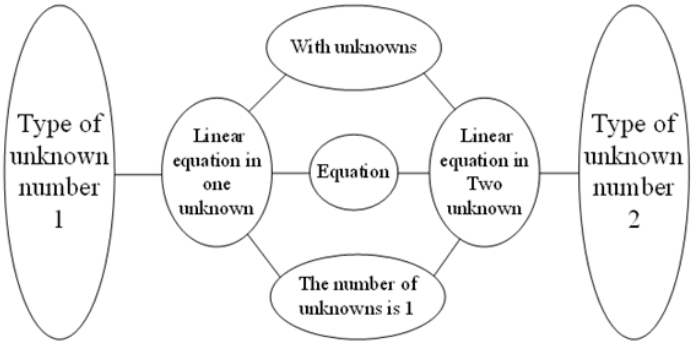

Figure 4: Equation Double Bubble Chart

4.2. Multiple Representations, Promoting the Dominance of Implicit Thinking

In the online teaching of junior high school mathematics, the focus of teachers' thinking visualization training is to enable students to see thinking and enter thinking. This requires teachers to be able to attract students' attention, enable them to participate in high-quality classroom learning and actively participate in various online teaching activities. In this way, it is more conducive for

students to implement different ways of thinking into valuable thinking achievements.

In the visual guidance of students' thinking, teachers can use the drawing tools provided by the online teaching platform to train students in thinking by drawing, so that students can recognize the idea of solving problems, find the known conditions and problems needed, and better promote students' understanding of knowledge. Take the pursuit problem in the application of the unary linear equation as an example: car A travels 50km per hour, car B travels 100km per hour, and car A starts from the same place. After two hours of walking, car B starts to catch up. Ask B how many hours after the car can catch up with A? Simply sorting out the words and language is easy to disturb the thinking. At this time, we can use the tool of diagram to make the thinking explicit. If the car B is set to catch up with the car A after t hours, the event process diagram can be drawn, as shown in Figure 5.

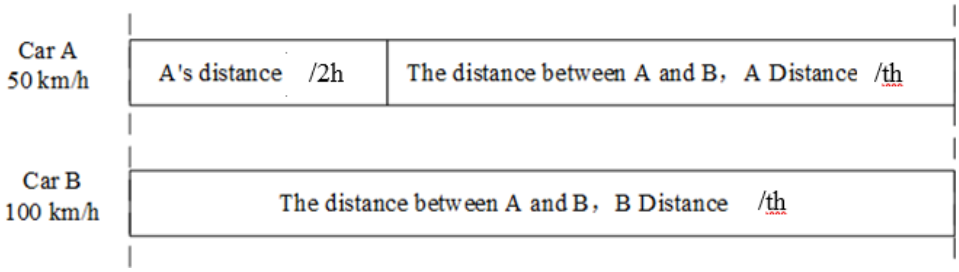

Figure 5: Process Chart of Tracing Problems

It is easy to establish an equivalent relationship through the process chart: the distance traveled by Party A in 2+t hours is equal to the distance traveled by Party B in t hours, that is, 50 × （2+t） =100t. Drawing process chart can improve students' solving speed, reduce the difficulty of knowledge and improve their thinking ability.

When explaining problems such as train crossing the bridge, teachers usually tell students that the distance from the front of the train to the rear of the train is the length of the bridge plus the length of the train. Some students said they did not understand that it was a train crossing the bridge, so why did they have to add a long train? At this time, our event process diagram plays a role again. The process diagram of train crossing the bridge is shown in Figure 6.

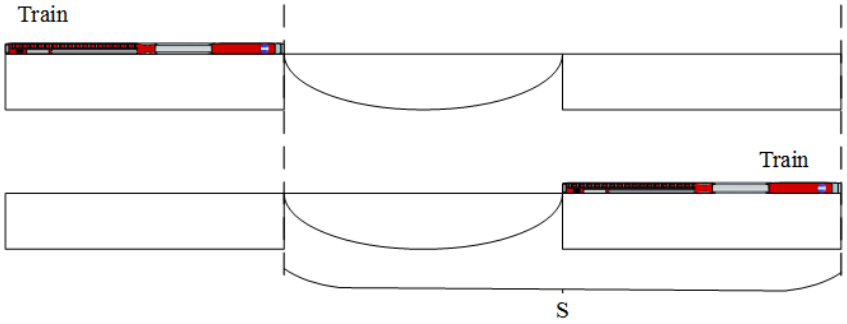

Figure 6: Train Crossing Process

In order to facilitate observation, we put a flag in the locomotive as the observation point. The moving distance of the flag is the moving distance of the train. From the above figure, we can see intuitively that the distance S traveled by the flag is the sum of the length of the train body and the length of the bridge. When learning knowledge for the first time and encountering problems, illustration can better enable students to understand various logical relationships in problems, and reproduce them in real life, so as to build the transformation and application of knowledge from virtual to real, and let students be the masters of knowledge management.

5. Practice Reflection

The combination of various methods and theories in visualization of thinking with online mathematics teaching is a very useful teaching method. In practice, two points should be paid attention to:

First, combine classes with classes. In online teaching, most students are knowledge receivers, and the time for active thinking and integrating knowledge is very limited. If there is a lack of after-school supervision and feedback, it is easy to ignore one thing and lose the other, thus affecting the quality of teaching. To this end, we can combine class and off class. In class, teachers gradually guide students to form knowledge logic through open classes, leaving time for communication and discussion with students. After class, we discuss the arrangement and expansion of problem scenarios of map with students through video conference, so as to guide students to fully and correctly understand and master knowledge, learn to be the master of knowledge, and stimulate learning interest.

Second, teachers should play a guiding role. In the process of thinking visualization, it is difficult to form a unified understanding when there are differences in students' thinking. At this time, teachers need to guide students to carry out logical exchange and collision thinking. Finally, the teacher conducts effective screening, comprehensively analyzes the students' logical thinking and thinking results, points out the deficiencies, and helps to correct them, so that students can think more comprehensively.

6. Conclusion

Nowadays, online education has gradually become an important teaching method of current national education. Therefore, we should recognize the advantages and disadvantages of online education, integrate existing resources and methods, promote the emergence, actively integrate the concept of thinking visualization, design effective teaching methods to integrate with it, stimulate students' learning desire, cultivate students' mathematical thinking ability, and better show the power of thinking, Lay a solid foundation for students' mathematics learning. At the same time, we should strengthen the interaction with students after class, complete the exchange of students' thinking and logic, let students be the masters of management knowledge, constantly enhance students' ability to solve problems and innovate in practical problems, and cultivate excellent successors for the motherland.

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