

A Case Study of the Field Experience of a Korean Mathematics Pre-Service Teacher in the U.S.

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Abstract

This study is for a Korean mathematics pre-service teacher Tay's case that participated in the field experience in the United States. Drawing on Goodell's (2006) critical incident framework, we analyzed his experiences with respect to the U.S. mathematics education in terms of mathematics class, student, teacher, and school administration. The findings indicate that the most critical events for him were in the order from a teacher, mathematics class, school administration and a student factor. We could see that his critical experiences influenced his perspective about mathematics teaching such as teaching methods and student assessment. The study also addresses how Tay's teacher preparation program experience in Korea played a role in his field experience in the United States.

Keywords: pre-service teacher, student teaching, mathematics, Korea, U.S.

1. Introduction

A large number of researchers (Ball and Cohen, 1999; Mewborn, 1999; Eisenhart, Borko, Underhill, Brown, Jones and Agard, 1993) have articulated importance of student teaching because field experience is the first opportunity to practice their knowledge and skills as a mathematics teacher and student teachers practice their teaching skills from what they learned in theory from college. Pre-service teachers may check their aptitude for teaching and also assess their own abilities while carrying out the practicum.

The importance of field experience is also highlighted in many countries and the situation is similar in Korea. In Korea, teachers are highly recognized and stable occupation, and many students desire to become a teacher in their future. Due to this stability and the popularity, it becomes more and more difficult to find a teaching job at the K-8 public schools. The competition rate of becoming teachers goes high each year and this has been a social issue. To resolve this problem, Korean Ministry of Education and Korean Council for University Education continuously have put efforts to help capable mathematics pre-service teachers to advance into foreign countries. The mathematics teachers were focused first because Korea is well known for its high level of achievement in mathematics certifications such as Trends in International Mathematics and Science Study (Mullis, Martin and Foy, 2008) and Programme for International Student Assessment (OECD 2010). These national projects were designed to help high qualified pre-service teachers who become mathematics teachers in K-8 settings exhibit their outstanding abilities as teachers and find a job in other educationally leading countries like the United States.

Based on this national project run by Korean government, one Korean pre-service teacher was selected to experience student teaching in the United States. The goal of this article is to describe what a K-8 teacher candidate learns during his field experience in the United State and to consider its educational implications. We also want to focus on the typical elementary mathematics classrooms in the United States through the lens of one Korea teacher candidate who was trained by a teacher education program in Korea.

2. Background and Literature Review

In this section, we first present how teacher education program look like in both countries. Second, the related literature are reviewed that compare teacher education programs in Korea and the United States. Lastly the theoretical framework that serves this study is addressed.

2.1 General Structure of Teacher Preparation Program: Korea and the U.S.

In order to analyze pre-service teacher's experience during the field experience, it is necessary to understand how each country's education system prepares K-8 teachers. It is common in both countries that students generally go to the university and need to pass the licensure test to become a public school teacher. The differences come from the flexibility and the program decision level. The difference is well illustrated in the study of Kim, Ham and Paine (2011). They explained that in Korea, only national teachers colleges of education offer the elementary teacher education program so if a student wants to be an elementary school teacher and the student needs to complete the program offered by national teachers college of education. For becoming secondary teachers, students take courses from Education College in the regular public or private universities.

What is more different is the decision making process. The education objectives of K-12 schools and the field experience structures are decided according to the Korean national curriculum. Once teacher candidates completed all the required courses, they must pass national teacher employment test organized by the government to be a teacher of a public school, and this test is extremely comparative (Kwon, 2004). In contrast, in the United States, although there are common requirements such as bachelor's degree, a certain amount of credit hours and teaching certificate, program details and required credit hours vary by the states (Kim et al., 2011). Compared to Korean structure of field experience, it is not easy to describe the field experience structure of the United States because it varies depending on the states. National Council for the Accreditation of Teachers Education (NCATE, 2008) provides professional guidelines and the variations are bonded by these guidelines.

Despite the different arrangement of teacher education program in two countries, teacher preparation programs in Korean and the Unities both require candidates to complete a certain amount of field experiences. In Korea elementary teacher candidates need to complete 12 weeks of field experiences and secondary teacher need 4 weeks. This is a part of the reason why the authors want to take an in-depth look about field experience in the United States through Korean lens. We believe that such a closer look will help teacher education researchers investigate possible ways to improve current teacher education research in both countries.

2.2 Comparative Studies regarding Teacher Education Program between the U.S. and Korea

The comparative studies between two countries tend to center around the textbook composition and contents, education, and teaching methods class (Seo, 2010). Specifically, a large number of studies compare the textbook contents such as textbook composition (Shin & Han, 2009), ratio and proportion (Park & Jeong, 2010), multiplication (Lee, 2005), and figures (Choi & Kim, 2005). Also, the comparative studies often focus on the knowledge of teacher education program and the study of Kim et al. (2011) is the one of them.

The study of Kim et al. (2011) studied the difference between Korea and the U.S. with regard to the knowledge expected from the mathematics teacher training programs. The major finding of the study was Korean program places much emphasis on content knowledge and pedagogical content knowledge in the pre-service teacher curriculum whereas in U.S. teacher education program, content knowledge was less focused but general education knowledge and knowledge gained from field experience was higher than Korea. Majors in the departments of mathematics education in Korea mostly cover college mathematics to emphasize the academic basis for mathematics teaching in secondary school. Such subjects are the mandatory and heavily focused because pre-service teachers have to pass mathematics content knowledge subject test to become K-8 teacher. This contrasts with the current U.S. elementary teacher education program that does not require heavy content knowledge in mathematics as a part of elementary teacher certificate. They also address that the Korean education is relatively weak in terms of its student teaching experiences because typically Korean secondary student teachers are required to do student teaching for 4 weeks and this is much shorter than that of 16 week training in the U.S program.

To investigate the differences and similarities between the U.S. and Korea, Seo (2010) compared two characteristics of university courses in Korea and the United States using his mathematics teaching theory; the general themes of courses required for elementary mathematics educations and the major focus of the mathematics methods courses.

Seo reported that the presented themes across the courses in mathematics education were similar between two countries but the major focus of methods classes was different. He addressed that what stood out more in the U.S. methods course were small group activities, teaching through videos and the use of math related children's literature for their instruction and the U.S. methods class was designed to help pre-service teachers think about how elementary students learn mathematics. In the meantime, Korean mathematics methods class tended to emphasize individual activities, articles and written documents, and the course emphasized pre-service teachers' in-depth understanding about the content of the textbook for their elementary students. Seo interpreted this difference seems depending on whether they have national curriculum or not.

2.3 Theoretical Framework: Critical Incident Reflection

As a theoretical framework, this study adopted Goodell (2006)'s framework. In her study, pre-service teachers were asked to discuss the important events that student teachers experience during field experience as a group and reflect those event and present them as a whole group on a regular basis. Goodell conceptualizes those important events as critical incidents and investigated how this critical incident reflection could help student teachers learn how to teach mathematics in the elementary classroom. Goodell's findings show that critical incident reflections hugely support prospective teacher's learning to teach throughout the semester. For instance, student teachers used shared mistakes for learning opportunities, learned some teaching skills of how to teach mathematics for understanding, and listened to each other how to make personally relevant alternatives and solutions through class discussions. Zeichner (1996) states that the field of teacher education need to focus more on the critical incident reflections as social practice because it develops teacher learning. Goodell argue that these reflections in his study addresses Zeichner's (1996) such concerns in teacher education.

A number of research studies also highlight the importance of critical incident reflections. Loughran (1996) argues that it is crucial to use reflections for pre-service teachers' own teaching experience and Lerman (1994) states critical incidents foster reflections in teaching. It is also argued that pre-service teachers improve their teaching through critical incidents (Hole & McEntree, 1999).

Training pre-service teachers to become professional mathematics teachers is a major objective of teacher education. To this end, Dewey (1904) emphasized that teachers need experience in pondering over their own learning, pointing out the importance of practical experience. Student teaching opportunities provide pre-service teachers with practical field experience so that they can build up their own view of education as teacher, and observe how cooperating teachers conduct their classes, plan and practice their own classes. Daniel, Patterson & Dunston (2010) called such experience as Service Learning. Learning how to teach mathematics in an actual situation is not only a practical application of theories but also a potential stimulation of thinking to develop a personal theory on a study for practice (Sullivan, 2002, p.291). The above-mentioned studies emphasize the importance of student teaching experience and also highlight that reflection is a critical experience in shaping their teaching practice.

2.4 Rationale of the Study

As summarized above, the current comparative literatures between the United States and Korea mostly focus on comparing teacher education program or its content in both countries, such as comparing textbooks, students' achievement or their thinking. However, there is little research that addresses field experience in the United States. In the study of Seo (2010), teacher education lectures in the universities are compared but the cultures and specific experience of student teaching in both countries are not presented. Kim, Ham & Paine (2011) also compares systems and curriculums objectively, but it does not discuss cultural experiences of pre-service teachers.

Moreover, despite of the importance of reflections in teaching practice, we know little from the related research about how the teacher education program experience in Korea played a role in the education field in the United States. Overall, this analysis brings an attention that it is necessary to focus on the student teacher's field experience in terms of mathematics teaching practice to better understand the teacher preparation program in both countries.

To explore this agenda, this study pays particular attention to the following research questions:

1. What are some of the critical incidents that the Korean mathematics pre-service teacher experienced during the field experience in the United States?

2. How did these critical incidents influence Tay's perspectives of teaching mathematics?
3. How did Tay's teacher education program experience in Korea play a role during his field experience in the United States?

3. Method

3.1 Data Sources

This study adopted qualitative methods, in particular, a case study. The data are collected during 16 weeks of spring 2012 semester and the major data sources for this study are reflective journals, emails he wrote to the researchers, and in-depth interviews. Among them, reflective journals are the major sources for this study to record critical incident reflections in a written format. Similar to Goodell's study, Tay was asked to write weekly journals about critical incidents that happened in his classroom. The interview questions consisted of two parts. First, it included his knowledge background such as classes he took from teacher education program in Korea, his prior experience with mathematics and mathematics teaching pedagogy. The second part of interview focused on his field experience in the United States. The field experience interview includes; his perspective about how mathematics is taught in American mathematics classrooms, the student-teacher relationships, teacher's pedagogy, and comparative analysis between Korean and American mathematics classrooms. The interviews enabled us to understand his mathematical background as a teacher and helped us to analyze his critical incidents of field experience. Emails were used as supplementary data for the communication between the researchers and the participant. As the participant was in the U.S. while one of researchers is in Korea we communicated via email to keep track of the situation. Table 1 shows the summary of the collected data.

Table 1: Summary of Data Collection

Participant/Data sources	Time frame	Description
Tay (pseudonym)	Fall 2011	<ul style="list-style-type: none"> ▪ A Korean senior teacher candidate ▪ Took mathematics methods class from one of the authors at the University in Korea ▪ Proficient in English
Field experience Location/duration	4th~8th grade public and private schools/16 weeks of Spring 2012	<ul style="list-style-type: none"> ▪ He was assigned to one public school and one private schools in the Midwest of the U.S.
Reflective Journals (n=55)	Spring 2012	<ul style="list-style-type: none"> ▪ Collected to record critical incidents while student teaching in US
Emails (n=18)	Spring 2012	
Interview (28 questions)	Summer 2012	<ul style="list-style-type: none"> ▪ Part I focuses on his mathematics education experience in Korea ▪ Part II focuses on his field experience in the United States classrooms

The participant of the study is one Korean male mathematics teacher candidate. He was preparing to be secondary school teacher. He earned 21 credits for mathematics contents, 3 credits for theory of mathematics education, 3 credits for assessment of mathematics learning, 3 credits for computers and teaching tools in mathematics education, 3 credits for material development for teaching mathematics, and 3 credits for teaching methods in Korea. He was selected for three reasons. First, he was one of the author's former students and that brought us deeper understanding about his teacher preparation experience in Korea. The other reason was due to his fluency in English. As he was supposed to communicate with English speaking teachers and the students, English proficiency was the most important criteria of the selection to minimize the language barrier. Finally he had unique experience in that he was educated in Korea and participated in practicum in U.S. prior to his field experience.

3.2 Data Analysis

The data was analyzed built on Goodell(2006)'s framework. Goodell categorized four emerged themes focusing on the main topics of students' reflections and they are; 1) teaching and classroom management, 2) student factors, 3) relationships and professionalism, and 4) school policies and procedures. The above four elements consist of several sub-elements that indicate pre-service teacher's experiences. Goodell counted the number of critical incidents that pre-service teachers wrote in the reflections and reported how many of those reflections go into each category, and then calculated the rate in each category. This study adopted Goodell's framework to analyze Tay's critical incident reflections during field experience in the U.S.

As an open step in the analysis, the authors carefully read through all the reflective journals and interviews multiple times without finding any categories or coding. This process was helpful to understand the data in general. As a next step, we analyzed emerging themes and categorized the participant's incident reports – emails, reflective journals, and interviews – similar to Goodell's four categories listed above. After carefully reviewing the data, we found that four main themes emerged: mathematics class, student, teacher and school administration. For each broad category we conducted a second content analysis to classify the sub-category. What follows is the sub-category of each category.

1. Mathematics classroom - class contents, textbooks and assessment
2. Student- attitudes in classes and the level of understanding mathematics
3. Teacher - teacher knowledge, mathematics teaching methods, and relationship with students
4. School administrations - daily schedule, classroom structure, and principal.

Given that the main purpose of this study is to understand critical incidents during field experience from Tay who experienced teacher preparation program in Korea, the incidental reports are expressed based on comparative perspective.

4. Results

4.1 Incident Reports: Four Categories

To answer the first research question, Tay's critical incidents regarding the U.S. field experience were analyzed drawing on Goodell's framework. Table 2 below shows the list of the category and sub-category that emerged in the data. It also illustrates the number of incidents (frequency) in each and sub-category and the rate of incidents.

Table 2: Frequency and Ratio of Incidents

Category	Sub-category	Number of Incidents	Rate (%)
Mathematics Class (MC)	MC.1 Class Contents	2	5.7 %
	MC.2 Textbook	4	11.4 %
	MC.3 Assessment	4	11.4 %
	Mathematics class total	10	28.5 %
Student (S)	S.1 Attitude in classes	3	3 %
	S.2 Level of understanding mathematics	1	1 %
	Student total	4	11.4 %
Teacher (T)	T.1 Knowledge	6	17.1 %
	T.2 Teaching methods	4	11.4 %
	T.3 Relationship with students	1	2.9 %
	T.4 Other	1	2.9 %
	Teacher total	12	34.3 %
School Administration(SA)	SA.1 Daily schedule	2	5.7 %
	SA.2 Classroom structure	3	8.6 %
	SA.3 Principal	3	8.6 %
	SA.4 Other	1	2.9 %
	School total	9	25.8 %
Total incidents reported		35	100 %

The frequency and rate in the above table identifies that the most critical incidents for Tay seemed related to the teacher (34.3%) and the mathematics class (28.5%). School administrations (25.8%) come next and he addressed the least number of incidents as student factors (11.4%). It is possible that Tay highlighted teacher and mathematics class the most because they were different from his experience in Korean education. To better understand his perspective, the more details of incidents will be address by the category in the order from the higher percentage to the lower percentage.

4.1.1 Teacher

The data analysis shows that teacher factor is the most critical incidents for Tay. Among four sub-categories of teacher factors (T.1~T.4), Tay addressed teacher's content knowledge (T.1) the most. During field experience in the United States, Tay worked with four different mathematics teachers from 4th to 8th grade. He reported in the journal that those teachers made mathematical errors during their instructions. The errors came from such contents as scale, linear inequality with an absolute value, sum of interior angles of a polygon, and values of an inequality. Tay mentioned that he was surprised by teachers' insecure mathematics content knowledge. Unfortunately, the U.S. teachers' lack of mathematics content knowledge has been pointed out in several researches (Ball, 1990; Ball and Bass, 2000; Brown and Borko, 1992) and at the same time mathematics education reform has put a lot of efforts to improve the situation (Stigler & Hiebert, 1999). As stated earlier, Korean teacher preparation program requires college level mathematics for K-8 teachers. This makes it difficult to observe mathematical content mistakes from the instruction. Hence, from Tay's perspective, who took the advanced level of mathematics content courses, it could be surprising to see incorrect mathematics concept is being taught in the elementary and middle school classrooms.

Another identified critical incident for Tay was the mathematics teaching methods (T.2) of the teachers. Tay had observed mathematics teaching methods from various teachers in Korea and compared those experiences to the field experience in the United States. He reflected these comparative observations during the interview. According to the interview, two features stood out the most; how mathematics is taught is very different depending on the given textbook and teaching methods were heavily drawn from the textbook in U.S. All American teachers he observed in this study taught mathematics traditionally which means focused more on the procedures and worksheets and less focus of problem solving. Tay reflected that most of explanation came from the given textbook and the instruction of similar topic was different across teachers depending on the given textbooks. When the students expressed lack of understanding, the same explanation from the textbook was repeated instead of providing multiple ways of explanations. Korean teachers whom Tay met tended to reconstruct teaching materials and use various teaching methods. It seems that the different textbook systems in both countries are accounted for the incident.

In Korea, elementary mathematics textbooks are published by the national government and the teacher candidates learn how to teach the national textbooks to their students. Typically, the national textbooks employ multiple strategies of problem solving and pre-service teachers are trained to master the content of the textbook to earn the certificate. Thus, most Korean K-8 teachers are familiar with the nationalized textbook they teach from the beginning. However, that is not the case for the teachers in the United States. As the textbook is determined at the local level, often times the U.S. beginning teachers need to spend quite amount of time to learn the content of curriculum instead of planning how to present the content to facilitate the students' understanding (Brown and Borko, 1992). Considering the given condition, Korean teachers may have more advantages to try multiple strategies earlier than the U.S. teachers.

Relationship with the student (T.3) was another incident that Tay found out to be impressive. He stated that the teachers in this study seemed less teacher-directed and the teachers try to communicate with the students during the instruction. It was often observed that teachers were patient to listen to their students even when the conversations were not related to the content. Tay stated that the U.S teachers looked more patient than Korean teachers and tried to communicate with students in general.

4.1.2 Mathematics Class

The second frequent category of critical incident is about mathematics classes in the United States. The sub-categories of mathematics class are class content (MC.1), textbook (MC.2) and assessment (MC.3) and incidents about each sub-category are illustrated below.

The first sub-category is the content of mathematics (MC.1) that was taught for 4th to 8th grades. Tay stated that the content of mathematics instruction he observed in the United States seemed less advanced than that of Korea in general. For example, Korean students learn the unitary conversions during 1st ~ 4th, but the similar contents are taught in 4~8 grades of the U.S. classrooms. Also, there were some contents that were presented only in the U.S. curriculum such as customary measurement and time zone. The contents were totally new for Tay because Korea uses metric system and time difference is not necessary in Korea.

With respect to the textbook (MC.2), Tay briefly described how he felt about the U.S. textbook in his journal.

It seems that Korean textbooks include a lot of explanation of concepts with a relatively small number of problems. Students in Korea often purchase workbooks for themselves to solve more word problems. On the contrary, textbooks in the U.S. include many more problems than Korean textbooks and a lot of them are real world problems. Also I feel like the contents of the U.S. textbook are so many that they are not fully covered and the latter part is hardly handled during the year. In Korea, contents of a textbook are fully covered within a year, and the contents have been reduced to relieve burden of students in the recent revision of the national curriculum. The same topic never reappears in higher grades. (Weekly journal, March 2012)

Tay addressed that difference between the textbooks was easily noticeable because Tay was familiar with Korean textbook and he worked with the U.S teachers who taught the mathematics mostly using the given textbooks.

Another issue that grabs Tay's attention about mathematics class was the assessment process (MC.3). Tay expressed that the assessment was one of the most critical incidents he experienced in the U.S. field experience. The U.S teachers in this study adopted criterion-referenced evaluation system and used various formats of assessment tools. For instance, in the U.S. mathematics class, instead of assigning midterm and final to give students' grade, the grade is determined based on multiple types of assessments such as lesson evaluation, chapter quiz, homework and in-class work. The progress towards the standard is critical in the U.S. elementary school and the students are allowed to re-take the same test or quiz to improve their grades. In the meantime, in Korea, norm-referenced evaluation is applied depending on the education policy. Regular examinations such as midterm and final exam and performance assessment decide the student's score. It is impossible for Korean students to re-take the same test to improve their grade because assessment is very comparative. From Tay's perspective, assessment items in the U.S are mostly constructive questions, and only true-false questions may be used for multiple choice items. Constructive questions are also presented in Korean assessment, but the multiple choice questions take the largest portion of the test.

4.1.3 School Administrations

Among the school related incidents, the three sub-categories were stated frequently; daily schedule (SA.1), classroom structure (SA.2), and principal (SA.3). The following transcripts illustrate his critical incidents about the school administrations. When asked "what is the difference between Korean school system and the American school system?" in the interview, Tay replied;

Based on my observation, I would say the major difference was the time, the schedule of the classes. Korean elementary school starts around 9:00 am and ending time varies depending on the grade level. Typically primary grades (1st to 3rd) dismiss earlier (before 2 pm) than upper grade elementary (around 3 pm). The Korean middle school runs from 9:00-4:00. I noticed that the U.S. elementary and middle schools start earlier than Korea (around 8 am) and the dismissal time is identical for K~5th graders. (Tay's interview, June 2012)

Incidents such as this seemed natural because each country may run different school schedules (SA.1). What follows next seemed more impressive incident for Tay.

What's more surprising to me was that there was no break in between classes in the elementary school. In Korea, the first class begins at 9 am and ten minutes are given as a break time between classes. Each class runs for 40 minutes. Since there is no break in the U.S. elementary classroom, I observed that students went to restrooms, sharpened their pencils, and took classroom materials during the instruction time. There was no official break time after the first class until the lunch time. It was very new experience to me. I would say this was the most difficult experience that I had to adjust for myself during the entire field experience in the United States. (Tay's interview, June 2012)

Tay also mentioned that the U.S. classroom structure (SA.2) – teacher owns classroom and students rotate the classrooms – seemed more beneficial for teachers because all teaching materials are arranged at one place. In Korean middle school, teachers rotate the classrooms so teachers have to bring teaching materials every time. Another critical incident for Tay was the combination class of two grade levels. He observed that in the U.S. classrooms, two different grade students are combined as one class and sometimes the grade level class was divided depending on the students' level of understanding. This structure is very rare in Korean school system except for rural region. Differentiated instruction to meet the individual student's need seemed more advanced in the U.S. classrooms than Korea.

Lastly, Tay reflected that role of principal (SA.3) in the U.S. schools was quite different than that of Korea. From his perspective, the principals in the U.S. rarely joined classes. Instead, they welcomed students every morning, handle various kinds of administrative tasks to support teachers, manage the annual school event and discipline students' behaviors. Compared to the U.S. principals, Tay addressed that principals in Korea seem more authoritative and prescriptive and they rarely engage with students.

4.1.4 Student

As data shows that student factor was the least critical incidents for Tay, it will be briefly discussed in this section. Tay reflected that students' attitudes toward mathematics classes (S.1) were the most impressive factor. Here is his statement;

To me, it seems that students in the U.S. classrooms are more active and they are not afraid of mathematics. Students easily raise their hands to ask questions and share their thoughts. Even when they didn't know the answers they were not intimidated to share their thought. Actually, students' active participation encouraged me a lot when I teach them in English. Also, students didn't seem very stressful about the chapter test or quarterly test. (Tay's interview, June 2012)

He said this is something difficult to observe in Korean mathematics classrooms where the students are more passive and comparative and the environment is more teacher-directed and the answer oriented. And he evaluated that the level of understanding mathematics of the U.S. students was lower than Korean.

So far, drawing on Goodell (2006)'s framework, Tay's critical incidents were reported. To answer the second research question, it will be discussed how these incidents influenced Tay's perspective of teaching mathematics.

4.2 Impact of Critical Incidents about Teaching Mathematics

The data analysis demonstrates that the critical incidents influenced Tay's perspective of teaching mathematics in two ways; mathematics teaching methods and students' assessment. The impacts are described in details in the following section.

4.2.1 Mathematics Teaching Methods

During the field experience, Tay observed that teachers heavily depended on the given mathematics textbook for their mathematics instructions. He also noticed that the U.S. mathematics textbooks consist of so many contents and problems and often times, not all of contents and the problems from the textbook are covered during the school year. Students tend to move to the next grade level without secure knowledge of uncovered content. This experience led him think about the effective use of textbook in teaching mathematics and Tay tried the several methods. First, he assigned the review part or repetitive content of the textbook as an assignment so the more time is given for the remaining part of textbook during the instruction. Secondly, Tay tried to work on real life example problems as much as possible during his instruction time because he felt that many of the real life problems in the textbook were not covered by the cooperating teachers he observed. For instance, when teaching volume units, he used plastic milk or drink bottles to compare and convert units. He showed the weather forecasting of the U.S. and Korea, asking the students of the difference. Explaining the origin of Fahrenheit and Celsius, he helped them recognize that they were different measuring units. He also helped them intuitively compare the two different temperature units by explaining that the average human body temperature is 36.5°C and about 98°F which are the same. He explained that when the four fingers except the thumb were the Time Zone with a fist made, the region where the sun rises first was the PACIFIC ZONE. Besides, he presented an actual flight schedule and asked the departure time and arrival time of an airplane leaving New York for L.A.

Lastly, since the textbook was not given to every student in U.S. classrooms, Tay distributed activity sheets during a class, and the backside of the sheet was a math diary on which the students could summarize what they learned on a daily basis. The math diary was also used for interaction between the teacher and the students because students could write down any questions or what they could not understand during the class.

4.2.2 Student Assessment

Tay reflected that the U.S. field experience was a good opportunity to reconsider about assessment process in the mathematics classroom. As stated earlier, Tay experienced different types of assessment structures in the U.S. mathematics classrooms and he stated that he wanted to ponder upon the strengths and weaknesses of each country's assessment system. However, he said it was also a limited opportunity to deeply learn about U.S. assessment structure due to his position as a student teacher. In the interview, he mentioned;

I think the U.S. field experience was not very influential in terms of my perspective about students' assessment. Because I was a student teacher, I had a limited access to students' assessment scores. I was assisting my cooperating teachers I didn't have full authority to evaluate students' work either. What I could do was formative assessment – check students' homework and walk around the classroom to check students' understanding during the instruction. I think I would need more time and authority to engage with students' evaluation. (Interview, June 2012)

Even though Tay had limited access to students' evaluation, he stated that what he learned from Korean teacher education program was useful to assess students' mathematics understanding during field experience in the U.S. The following section explains how useful it was to answer the 3rd research question.

4.3 The role of Korean Teacher Preparation Program in the field experience in the United States

Most of all, Tay pointed out that the numerous mathematics education courses he took from Korean program played a huge role in completing field experience in the United States. As listed in the methods section, his knowledge of mathematics education is not limited to mathematics contents but it extends to pedagogical content knowledge as well as mathematics education theories. Such knowledge was reflected in the class preparation, teaching method, and student assessment during whole field experience. For instance, Tay pursued a way of mathematics education that would help students solve problems for themselves and he was able to differentiate items based on students' level. This process required him to precisely assess students' different mathematics achievement and he reflected that 'Assessment of Mathematics Learning'¹ class enabled him to do that. During the field experience, he observed several teaching practice from different 4th~8th grade teachers. He said he was able to compare how theories and knowledge he learned from different classes worked in practice and what seemed more or less useful in the mathematics classroom. He reflected that his plentiful course experiences were beneficial to judge what would work the best for his future students.

In addition, the Korean teacher education course provided strong mathematics content knowledge. Thus, unlike many of middle school mathematics teachers in U.S., Tay didn't need to learn the content of various types of U.S. mathematics textbook. Instead, he was able to catch and fix the mistakes earlier and focus on planning the lesson to enhance students' understanding. When he had to teach the new content - time zone and metric versus English system in measurement -, due to his strong content knowledge he was able to understand the content in the textbook quickly and to apply his knowledge to develop real life mathematics problems.

5. Conclusion and Suggestion

This study shows the difference between the U.S. and Korea with regard to the education system that Tay, a Korean pre-service teacher learned while participating in the field experience in the U.S., and how the way of teaching mathematics that Korean mathematics teachers are accustomed to can be applied to the education field of the U.S.

A lot of efforts are put forth in Korea into advancing pre-service teachers just as Tay into overseas education centers. Now that mathematics education is not limited to certain countries in this era of globalization, there could be a lot more similar cases with Tay's. Here are some suggestions for pre-service teachers who may have such experience.

¹The contents of this subject are the principles of assessment, the development of items, the diverse methods of mathematics assessment, and scoring procedure etc.

First of all, when given an opportunity of practicum in a foreign country, it is necessary to be familiar with the curriculum of that country. Although mathematics is a universal discipline, each country's characteristics may be reflected in the mathematics education. As there is no standardized curriculum in the United States, the opportunity to learn for the students and the pedagogical approach to mathematics content is different depending on the publisher (Kang, 2014). Thus, all teachers and teacher candidates need to be familiar with the common core standards or NCTM standards so that they could understand what the students have learned and will learn and what the education program pursues.

Kang's study argues that due to this variation in the U.S. mathematics textbook, it is important for teachers to understand what is presented in the textbook and how to teach them to maximize students' learning. Tay's case well represents what teachers need to do. During the field experience, Tay noticed the weaknesses of the given mathematics textbook. Instead of following the instruction of the textbook as it is, Tay tried to use different strategies to enhance students' learning based on his prior knowledge. It implies that knowing the content maybe not enough and it is important to keep trying new strategies to meet the diverse needs of students in the classroom. And an individual who teaches mathematics in a foreign country may face a language problem. Although Tay practiced English speaking and learned mathematics terms in advance, he was not free from language problems when students asked meaningful questions. However, as shown in this study, the language barrier enabled him to think critically in terms of teaching mathematics at the same time. For instance, he could think about the role of language in teaching, English Language Learners' perspective in a class, and he tried multiple different hands-on strategies to overcome the language gap. It is vital to prepare sufficiently so that not language problems but teaching mathematics could be the main concern in the practicum. Yet, we believe that Tay's such experience can be a helpful learning opportunity for teachers in both countries as the diversity of classroom becomes more central.

All above suggestions cannot be practiced on the level a teacher-training program at college. Zindi (1996) related that it would not be appropriate for a college professor to evaluate the practice of a student teacher since the situation of the student teacher must be understood prior to evaluation. In particular, since cooperating teachers are responsible for the guidance of a student teacher who is taking practicum in a foreign country, whether the cooperating teacher is qualified and has sufficient expertise is of great importance as is the cooperation with the college that trained the pre-service teacher.

This study compared the education practices between the U.S. and Korea based on one individual named Tay and describes student teachers' class practice. Since this data is based on Tay's perspective, it may not reflect many other situational elements in practicum. Clarke & Collins (2007) defined practicum as a complex system, rejecting viewing practicum only from a certain perspective. It is necessary, therefore, to examine aspects that are not specified in this study when it comes to practicum. Although this study states Tay's experience in his perspective, how his classes were evaluated by the students and teachers in the U.S. was not presented. The future study may include such aspects as well if a similar case is examined.

Acknowledgements

This work was supported by the National Research Foundation of Korea Grant funded by the Korean Government (NRF-2012-013-S1A2A1A0-1030926).

References

- Ball, D. L. (1990). Prospective elementary and secondary teachers' understanding of division. *Journal for Research in Mathematics Education*, 21, 132-144.
- Ball, D. L., & Bass, H. (2000). Interweaving content and pedagogy in teaching and learning to teach: Knowing and using mathematics. In J. Boaler (Ed.), *Multiple Perspectives on Mathematics of Teaching and Learning* (pp. 83-104). Westport, Conn.: Ablex Publishing.
- Ball, D. L., & Cohen, D. (1999). Developing practice, developing practitioners: Toward a practice-based theory or professional practice. In L. Darling-Hammond & G. Sykes (Eds.), *Teaching as the learning profession: Handbook of policy and practice* (pp.3-32). San Francisco: Jossey-Bass.
- Brown, C. A., & Borko, H. (1992). Becoming a mathematics teacher. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 209-239). New York: Macmillan.

- Choi, K. & Kim, H. (2005) A comparative study on elementary school mathematics textbooks in Korea (7th Curriculums) and America (Harcourt Math) - Focused on the area of geometry-. *Journal of Korea Society Mathematics Education Series A: The Mathematical Education* 44(2), 179-200.
- Clarke, A. & Collins, S. (2007). Complexity science and student teacher supervision. *Teaching and Teacher Education* 23, 160-172.
- Common Core State Standards for Mathematics (CCSSM). <http://www.corestandards.org/Math/>
- Daniel, K. N., Patterson, G. & Dunston, Y. (2010). Rules of engagement: A service learning pedagogy for pre-service teacher education. *Journal for Civic Commitment* 15, 1-16.
- Dewey, J. (1904). Significance of the school of education. *The Elementary School Teacher*, 4(7), 441-453.
- Eisenhart, M., Borko, H., Underhill, R., Brown, C., Jones, D., and Agard, P. (1993). Conceptual knowledge falls through the cracks: Complexity of learning to teach mathematics for understanding. *Journal for Research in Mathematics Education*, 24, 8-40.
- Goodell, J. E. (2006). Using critical incident reflections: a self-study as a mathematics teacher education. *Journal of Mathematics Teacher Education*, 9, 221-248.
- Hole, S., & McEntee, G. H. (1999). Reflection is at the heart of practice. *Educational Leadership*, 56, 34-37.
- Kang, H. J.(2014). A cross-national comparative study of first-and fourth-grade math textbooks between Korea and the Unites States. *Curriculum and Teaching Dialogue*, 16(2), 91-108.
- Kim, R. Y., Ham, S. & Paine, L. W. (2011). Knowledge expectations in mathematics teacher preparation programs in South Korea and the United States: Towards international Dialogue. *Journal of Teacher Education*, 62(1), 48-61.
- Kwon, O.-N. (2004) Mathematics teacher education in Korea. Paper presented at the International Congress on Mathematical Education (ICME-10), Copenhagen, Denmark.
- Lee, J. (2005). Comparative analysis on Korean and the U.S. Mathematics classroom: Focused on the case of multiplication unit of 2nd~3rd Elementary level. *The Journal of Curriculum Studies* 23(2), 221-256.
- Lerman, S. (1994). Reflective practice. In B. Jaworski, & A. Watson (Eds.), *Mentoring in mathematics teaching* (pp. 52-64). London: The Falmer Press.
- Loughran, J. J. (1996). *Developing reflective practice: Learning about teaching and learning through modeling*. London The Falmer Press.
- Mewborn, D. S. (1999). Learning to teach elementary mathematics: ecological elements of a field experience. *Journal of Mathematics Teacher Education*, 3, 27-46.
- National Council for Accreditation of Teacher Education (2008). *Professional standards for the accreditation of teacher preparation institutions*. Washington, D: Author.
- OECD(2010). *PISA 2009 Results:What Students Know and Can Do – Student Performance in Reading, Mathematics and Science(Volume I)*.
- Park, H. & Jeong, E. (2010). A comparative analysis on units about ratio and rate between Korean mathematics textbook and MIC textbook. *Journal of Elementary Mathematics Education in Korea* 14(3), 769-788.
- Seo, D. Y. (2010). A comparative study between the lectures on the practices of mathematics education in the courses for pre-service elementary teachers of two universities in United States and Korea - Focussed on two professors' cases-. *Journal of Elementary Mathematics Education in Korea* 14(3), 547-565.
- Shin, H. & Han, H. (2009). Experimental Analysis of Korean and CPMP Textbooks: A comparative study. *Journal of the Korean School Mathematics Society*, 12(2), 309-325.
- Stigler, J. W. & Hiebert, J. (1999). *The teaching gap*. NY: Free Press.
- Sullivan, P.(2002). Using the study of practice as a learning strategy within mathematics teacher education programs. *Journal of Mathematics Teacher Education*, 5, 289-292.
- Mullis, I. V. S., Martin, M. O., & Foy, P. (2008). *TIMSS 2007 International Science Report: Findings From IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grade*. MA: Boston College.
- Zeichner, K. (1996). Teachers as reflective practitioners and the democratization of school reform. In K. Zeichner, S. L. Milnick, & M. L. Gomez (Eds.), *Currents of reform in preservice teacher education* (pp. 199-214). New York: Teachers College Press.
- Zindi, R. (1996). Towards the improvement of practical teaching assessment. *The Zimbabwe Bulletin of Teacher Education*, 4(4), 26-37.