ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com

International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 8, Issue 12, December 2022

The application and countermeasure analysis of naturalization in mathematics teaching

Yumei Huang[1], Liang Fang[1,*], Xiaorong Zhu[2]

[1]College of Mathematics and Statistics, Taishan University, Tai'an, China

[2]College of Information Science and Technology, Taishan University, Tai'an, China

[*] Email:fangliang3@163.com

***Abstract*—The application of the idea of transformation, can let students know how to use the old knowledge to solve new problems, this paper mainly introduces the idea of transformation in junior middle school mathematics textbook geometry performance, and gives the idea of transformation in the process of mathematics teaching application countermeasures, as well as some specific ways to achieve effective transformation.**

***Index Terms*— Application ability, Transforming ideas, Logical thinking, Geometry teaching**

I. INTRODUCTION

The thought method of transformation is implicit in the system of mathematical knowledge and belongs to the category of logical thinking, which is gradually accumulated and formed in the process of students' thinking development. The idea of transformation needs to be gradually permeated in the concrete teaching process. The cultivation of the thought of transformation should follow certain principles, The application of the idea of transformation should also have the way and countermeasure to realize the effective transformation.[1-3].

II. THE PRINCIPLE OF THE APPLICATION OF THE THOUGHT OF TRANSFORMATION MATHEMATICS TEACHING

A. The principle of goal

The concepts, rules, formulas, properties and other knowledge of mathematics are all in the textbook, while the thought method of transformation is hidden in the knowledge system of mathematics, and appears in various chapters of the textbook systematically. How much the teacher says is more random, students can not grasp how much.

As teachers should first renew the idea, continue to improve on thought for pervasive recognition of the importance of thinking, to grasp mathematics knowledge and pervasive thinking method into the teaching goal, at the same time create knowledge aim, and the organic combination of change thinking method and matching, and the thought method teaching requirements into their lessons. Secondly, we should study the teaching materials deeply and try our best to explore the contents that can be penetrated by the methods of transformation and transformation. The teaching of the idea of transformation is designed as a whole, so that the overall planning and clear goals can be achieved.

B. *Principle of repetition*

The thought method of transformation belongs to the category of logical thinking, and students should have a development process from sensibility to rationality, from concreteness to abstraction, from low level to high level to comprehend and master it. This process is gradually accumulated and formed in the process of inspiring students' thinking, which needs to be realized after many times of repeated guidance. We should pay attention to the long-term nature of infiltration, the infiltration of students' mathematical thought and method is not overnight, the improvement of students' mathematical ability needs a process. Mathematical thought method must step by step and repeated training, in order to make students truly understand.

C. *Principle of feasibility*

The teaching of transforming thought method must be realized through the concrete teaching process. Therefore, it is necessary to grasp the opportunity of mathematical thought and method teaching in the teaching process -- the process of concept formation, the process of conclusion derivation, the process of method thinking, the process of thinking exploration, the process of law disclosure and so on.

In the teaching of the thought method of transformation, we should pay attention to organic combination and natural penetration, consciously enlighten students, let students understand all kinds of mathematical thought methods contained in mathematical knowledge, and avoid the counterproductive practices such as copying, telling the truth, and leaving reality.

III. THE APPLICATION COUNTERMEASURE OF THE THOUGHT OF TRANSFORMATION IN JUNIOR MIDDLE SCHOOL MATHEMATICS TEACHING

In order to really apply the idea of naturalization to solve new problems, on the basis of grasping the above principles, but also to find the way to achieve effective naturalization, in the process of mathematics teaching, the application of naturalization skills.

ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com

International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 8, Issue 12, December 2022

A. Convert an oblique triangle into a right triangle

For example, in an oblique triangle, a triangle is definite if its sides or angles satisfy one of the following conditions: ① the angles between the sides and them; ②The two corners and their clamps; ③The two angles and their opposite sides; ④ Three sides.

In real life, many problems are based on the oblique triangle as the background, such as finding a side of the oblique triangle, the degree of an Angle or the area of the triangle. Most of the problems can be solved by making the high line of the triangle to convert the slanted triangle into a right triangle, and then the unknown side length, circumference and area of the original triangle can be obtained by solving the right triangle. This transformation idea of "turning the slanted triangle into a straight one" is the main method to solve the slanted triangle.

B. Turn the curve into a straight line

For example, in the textbook, the typical example of applying the curve to the straight, measuring the circumference of the circle and deducing the formula of the area of the circle.The process is as follows: first, wrap the cotton thread around the coin, and then measure the length of the thread to get the circumference of the circle. Secondly, the area formula of the circle is derived by converting the circular paper into the graph of approximate linear line.

"Curve for straight line" method is especially suitable for solving the "complex stroke problem" this kind of problem, the process of some schedule problem is very complex, if consider each link, it is difficult to straighten out, but as long as we grasp the schedule of speed always remains the same, this time although movement route is more complex, the twists and turns, but as long as we are around the complex line, the curve "straight", This kind of problem can be solved.

For example, A, B and C are running an 800 meter race along a 400 meter circular track. When A runs one lap, B is 0.125 laps longer than A and C is 0.125 laps less than A. If their respective running speeds remain the same, then when B reaches the finish line,how many meters is A in front of C?

If the problem is in May be affected by annular ring figure up inquiry we will get more complex, adopt the method of curved into straight is easy to understand, the whole 800-meter run as running along A straight line, A, B, C three people at the same time the run way for 8:9:7, due to the three people running at the same time, so they have run the distance ratio of 8:9: 7. The simple proportional relationship S_A=800, S_B=900, S_C=700, and the subtraction of S_A and S_C makes the problem very easy.

C. break up the whole into parts

Breaking up into pieces means to decompose a seemingly complex problem into a number of simple and easy to solve problems, through the solution of several simple problems, to achieve the purpose of solving the whole problem.

For example, as shown in the figure, In quadrilateral ACBD, $\angle C = 90^{\circ}$, BC=2, AC=$2\sqrt{3}$, BD=3, AD=5, find the degree of $\angle CBD$.

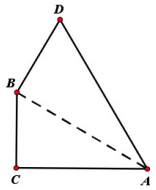


Fig. 1. Parallelogram ABCD

Analysis: Since the measure of Angle CBD cannot be solved directly, the problem needs to be transformed. By connecting AB, $\angle$CBD can be divided into two angles CBA and ABD, that is, a quadrilateral is converted into two right triangles. To find the measure of $\angle$CBD, you just need to find the measure of CBA and ABD.

It is obvious from the length of the sides that $\angle$CBA=60° and AB=4, so it is easy to determine that $\triangle$ABD is a right triangle and $\angle$ABD=90° , so we get $\angle$CBD=150° , thus solving the problem.

D. Turn complexity into simplicity

Some problems may be complicated or impossible to solve according to the general method. If we start from the particularity of the problem and find the qualified special case (such as special value, special case or special position, etc.) into a simple case, the problem will be easily solved. That is to say, when we encounter difficulties in solving a complex problem, we can start from the special case, through the way of specialization or replace the variable object with a specific concrete object, and get the special result of the complex problem, so that the problem can be easily solved. This technique is especially good for filling in the blanks and choosing small questions.

For example:

Given $\frac{x}{2}=\frac{x}{3}=\frac{x}{4}$, find $\frac{3x-5x+4x}{x-3y+2z}=$____.

The general method of this problem is to set x=2k, y=3k, z=4k, and then plug it into the formula to be calculated to get the result. This method of converting pluralism into unary element has complicated steps and is prone to errors. In this case, considering that it is a fill-in-the-blank problem, three letters are interrelated to represent general real numbers. If x=2, y=3, z=4 can replace the generality represented by letters with particularity, it can not only improve the solving speed, but also improve the correct rate. Of course, when applying the method of transformation from complex to simple, we should pay attention to the proper use of the characteristics and conditions of the problem, especially in the comprehensive problem. This special and simple method can only be used for exploring ideas, and generally cannot be used as the solution process.

E. The substitution method

By introducing new variables, the method of substitution is to connect the scattered conditions and reveal the hidden

ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com

International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 8, Issue 12, December 2022

conditions, so as to transform the original unfamiliar into a familiar form, so as to achieve the purpose of solving the problem.

IV. THE APPLICATION COUNTERMEASURE OF NATURALIZATION IN JUNIOR MIDDLE SCHOOL MATHEMATICS TEACHING

A. Delve into teaching materials and excavate the thoughts of transformation

Different from the concepts, theorems and formulas that are clearly written in the textbook, naturalization is an intangible and abstract knowledge, which is hidden behind the mathematical knowledge and scattered in the content of each chapter of the textbook. As teachers, they should first change the traditional teaching concepts and strive to integrate the transformation thought method into every link of lesson preparation. They should study the content of the textbook deeply, dig the transformation thought and method contained in it, summarize the transformation method used in the problem solving process, and refine the transformation thought contained in it. In view of each knowledge point involving the thought of Hua Gui, we should consider how to combine the thought of infiltration with specific knowledge and what degree the thought of infiltration should reach finally. In this way, when carrying out specific teaching, we can achieve organic combination and natural penetration, consciously enlightening and guiding students, so that they can discover and comprehend the transformation thoughts hidden behind mathematical knowledge.

B. The process of integration in specific cases

In teaching, the following problems often appear: the topic has been explained many times, but the students are always at the level of imitating the problem. If the conditions change, the students will be confused, unable to properly use the method of transformation to solve the problem. Therefore, in the teaching process, the teacher should not only explain the topic, but also give methodological guidance to the same kind of topic. Teachers can use many methods, such as concept research, theorem, problem solving, knowledge review, etc., to guide the ideological activities of the transformation. Teachers show the thinking process of transformation to the students when they talk about the problem. For the explanation of theorems and formulas, the transformation thinking process should be explained clearly and thoroughly, because the proof process of some theorems is very good transformation example problems. Showing the proof process of theorems to students and pointing out the transformation thought contained in theorems can effectively promote students' thinking and knowledge transfer and improve their problem-solving ability and performance. .

C. The new and old knowledge is taught using spiral in-depth method.

In teaching, after finishing the study of a certain chapter, we can add the practice of training the naturalization method to consolidate the naturalization method and strengthen students' application of the naturalization thought. The object of normalization, the object of normalization and the method of normalization are three elements in the process of normalization. New problems can always be replaced with old ones that are easy to solve, generating new knowledge in the process of replacement. Sometimes, the goal of naturalization is relatively hierarchical, which should be defined according to the requirements of specific problems, so that the thinking method of naturalization is gradually rooted in students' thoughts. [7] examined the development and refinement of possible mathematical models for the intellectual system of career guidance. Mathematical modeling of knowledge expression in the career guidance system, Combined method of eliminating uncertainties, Chris-Naylor method in the expert information system of career guidance, Shortliff and Buchanan model in the expert information system of career guidance and DempsterSchafer in the expert information system of career guidance method has been studied. The algorithms of the above methods have been developed. The set of hypotheses in the expert system is the basic structure of the system that determines the set of possible decisions of the expert system. This set, which is crucial in decision-making, should be sufficiently complete to describe all the possible consequences of situations that arise in the subject area. Therefore, it is important to improve the mathematical models of the intellectual system of career guidance. [8] discussed that according to the observations in this paper, an existing mathematical model of banking capital dynamics should be tweaked. First-order ordinary differential equations with a "predator-pray" structure make up the model, and the indicators are competitive. Numerical realisations of the model are required to account for three distinct sets of initial parameter values. It is demonstrated that a wide range of banking capital dynamics can be produced by altering the starting parameters. One of the three options is selected, and the other two are eliminated. The model is generalized taking into account fractional derivatives of the bank indicators for time, reflecting the rate of their change. Based on numerical calculations, it is established that reduction of the order of derivatives from units leads to a delay of banking capital dynamics. It is shown, that the less the order of derivatives from the unit, the more delay of dynamics of indicators. In all analyzed variants indicators at large times reach their equilibrium values.

D. Repeatedly reproduced, in-depth return to the idea

The main way for students to learn mathematics is to solve problems, which is also an important means for teachers to teach mathematics. In the process of actual problem solving, we may repeatedly use the idea of transformation, but each time the direction of transformation may be different, which requires teachers to make students understand the three elements of transformation: object, purpose and method. In the process of actual problem solving, teachers should establish the scene of different problems and adopt appropriate means for transformation. As mathematics

ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com

International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 8, Issue 12, December 2022

knowledge is gradually deepened, the thought of transformation has a certain level. Therefore, the teaching should pay attention to its application in different knowledge learning stages, guide students to jointly explore the formation process of transformation thought in different knowledge stages, and guide students to expand their thinking, deepen their understanding and strengthen their memory.

As for the teaching of naturalization thought, teachers should consciously inspire and permeate the mathematics knowledge if it contains naturalization thought. In addition, they can also add training courses on naturalization thought during the final review process. For example, after the review of the chapter of rational numbers, they can add a training course on solving problems with naturalization thought. Experience the application of the thinking process of transformation and consolidate the study of transformation. After many such training, the thoughts of transformation gradually go deep in the minds of students. The study of naturalization is a long process. In the future teaching, students should be guided to use naturalization to solve more complicated calculation and geometric figure problems.

E. Reflect on the nature of the problem and guide the students to sort out the transformation process and find the key points

Reflect on the nature of the problem, improve the degree of abstraction of thinking, and cultivate students' good habit of reflection. In a mathematical problem, the forms of interdependence and interrelation between the main elements are variable, and the solutions are varied. But, in general, there is a higher level of mathematical thinking at work. Therefore, we must, according to the information provided by the problem itself, make use of dynamic thinking and analyze the problem on a case-by-case basis, to seek for the path and method of transformation that is conducive to the solution of the problem. Especially after solving the problem, we should get used to going back to analyze the essence of the problem, inspire students to find the connection between knowledge points and explore the general law, which can not only deepen the problem, but also make it easier to grasp the essence of the problem, and improve the degree of abstraction of students' thinking. Therefore, after learning part of the content, teachers should first reflect on the knowledge, clarify the context of knowledge, and then share the results with students.

F. Attach importance to the connection and synthesis of knowledge, and constantly improve the structure and network level of knowledge

On the one hand, the presentation of junior middle school mathematics textbooks is based on the law of students' cognitive development, on the other hand, it also reflects the internal connection of mathematics knowledge. Vertical connection generally refers to the connection of knowledge in chapters; Horizontal connection generally refers to the knowledge connection between chapters and disciplines; Network connection, network connection generally refers to the vertical and horizontal comprehensive connection. This connection is the most important connection between mathematical knowledge. In addition, we can self-construct individual knowledge networks based on certain connections. For example, we can construct the knowledge network of junior high school with the method of naturalization thought with high abstractness. This requires us to find out the content contained in the thought method and analyze the connection between these knowledge. Based on the content of rational numbers, algebraic expressions and equations, we construct a chart which is governed by the method of transformation.

Throughout the mathematics textbooks of junior high school, there are many knowledge blocks that can form such a network, and teachers can intentionally arouse students' attention to the links between knowledge in ordinary teaching. For example, when learning new knowledge, recall the old knowledge related to it, or after learning part of knowledge, analyze and compare with other knowledge to establish the connection between knowledge, which plays an important role in forming the structured and networked knowledge structure of students and promoting the formation of students' comprehensive ability.

V. CONCLUSION

This paper introduces three application principles of naturalization thought: objective principle, repeatability principle and feasibility principle, and analyzes the application of naturalization thought in junior middle school mathematics teaching through examples, and gives the countermeasures of application of naturalization thought in junior middle school mathematics teaching..

ACKNOWLEDGMENT

This paper is supported by Shandong Province Undergraduate University teaching reform research project

“Research on the development of core literacy of normal school students (mathematics) based on the integration of Excellent Teacher 2.0 into curriculum ideology and Politics” (M2020183), Taishan University 2021 Annual Teacher Education Research Project "Theoretical and practical research on the cultivation of Middle School students' Mathematics core literacy"(JY-01-202139), and Taishan University 2020 Annual Teacher Education Research Project "Research on the Core Literacy Cultivation of Primary and Middle School Students from the Perspective of STEM Education"(JY-01-202011).

REFERENCES

[1] Y.Y.Su, “How to cultivate elementary students' mathematical abstract thinking ability,” *Mathematics Teaching Newsletter*, vol. 9, pp. 87-89, September 2019.

[2] J.X.Li, “The cultivation of mathematical abstract thinking,” Dajiang Weekly Forum, vol. 10, pp. 172-173, October 2012.

ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com

[3] H.Zhang,"How to cultivate students' abstract thinking ability in Mathematics teaching," *The middle school teaching*, vol.5, pp. 97-98, May 2015.

[4] P.Yang,"Evolution of Teachers' teaching methods under the Background of New Curriculum Reform,"M.S. thesis, Dept. Education. Eng. Shandong Normal University, Shandong, China, 2016.

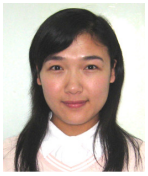
[5] L.L.Zhang, "On the cultivation of students' mathematical thinking ability," *Reference for Middle school teaching.*, vol. 32, pp. 23-24, October 2010.

[6] Z.C.Zhang,"The Certain Research on the Training of The Abstract Thinking Ability Based on The High School Mathematics,"M.S. thesis, Dept. Education. Eng. Fujian Normal University, Fujian,China, 2012.

[7] Christo Ananth, A.R. Akhatov, D.R. Mardonov, F.M. Nazarov, T. AnanthKumar, "Possible Models and Algorithms for the Intellectual System of Professional Direction", International Journal of Early Childhood Special Education, Volume 14, Issue 05, 2022,pp. 4133-4145

[8] Christo Ananth, N. Arabov, D. Nasimov, H. Khuzhayorov, T. AnanthKumar, "Modelling of Commercial Banks Capitals Competition Dynamics", International Journal of Early Childhood Special Education, Volume 14, Issue 05, 2022,pp. 4124-4132.

Authors' biography with Photo



Yumei Huang is a lecturer at Taishan University. She obtained her master's degree from Shandong University of Science and Technology in July, 2008. Her research interests are in the areas of applied mathematics and mathematics education in recent years. email id: huangyumei125@163.com

Liang Fang was born in December 1970 in Feixian County, Linyi City, Shandong province, China. He is a professor at Taishan University. He obtained his PhD from Shanghai Jiaotong University in June, 2010. His research interests are in the areas of cone optimizations, numerical analysis, and complementarity problems.

Xiaorong Zhu (1979-), female, master, associate professor, Taishan University, research interest: mathematics education. (Tai 'an 271000, Shandong, China)