Activation of Comparative Studies on Mathematics Education

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Activation of comparative studies on mathematics education is discussed. Some related researches are reported on. Some suggestions for effective research are given.

1. INTRODUCTION

Human beings develop shared cultures, and each nation has its own unique culture. In ancient times, exchanging and sharing ideas and information among the cultures or races was difficult for various reasons. Such a situation made cultural development slow and sometimes resulted in evaporation of some cultures. But, nowadays thanks to fast and convenient communication and transportation systems, sharing information has become easy. This makes it possible for some cultures to grow fast. All countries in the world are so close to one another. They can efficiently cooperate to pursue the common prosperity.

Korea is attempting to accept such changes and trends with the *Segehwa* (: globalization) policy. In fact, Korea is trying to support global prosperity and cultural development with other countries through understanding the world and helping the world to understand Korea.

However, the language barriers among the countries and races still exist as obstacles to the fluent communication in the world. But in mathematics, such obstacles are not a serious problem. Mathematics is characterized by its symbols and notations commonly used internationally. That's why mathematics is considered as an international language. Furthermore, mathematics plays a remarkable role in cultural development. It is important to develop mathematics and hand it down to the following generation. Mathematics is not only an object of common interest, but also a convenient method of international communications.

In these days, new plans and methods are needed in mathematics education because of environmental changes. Ethnomathematics [11] and the study on the

relation of history and pedagogy of mathematics [7] are such examples. In ethnomathematics, the tech-niques developed in different cultures are studied to explain and to understand their sociocultural environments. Part of the basic background for ethnomathematics is the fact that culture and cognition are strongly related. The relation between culture, history, and mathematics is investigated. Ethnomathematics is one of the study areas of the International Study Group on the Relations between History and Pedagogy of Mathematics (HPM), an affiliate of ICMI. The active research in HPM makes it possible for each race to take pride in its own mathematics. Even though current mathematics has been deeply influenced and led by Western countries, China, for example, has her own culture (Confucianism, for example) and her own mathematics. We can't deny that Chinese mathematics has contributed to the current mathematics.

The interest in multicultural mathematics education [15] is noticeable in America and Australia where various races live together. Since migrating among races became easier and more frequent, the number of classrooms of multicultural students is growing fast. To cope with such a situation, we have to understand and respect each culture, and we should look for the methods to teach such groups more effectively. This may be a crucial problem in multicultural mathematics education.

We also note that one of the main trends in mathematics education is the sociocultural perspective that stems from Vygotsky. It can be considered as complementary to the constructivism, which resulted from Piagetian theory [9]. In the sociocultural perspective, it is assumed that cultural and social processes are integral to mathematical activity. Recently the notion of sociomathematical norms has been introduced as the normative aspects of classroom discourses that are specific to students' mathematical activity [14].

In this article, we discuss the need for the activation of comparative studies on mathe-matics education for similar purposes to those of the recent movements in mathematics education mentioned above.

2. The Need for Comparative Studies on Mathematics Education

In education, the significance of comparative study has been adequately confirmed. In fact, lots of comparative research has been performed. Through comparative studies, we can observe the changes and innovations in each country's educational system, curriculum, contents of textbook, teaching-learning methods, teaching materials, and assessment methods. Scientific technology is not limited to a sole

nation, and it is progressing rapidly. Mathematics education must keep up with such changes. Sharing various perspectives and experiences with other nations, we can set up proper goals for mathematics education. Through the various comparative studies, we can accumulate enough referential information, which is useful in reforming or developing mathematics education. Bereday [6] also lays stress on the necessity for comparative studies.

The Third International Mathematics and Science Study (TIMSS) reported that a comparative study on education of mathematics was conducted in about 50 countries [12]. The goal of TIMSS is to measure student achievement in mathematics and to assess some factors that influence student learning. In his e-mail [5], Jerry P. Becker claims that *solid curriculum and strong teaching outweigh negatives in mathematics and science learning*. His claim is based on the TIMSS results. We also remark that the TIMSS report emphasizes the need for enough data and for further research.

The twelve members of Asia-Pacific Economic Cooperation (APEC) have a survey conducted on levels of achievement in mathematics and on related issues in education in the Asia-Pacific Region [8]. This survey is mainly concerned with:

· How educational standards are established and assessed.
· What current programs exist for assessing students' performance in mathematics.
· How these programs cater to the needs of all students.
· How teacher training is developed in the Asia-Pacific region.

This survey is a result of recognizing the need of comparative studies among APEC countries.

As mentioned before, mathematics can be thought of as an international language since it is less influenced by language barriers among nations. Thus mathematics and mathematics education are good topics which deserve active comparative studies. On the other hand, East Asian nations including Korea, China and Japan are enjoying similar cultures and languages. They have made and are making efforts to get acquainted with western languages, English in particular. This means that they are ready to study comparative education effectively. This fact is one of the reasons why the East Asian nations should lead the comparative study on mathematics education in the world.

3. Some Examples of Study in Korea

Comparative studies between adjacent nations have been conducted. For example, systematic research has been conducted in Arab States [4], and a similar research in

Philippines [13]. In Korea, several comparative studies on some nations were carried individually by some researchers. For example, a comparative study about the textbook policy of all kind of subjects and content structure has been carried out by Korean Education Development Institute (KEDI) [1]. Mathematics was included there. But the first systematic and thorough comparative study of mathematics education has been initiated only recently. We'd like to report some of the studies conducted and future plans in Korea.

1. Comparison of Korea and Russia on elementary and secondary education of mathematics

Since mathematics and mathematics education of Russia is on the high level, it is an interesting research topic for us. This study has been conducted since 1987 on the educational system, mathematics curriculum, and textbooks. In particular, the education system of   [16] proposed in 1992 as one of the educational reforms and some trends for elementary education development suggested by
[17] give us some ideas for mathematics education in Korea.

2. Comparison of Korea, America, and Russia on gifted education of mathematics

Gifted mathematics education of America and Russia is notable. These two nations' gifted mathematics education has a considerably long history and much know-how. Nowadays Korea is very interested in gifted education. So, we have studied the criteria and methods for the selection of gifted students, contents of subjects, and teaching methods of these two countries. The main institutes we were interested in are Kolmogorov School of Moscow State University in Russia and North Carolina School of Science and Mathematics in America.

3. Mathematics education in elementary, secondary, gifted school in China

Recently, many nations of the world are interested in China. In particular, the mathematics education of China deserves some attention. We hope to overview Korean and Chinese mathematics education in parallel in the near future.

4. Mathematics education in elementary, secondary, gifted school in Japan.

Japan is a highly advanced nation. Korean people are interested in Japan. As a result, there have been studies on Japanese mathematics education. These efforts will continue. Recently, we have noticed that many problem-posing methods are carefully included in Japanese mathematics textbooks [2]. From this fact, we can get some suggestions for Korean mathematics education. ICMI-EARCOME 1 will be held in

Korea in 1998, and ICME 9 in Japan in 2000. For the success of these two conferences, Korean and Japanese mathematical colleagues have to contact each other more closely. In preparing for these conferences together, we can understand related fields as well as the mathematics education of each other.

5. Mathematics education in elementary, secondary school in North Korea and Yanbian.

Most Koreans live in one of the three regions: South Korea, North Korea, and Yanbian area in China. They have different cultures and different social systems. But as parts of same race should understand each other's mathematics education and share common development with cooperation. We cordially ask North Korean and Chinese mathematics societies to cooperate with us for the common prosperity of our mathematics education.

6. Mathematics education in other nations (Southeast Asian countries, European countries, Canada, Australia, Singapore, Israel, Spain, India, etc.)

We'd like to do researches on other nations' mathematics education. At present, Korean researchers are studying German, French, Dutch, Spanish, Israeli, Arabic, Indian, as well as the English language. When we feel more ready, we are going to begin studying the mathematics education of those countries.

7. Comparative studies in the areas other than curriculum

We can come up with many meaningful results through comparative studies on the teaching methods, assessment methods, and in-service teacher-training etc. besides on curriculum. A project has recently been proposed by a research group consisting of Korean and American mathematics teachers [10]. In the project, the researchers will perform a comparative study of Korean and American elementary mathematics classrooms in terms of sociomathematical norms. One of the eventual purposes of the project is to better understand the subtle differences between Korean and American classrooms that are broadly organized on similar principles of encouraging students' explanations and discussions.

4. SOME SUGGESTIONS

1. Learning the language of target country

The most serious obstacle to the successful comparative studies is the difficulty of

learning the language of the target country. But from our experiences, we can say that we do not worry about it so much. In fact, when we started to study the Russian mathematics education, we used the literature about Russia written in English. But there were serious limitations and inconveniences. So, one of our research members who was an undergraduate student began learning Russian. After 3 years of hard endeavor, he could read Russian books.

Furthermore, he could help other researchers who were also interested in Russia to learn the Russian easily. Since then, we can use Russian materials directly for our studies on Russian education. At least one member of the research team needs to understand the language of the country to be studied. Here, we thank mathematics again for her universality. Thanks to her universal notations and symbols, mathematics can serve the world as an international language. Even though we have zero-knowledge on the language of a specific country, we can have some knowledge of mathematics education of the country through the mathematics textbooks and related materials of the country. However, an in-depth study of mathematics education of a foreign country requires reasonable amount of knowledge of the language of the target country. Furthermore, a much higher degree of linguistic knowledge may be needed, depending on the types of comparative study. For example, in [10] it will require that classroom protocols are transcribed in Korean and then translated into English so that cross-cultural team of researchers can come to have a shared understanding and shared interpretations of what is going on in the classroom.

2. Group (team) research

When we want to do a comparative study involving many countries, we need to understand many foreign languages, as suggested above. Therefore when we want to study mathematics education of other nations using materials written in their own languages, we have to study as a group. For example, all researchers of our research group have to understand English, and each researcher is required to understand one of the second foreign languages of his/her own choice. The comparative study on a specific country can be carried out by the researcher who can understand the language of the country.

3. Exchanging textbooks and related materials

Textbooks are most important materials for understanding a nation's mathematics education. But obtaining another nation's textbooks is sometimes surprisingly difficult, even though we have enough funds for the books. So, it is necessary to

exchange textbooks and related materials.

4. Exchanging researchers

Research using textbook and other written materials can be reasonably successful in a comparative study. But it is important for a researcher to live in the target country for a period of time and to experience the real education there. After understanding the mathematics education as much as possible through the exchanged materials, researchers themselves should be exchanged to study deeply and closely. Last year, some Korean mathematics teachers visited Louisiana State University (LSU) and planned a cooperative research. Now Professor Kirshner from LSU is invited to Korea for a comparative study. He will stay at Korea National University of Education for a semester. On the other hand, a Chinese doctoral student is carrying out a comparative study at Korea National University of Education. It is also desirable to exchange the academic credits or degrees, in the case that the researcher is still a graduate student.

5. A Study Group on Comparative Education of Mathematics

There are some international groups for studying special fields in mathematics education professionally and systematically. PME and HPM are such examples. We propose to organize "A Study Group on Comparative Education of Mathematics" for the effective study of comparative education in mathematics. In fact, this is not a new proposal.

As far as we understand, in 1817 Jullian of France proposed a similar idea for comparative studies among European countries [3].

6. ICMI-EARCOME 1, Korea 1998

As we know, "Comparative Study on Mathematics Education" is one of 12 Topic Groups in ICMI-EARCOME 1, Korea 1998, which will be held at Korea National University of Education. We hope we will have lots of presentations on the results of our research there.

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