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The Introduction of Native Knowledge in Mathematic-Teaching in Ethnic Elementary and Secondary Schools—Based on the Theory of "Cultural Discontinuities"

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Ethnic students will face the problem of "cultural discontinuities" when they learn school mathematics. "Cultural discontinuity" is the main obstacle when they learn school mathematics. Teachers should put up the bridge for introducing ethnic mathematical knowledge into school mathematics teaching. The concrete tactics are: widening ethnic mathematical curriculum, designing ethnic cultural situation and returning to ethnic mathematics life.

Keywords: ethnic elementary and secondary schools, cultural discontinuities, ethnic mathematical knowledge, introduction

Introduction

Since mathematics was created, it has been regarded as a kind of knowledge which is objective, rational and accurate, not connected with people's understanding, but universal. But as the theory of "Ethnic Mathematics" was put forward, the objectivity, the value neutrality and the universality of mathematics are deeply questioned and criticized. We gradually recognize that mathematics is not only subjective, but also cultural. That is to say, mathematics is a kind of culture. Based on the theory, different minorities have different mathematics. So ethnic students will face the school mathematics, which is different from their own when they learn mathematics at school. Thereupon, ethnic students will face how to deal with the conflict between the ethnic mathematical culture and the school culture so as to obtain connections among different cultures.

School mathematics and ethnic mathematics are produced from different cultures, and are two kinds of objective existence. School mathematics is the mathematics of school curriculum, which was developed from the ancient Greek culture (ZHANG, 1996), and developed in the Han culture. It is considered to be objective and universal. The systemic, the logical rigor and so on are emphasized. In the broader sense, compared with other countries' mathematics, school mathematics of our country is also a kind of ethnic mathematics. But in this essay, it is about the ethnic mathematics except the mathematics of the Han.

Ethnic mathematics is developed from different cultures, and is contextual. Ethnic mathematical culture can be considered as "the colligation of thinking mode of mathematics and the practical knowledge system existing in the culture of a community" (XIA, 2000). Analysis from the angle of cultural anthropology, ethnic students have the mathematics of their own before they go to school because of their different cultural backgrounds. That is to say, ethnic students' mathematical knowledge is based on their own cultures. So they

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are in the different backgrounds of cultures when they learn school mathematics, which produces "cultural discontinuities". "Cultural discontinuity" is the generalization about the conflicts and the fractures between the original culture and the heterogeneous culture, which arise the incompatibility phenomenon of culture. It manifests as the disjunction between ethnic mathematics and school mathematics. Thus, it causes maladjustment of ethnic students in learning school mathematics, and furthermore influences ethnic students' learning of school mathematics and experience.

The theory of "cultural discontinuities" was put forward by American educational anthropologist. It holds that, every minority has its own culture, and every ethnic culture is suitable; the achievement of the children of the immigration and the ethnic group is bad completely, because there is disjunction between the school education they receive and their own culture. School education design should fully consider the backgrounds of the students' cultures (LI, 2004). The theory of "cultural discontinuities" offers beneficial enlightenment for us to study how to introduce ethnic mathematical knowledge into school mathematics teaching.

There are 55 ethnics in China, and different minorities have different understandings and expressing forms; different understandings about mathematics and different representing modes form different cognitive structures and mathematical thinking modes. Thus, it makes ethnic students' mathematical abilities quite different (WANG & LU, 1999). So only when the efficient connection is established between ethnic mathematics and school mathematics can it be beneficial to the enhancement of ethnic students' cognitive abilities and school teaching quality.

School Mathematical Teaching Situation in Ethnic Elementary and Secondary Schools

Every ethnic mathematical knowledge responses its own unique cultural connotation, production and life style, unique mathematical thought and thinking modes. If one ethnic mathematic is taken as the standard knowledge for school curriculum, it must cause big problems for other ethnic students to learn and use mathematical knowledge. So in terms of reality, the knowledge of native mathematics should be embodied in ethnic elementary and secondary schools, but in terms of solid however, the knowledge of ethnic mathematics is a seriously lack. It exhibits two sides: (1) lack of ethnic mathematical textbooks; and (2) lack of ethnic mathematical knowledge in mathematics classroom teaching.

Lack of Ethnic Mathematics in Textbooks

In China, the three-level managerial system of curriculum "national curriculum, local curriculum and school-based curriculum" is carried out in the New Curriculum Reform. The purpose is to break the monopoly situation of the national curriculum in the past, and let the curriculum attend to different areas, different levels and different needs of different nationalities, but we found from the survey about the mathematical textbooks they use that, they all use the national mathematical textbooks. Although many ethnic elementary and secondary schools use ethnic mathematical textbooks, most of these ethnic mathematical textbooks are the "translations" of the national mathematical textbooks; although some of them develop their own "school-based curriculums", in fact, the curriculums are the extension of the national mathematical textbooks. For example, some schools take the summery of the important mathematical points or the exercise books they compiled as school-based curriculum. A survey about the development of local curriculums in Miao area in Guizhou showed that 84.2% of the teachers used national curriculum, 14% of the teachers used local curriculum and only 9% of the teachers used local textbooks which were compiled by themselves. And the content of local textbooks is unitary. In elementary schools, they mainly compile some ethnic Chinese or mathematical

textbooks used as instrumentality; in secondary schools, the local textbooks mainly concern local history and geography, but other social resources, such as cultural resources and natural resources are not fully excavated and used (LIU, 2005). We can know that the ethnic mathematical textbooks are lacking.

Ethnic mathematical knowledge and the characteristics of ethnic mathematics are not embodied enough. So the ethnic students can hardly form the connection between ethnic mathematics and school mathematics, which makes it hard for the ethnic students to study school mathematics and makes the ethnic students lose heart.

Lack of Infiltration of Ethnic Mathematical Knowledge

In the survey for some of ethnic elementary and secondary schools in Southwestern China, the author found that the setting course, teaching plans and teaching methods are the same as those for the Han students, and ethnic elementary and secondary schools mainly offer courses according to the plan of national curriculum. They mainly care about students' marks. In the course of teaching: firstly, teachers only teach textbooks. That is to say, the national mathematical textbooks are the only books for teaching ethnic students mathematics. They have no other referring books about ethnic mathematical knowledge, the ethnic mathematical history, and so on; secondly, teachers only care about the training of methods, skills, formulas, and the deducing of axioms, etc. They pursuit universality and unity, and ethnic mathematical knowledge is not embedded. Facts provide that the school mathematical teaching and the training of mathematics that cut off students' culture can not arouse ethnic students' interests, even make them feel fear about school mathematics because of their failure in learning school mathematics, and make them give off learning mathematics; finally, their failure in learning school mathematics even affect whole learning achievement.

Of course, some teachers attempt to infiltrate ethnic mathematical knowledge into school mathematical teaching organically, but they "bring ethnic knowledge, the ethnic spirit, ethnic life into classroom teaching on purpose is still an individual and occasional phenomenon. And it is not only lack of purpose and pertinence, but also is casualness" (JIN, 2008).

Exploration of Introduction of Ethnic Mathematical Knowledge

The students of different cultures need different mathematical curriculums and teaching methods. School mathematical curriculum must fully consider the event trace of human beings in the course of mathematical development, press close to life, communicate continuously the mathematics in life with the mathematics in textbooks, let life and mathematics fused as one" (The Department of Basic Education of Ministry of Education, 2002). Teachers should consider ethnic students' traditional ideas and backgrounds of culture, infiltrate the ethnic mathematical concept into mathematical teaching, and pay attention to students' social and cultural factors. And this kind of cultural facts should include all the styles injected into the learning environment, such as the understanding of mathematics, the content of curriculum, classroom culture, mathematical learning style, etc. (Shehenaz, Wifredo, & Bill, 2003).

The Expansion of School Mathematics

Curriculum is the vector of culture. Students of different cultures have their own mathematical knowledge structures and mathematical cognitive styles before they go to school. So, the most efficient curriculum for ethnic students is the curriculum which is developed from their own culture and connected closely with their life experience.

Firstly, excavate ethnic mathematical achievements. Different minorities have created and accumulated a

lot of mathematical achievements, formed different mathematical thoughts and mathematical methods, and have their own mathematical histories. These are important materials for us to develop ethnic mathematical curriculum. We must go out of the misunderstanding that mathematics has no cultural attribute, excavate ethnic cultural connotation of mathematics, embody the internal connection between mathematics and the national development of mathematical curriculum, reflect different mathematical thoughts and mathematical methods, unfold ethnic mathematical history. We can develop ethnic mathematical textbooks (for example, compile the stories about ethnic scholars in mathematics) from the angle of ethnic mathematical history which can add interest to school mathematics, let ethnic students appreciate the charm of their native mathematics, and form the relation between ethnic mathematics and school mathematics so that they can understand the school mathematics best; developing mathematical textbooks from the angle of the mathematical cognitive structures can enrich the content of the mathematical textbooks, let them integrate school mathematics and their native culture as one, and enhance the interest and the ability of inquiry; excavate and collate ethnic mathematical thoughts, concepts, methods, and so on, and integrate them into school mathematics. This will be benefits for enhancing the mathematical ability of ethnic students.

Secondly, carefully choose mathematical materials in ethnic life. Different ethnics created different mathematical symbols in different periods of history. So, the mathematical curriculum resources which are connected with ethnic students' unique understanding should be brought into the school mathematical curriculum, such as ethnic mathematical games, unique methods of measures, etc.. It can make ethnic students form close and inherent relation. The curriculum resources which are connected with the unique cognition of mathematical symbol, memory, application of ethnic students should be brought into the system of school mathematics.

The Design of Ethnic Cultural Context

The research on cross-culture showed that there is great difference of achievement between ethnic students and the Han students no matter in central city or remote areas; the facts that affect the achievement of ethnic students is not the genetic facts—ethnic facts, but the acquired facts, which are the facts of region, religion, language, the custom of life and so on (FANG, 1996). In other words, ethnic students face the problem of "cultural discontinuities" when they learn school mathematics, and the tendency of culture is the right basis of our understanding the cognitive structure and the thinking mode for mathematics, and the starting point for us to introduce ethnic mathematical knowledge into school mathematics.

So, teachers should explore suitable cultural facts, analyze them, choose the facts that are suitable to be integrated into mathematics teaching, and then create interesting stimulation to help students develop their potentiality (Palus, 2001).

Firstly, use "native concept" in teaching. "Native concept" is the concept which is often used to express their styles of understanding the world by the native (CHEN, 2000). Different minorities have their own languages so they have their own ways of expressing numbers. The language structures of some minorities are quite different from the Han's. Some ethnic grammatical structures, especially the word orders are different from the Han's. For example, the reading and the writing of numbers of the Wa are different from the Han' s, which easily make the Wa's students misunderstand the meanings when they learn the concepts, the theories and the rules. School mathematics must be taught on the basis of "native concept" of the Wa. So, in teaching school mathematics, teachers should be clear about the corresponding concept in ethnic mathematics, then compare the concept with that in national textbooks, explore the fixed facts, and form inherent connection

between school mathematics and ethnic mathematics.

Secondly, suitable translation. The language of ethnic mathematics is quite different from that of school mathematics. When teachers use the language different from students' mother languages in teaching school mathematics, students' learning and thinking will be affected greatly. "At the time, one of the best the ways is to find suitable translation between nominal terms and native language in mathematics" (WANG & ZHANG, 2001). For example, the Wa expressed the concepts one to ten is: die (1), la (2), lu (3), bang (4), peng (5), li (6), ha li (7), tu die (8), tu deng (9), gao (10); the structural laws of eleven to nineteen is to add suffix: die (1), la (20), lu (3), and so on; and they are read as: gao die (11), gao la (12), and so on (YU, 2008). But some ethnic languages are not richer than the Han's in expressing numbers. For example, there is no words to express the numbers behind "thousand" in the Wa language, and there is only the single way of calculation. According to this, loan words need to be introduced and interpreted suitably.

In summary, mathematics teaching in the ethnic elementary and secondary schools should base on the civilization of minorities, use the mathematical knowledge that ethnic students can understand, explore problems that embody ethnic character and local character, let students feel familiar with them, stimulate students' interests of learning mathematics and creativity.

Returning to Life

Ethnic students use ethnic mathematical knowledge in everyday life. So, ethnic students have much mathematical knowledge and experience before they come to school, but the cultural background of school mathematics is quite different from their own. If the difference is not eliminated, it will cause psychological burden in their learning of school mathematics, and affect their mathematical achievement. Thus, ethnic mathematics teaching should not be the course of mechanical inculcation and the training of abstract thought. It should be based on ethnic students' everyday life, and connected with students' real life; the actual life should be the bridge of introducing ethnic mathematical knowledge into school mathematics teaching. This is also one of the concepts of the New Curriculum Reform.

Firstly, vivification of school mathematics. Vivification of school mathematics is to educe the content of school mathematics from students' everyday life, help them form mathematical significance. Concrete tactics are: (1) Represent abstract content by using examples of life and vivid language, help students understand mathematical concepts and rules (XIE, 2005). For example, horses, yaks, yurts, towers, temples, and so on, can be used for Tibetan children to learn numbers and geometric figures; (2) Introduce new mathematical knowledge creatively by guiding students to find problems which are based on their mathematical actualities; and (3) Explore mathematical materials in students' life and guide them on finding mathematical problems.

What needs to be emphasized is that the vivification of school mathematics does not mean that we regard ethnic mathematical teaching as ethnic students' everyday life. It emphasizes that we should teach school mathematics basing on students' experience of life so as to help ethnic students learn school mathematics better.

Secondly, it should offer context in teaching school mathematics. A certain education must be carried out in certain context. Only when a certain curriculum roots from educational context of areas and schools, cares about the difference among areas and schools, can it make the good results (JIN, 2008). Generally, ethnic mathematical knowledge exists in production and everyday life. The mathematical ideas and methods are always covered up by specific context, and they have no universal applicability and norms, such as count, measure, location, mathematical games, timing, etc.. But they are the important facts which can make students

learn school mathematics better. Then, vivid and interesting context can be designed as: (1) offering real learning context. Learning context should be connected with students' real life, and the real learning context should be familiar to students. For example, Mongolian deer chessboard is made up of the figures of triangle, square, round shape, regular hexagon, regular octagon, and so on. Deer chess is a favorite game of Inner Mongolian students. If it is brought into school geometric teaching, it can improve students' interests in school mathematical learning; (2) offering context for solving problems and real tasks, let students solve complicated mathematical problems; (3) offering context for cooperation, let students expose real mathematical thinking and experience mathematical developing course; and (4) forming dialogue mechanism, let students and teachers question each other; teachers respect student's individual difference and creativity, encourage them to interact and commutate (XIE, 2009).

Thirdly, explore methods suitable to the ethnic students' thinking modes. School mathematics cares more about training students' thinking, but ethnic mathematics is apt to practical application. Thus, ethnic mathematical teaching should pay attention to the essence of ethnic culture, explore teaching methods originated from ethnic culture, care about the adaptability of ethnic culture to teaching methods, and subtract the bad influence brought by "cultural discontinuities" (LI, 2004).

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