

A Comparison Study of Curricular of Teacher Education for Elementary Teachers in South Korea and the United States: Focusing on Opportunities to Learn Teaching Mathematics

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Teacher preparation programs are responsible for preparing teachers to be able to perform their work with professional knowledge and skills. What opportunities to learn such knowledge and skills the programs intentionally develop for prospective teachers can be discerned by looking at the curriculum of teacher education. The purpose of this study is to find implications for the curriculum in elementary teacher education in South Korea, especially as that pertains to opportunities to learn teaching mathematics. This paper compares the curricula of 21 teacher preparation programs for elementary teachers in South Korea and in the United States. It finds that the programs in both countries emphasize teacher preparation to teach subject matter and to help elementary students improve their academic knowledge. The overall structures of the curriculums outlined in the programs of both countries are relatively comparable. In terms of the opportunities to learn teaching mathematics, however, they are quite different in what authentic contents they offer. This paper discusses the need for more emphasis on mathematical knowledge for teaching.

I. Why Teacher Preparation Is Important

To improve student achievement, teacher quality is critical (Cohen-Vogel, 2005; Committee on the Study of Teacher Preparation Programs in the United States, 2010). Teacher quality has been characterized as a reflection of competence, the psychological qualities of a teacher, the pedagogical

standards that a teacher exhibits, or the teacher's demonstrated ability to raise student learning (Strong, 2011). Although each approach has its own aims and dilemmas, teachers' professional preparation has been identified as fundamental in teacher quality (e.g., Holmes Group, 1986; National Commission on Teaching and America's Future, 1996; Rosenberg, 2012). Where much doubt persists, however, is how teacher education ought to go about preparing prospective teachers (Imig & Imig, 2007). Irrespective of discussions, one thing

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that is critical for teacher quality is educational opportunities in teacher preparation programs for prospective teachers.

A target that has excited a great deal of discussion as ripe for political and social reform has been teacher education programs. Many researchers in the United States have scrutinized the curriculum for teacher education (e.g., Darling-Hammond, Hammerness, Grossman, Rust, & Shulman, 2005; Liston, Whitcomb, & Borko, 2009), and teacher preparation for teaching mathematics (Morris, Hiebert, & Spitzer, 2009; Sleep & Boerst, 2012; Superfine & Wagreich, 2010). In South Korea, however, few researchers are delving into curriculum of teacher education for elementary teachers. This may be because since the independence of the country, the Higher Education Act has kept stable teacher education programs for elementary teachers. Another reason might be that prospective teachers have very high-level content knowledge thanks to their intensive learning through high school. However, the knowledge entailed in teaching is professional knowledge. Having features quite different from knowledge that people as learners study, it is to help others learn subject matters (Ball, Thames, & Phelps, 2008; Shulman, 1987). Teacher preparation programs are responsible for preparing teachers who can perform their work with professional knowledge and skills. A window into what opportunities such programs design for prospective teachers is available by looking at the curriculum of teacher education.

The current study aims to find implications for curriculum in teacher education for elementary teachers in South Korea, particularly as that pertains to learning to teach mathematics.

Opportunities to learn are framed as content coverage, as “the content of what is being taught, the relative importance given to various aspects of mathematics and the student achievement relative to these priorities and content” (Travers & Westbury, 1989, p. 5, as cited in Wilson, 1976). The current study compares 21 curricula of teacher preparation programs for elementary teachers in South Korea and the United States in terms of what opportunities of learning to teach mathematics can be expected. In terms of international comparison studies, Blömeke and Paine (2008) specified “Unquestionably one of the most important benefits of international comparisons is the variety of manifestations which makes hidden national characteristics visible” (p.2030). In a teacher preparation program, one subject that all prospective elementary teachers need to prepare for teaching is mathematics. Therefore, the current study compares goals of teacher education, principles of building curriculum, and content of teacher education in the two countries. Such a comparison aims to clarify the features of each country’s curricular in teacher preparation programs. Then, content related to learn teaching mathematics is elaborately compared. The research is framed by four questions:

1. Regarding each elementary teacher preparation program, to what extent are South Korea and the United States different or similar in their goals and purposes?
2. Regarding each elementary teacher preparation program, to what extent are the two countries different or similar in their principles used to design the curriculum?
3. Regarding each elementary teacher preparation

program, to what extent are the two countries different or similar in their content?

4. Regarding each elementary teacher preparation program, to what extent are the two countries different or similar in the opportunities they give to learn teaching mathematics?

II. Curriculum in Teacher Education and Opportunity to Learn Teaching Mathematics

1. International Studies about Curriculum for Teacher Education

A recent important study comparing teacher education for elementary and lower-secondary mathematics teachers is TEDS-M study (e.g., Ingvarson et al., 2013). This study compared teacher context and structure about teacher education and teachers' mathematical knowledge for teaching in 17 countries. This large study also reported features of the pipeline to becoming a teacher, how to assure the system, etc. Another recent work, MT21, analyzed lower secondary prospective teachers' survey in six countries including South Korea, and characterized that South Korea focuses most extensively on mathematics but modestly on both the theoretical and practical aspects of pedagogy in teacher education (Schmidt et al., 2008). Pryor, Akyeampong, Westbrook, and Lussier (2012) compared curricula of teacher education in six African countries, and Blömeke and Paine (2008) compared in Germany and the United States curricula for elementary and secondary mathematics teachers. Both research

found different structures of curricula and different purposes involved in the curricular.

2. Purpose in Teacher Education

"Teacher education perceived through the lens of public interest reaches beyond any single theoretical outlook or domain of value" (Hansen, 2008, p. 20). The current teacher preparation programs hold four purposes and value (Conway, Murphy, Rath, & Hall, 2009; Hansen, 2008). First, teacher preparation programs prepare teachers to be able to manage instruction for students' academic learning. Consequently, teachers are able to generate activities that enable students to develop understanding with the significance of academic knowledge. Second, teacher education puts a value on human development based on the belief such as human generativity and meaning making. Teachers can grow as a moral person and a whole person and care about their students' human development. Third, teacher education conceives of social justice as the core value in the preparation of teachers, and, thus, teachers become cultural and civic citizens. "Teacher preparation is a dynamic vehicle for equipping new generations of teachers to play a part in societal transformation" (Hansen, 2008, p. 13~14). Finally, teacher education programs prepare teachers who can be committed to their continuing professional development.

3. Requirements for Teacher Education as Professional Education

Ball and Cohen (1999) argued that strong teacher education is professional education: teachers should

become professionals who can be against conservative and traditional lessons and help diverse learners become competent and skilled and understand what they are doing. The authors emphasized that teacher education needs to center around professional learning for the practice of teaching. Of professional education, they specified three basic requirements: professional performance, professional knowledge, and professional discourse. First, “teacher education must offer opportunities to experience the tasks and ways of thinking that are fundamental to the practice” (Ball & Cohen, 1999, p. 10). Performance in teaching should be professionally responsible to students and skillfully carried out for students’ learning. Those experiences of responsible and responsive teaching need to be compelling and vivid. Second, teacher education must be education that cultivates the knowledge and skills that will enable a teacher to be highly effective in helping students learn. “The professional knowledge would include ideas about appropriate curriculum and pedagogy, the materials and experiences best suited to help people learn, and how to engage them” (Ball & Cohen, 1999, p. 10). Third, learning for professional performance and professional knowledge can be cultivated with the development of professional discourse and engagement in communities or practice. Furthermore, professional discourse serves to build and sustain a community of practitioners who collectively seek human and social improvement. Such discourse needs to be rooted in shared intentions and challenges and improve them. The current study uses these three requirements to investigate principles of building curriculum for teacher education.

4. Knowledge for Teaching as Professional Work

“Teaching is a profession, and teachers must be prepared to make decisions in the best interests of their students using the best available knowledge to so” (Darling-Hammond, 2006, p. 83). Ball and Cohen (1999) specified features of such knowledge: understanding both the ideas and ways of reasoning in particular subject fields; knowing what children are likely to find interesting or have trouble with in certain domains; becoming acquainted with cultural differences; developing their ideas about learning, including what it means to learn and what helps children learn; and possessing the capacity to adapt and shift modes in response to students. Darling-Hammond (2006) also classified the three general areas of a professional knowledge for teaching: knowledge of learners and learning in social contexts; knowledge of curriculum and subject matter; and knowledge of teaching.

In terms of content knowledge for teaching, Shulman (1987) highlighted the connection between subject matter knowledge and teaching. With regard to teaching mathematics, several researchers have introduced their conceptualizations about mathematical knowledge that work in teaching (e.g., Baumert et al., 2010; Rowland, Huckstep, & Thwaites, 2005; Tatto et al., 2008). Particularly, Ball et al. (2008) elaborated Shulman’s conceptualization as *mathematical knowledge for teaching*, which is the mathematical knowledge, skill, and habits of mind entailed by the work of teaching. There are four major subdomains: *common content knowledge* as the mathematical knowledge possessed by any educated adult;

specialized content knowledge as mathematical knowledge and skills used by teachers in their work; *knowledge of content and students*, such as what students are likely to think and what they will find confusing; and *knowledge of content and teaching*, such as the design of instruction. This study used these four subdomains to identify features of opportunities to learn teaching mathematics.

III. Systemic and Social Differences around Teacher Preparation Programs in South Korea and the United States

Before jumping to the curricula in teacher preparation programs, it would be beneficial to have a sense of how the United States and South Korea differ systemically and socially in their teacher education. Such differences are indeed intimately related to curricula for teacher education and finally influence the existence of different foci in opportunities to teach and learn mathematical knowledge for teaching.

In South Korea, many aspects of teacher education programs and certification processes are governed by the Ministry of Education. For elementary school levels, there are thirteen institutions to offer teacher preparation programs for elementary teachers. Ten of them are the national universities of education only for elementary schools; two are a single major in elementary education in the national universities,

and one is in a private university. Each designs and implements a curriculum under Articles 41 and 44 of the Higher Education Act in accordance with the relevant rules set by the Ministry of Education. Because of the appropriately maintained system for the supply and demand of elementary school teachers, many prospective elementary teachers get teaching positions, although the situation varies from year to year. After completion of the programs, all graduates receive a bachelor's degree in elementary education, and the initial teacher's certificate is awarded if they gain appropriate scores for aptitude test for teaching and pass a license examination. This certificate is valid for life. Generally to get a teaching position in elementary school, teacher candidates who have already graduated or are candidates for graduation, must take and pass the government-administered Teacher Employment Examination.

In the United States, each state has different rules and procedures related to teacher certifications and policies for teacher education. There are various types of institutions that offer teacher preparation for candidates, such as universities and colleges that can recommend qualified candidates to the Department of Education for provisional teaching certification, universities and colleges that are not certificated by the states, and alternative teacher certification programs (e.g., Teach For America, New Teacher Project, etc.). Generally, candidates have to complete additional requirements before beginning the program and after finishing the program, such as criminal background check requirements, training for blood-borne pathogens, and test for teacher certification readiness examination before beginning the program. At the

end of a program, many programs also ask candidates to be certified in CPR (child and adult) and first aid and to take and pass a test for teacher certification in Elementary Education. Although it differs by state, certification is generally valid for up to six years. Moreover, the teacher education program is generally offered to students in their junior year. In other words, many undergraduate students in teacher preparation programs in universities are technically transfer students within the universities, although they can transfer from external institutions.

In South Korea, a teaching position is desirable for its job security and benefits (Kwon, 2004). Teachers may work until retirement age, 62, and after their twentieth year of teaching they receive a pension. Furthermore, a teaching job is considered a high-status profession that makes a greater contribution to society (Barber & Mourshed, 2007). In the United States, it would be difficult to defend that a teaching position is a desirable job. Teaching positions are not stable because of lots of part-time positions and low salaries. Teaching is still not recognized as a professional position. There are still many teachers who majored in something other than education or who teach without teaching certificates. This situation is slowly changing, thanks in part to the Obama administration's strengthening, as of 2007, the quality of teachers by redesigning and reforming No Child Left Behind. Nonetheless, it is easy to find policies that show teaching positions considered as non-professional work in the United States.

Additionally, elementary teachers in South Korea typically teach ten subjects (morality, Korean language, social science, mathematics, natural science, physical education, music, art, English, and practical course education), integrated subjects, and extracurricular subjects. Thus, teacher preparation programs offer courses related to teaching all these subjects. However, in the United States, elementary teachers generally teach only four subjects (literacy, mathematics, social studies, and science), which are then the focus of many teacher preparation programs.

IV. Data and Method

1. Data

This paper selected twelve programs out of South Korea's thirteen teacher education programs for elementary teachers. It selected nine top-10 programs in the United States from the list of 2014 Education Rankings in U.S. News about elementary teacher education.¹⁾ Thus, the United States programs are not nationally representative but considered of much higher quality teacher education. This study seeks implications about teacher education in terms of opportunity to learn the teaching of mathematics in South Korea. Hence, this purposive sampling in the United States would seem reasonably appropriate. This study focuses, in both countries, on undergraduate-level teacher education programs for

1) One curriculum in South Korea does not show credits for each course, and one top-10 ranked teacher preparation program is a master's degree program. Thus, these two preparation programs are excluded from the current study.

elementary teachers. Here, 10 teacher education programs are offered by independent institutions only for elementary teachers in South Korea. The other two programs in South Korea and the nine programs in the United States are a single major in elementary education. After selecting the 21 programs, the curriculum of each program was gathered (in the fall of 2014 via their websites) from their official documents that introduce their programs.

2. Method to Analyze the Data

This study analyzed the data by document analysis (Bowen, 2009). Opportunities to learn the teaching of mathematics are associated with one part of teacher preparation for elementary teachers. This being the case, it is reasonable to investigate this opportunity from the overall curriculum to narrow sections related to teaching mathematics in

each curriculum of each preparation program.

Of each curriculum, the study examined four parts: purposes and visions of elementary teacher education program, principles of building curriculum for teacher education program, its curricular structures and overall content, and content to learn teaching mathematics. The curriculum documents were coded by the features of these four parts. First, purposes and visions of each teacher preparation program for elementary teachers are coded according to the four features that Hansen (2008) and Conway et al. (2009) identified in the previous section. Second, principles to build teacher education curriculum are coded by the three requirements for professional education by Ball and Cohen (1999), as described in the previous section. Third, curriculum structure is examined in course titles and their explanations. Particularly, they are classified based on Darling-Hammond (2006), Shulman (1987), and

<Table IV-1> Categories of Knowledge and Related Courses Offered by Teacher Preparation Programs for Elementary Teachers

Type of knowledge		Examples of courses
General pedagogical knowledge	Theory of education	Introduction to Education; Educational Psychology; Educational Administration; Childhood Development; Instruction and Assessment
	Practical knowledge for classroom and school	Legal and Ethical Issues for Teachers; Teaching the Exceptional Learner; Managing to Teaching and Instruction
Knowledge for teaching subjects	Theory of subject matter education	Theory of Elementary Mathematics Education; Introduction to Arts Education
	Content knowledge	Calculus; English Composition; American History
	Subject matter knowledge for teaching	Elementary Mathematics for Teachers; Biological Science for Elementary Teachers
	Knowledge about instructional method & content and students	Practice of Elementary Mathematics Education; Teaching and Learning Social Studies to Elementary Students; Literature, Media and Creative Pedagogy for Classrooms
General knowledge		Courses for the Liberal Arts, university-wide requirements and electives
Field placement		Internship in Teaching Diverse Learners, Student Teaching, Practicum
Performance for art and physical education ²⁾		Courses of practicing performances for art and physical education

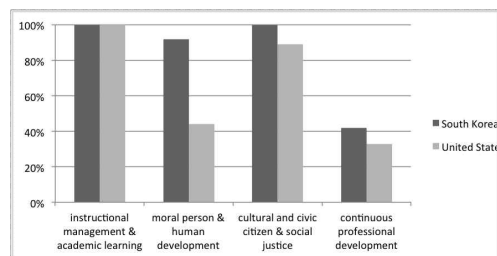
Ball and Cohen (1999), which is also specified in the previous section. For the intensive courses for advanced subject matter knowledge in teacher preparation programs in South Korea, this study used courses related to mathematics based on the assumption that courses related to the nine other subjects are designed similarly. Table IV-1 shows the conceptual categories of teacher knowledge and examples of related courses. Finally, content related to learning the teaching of mathematics are categorized based on Ball et al. (2008) and parts of categories in Table IV-1.

Field coding the curriculum documents were the author of this paper and another researcher, both of whom are competent in English and Korean and work in mathematics education. If a given key idea was found, we assigned a 1 to the program. Otherwise, 0 was assigned. The interrater reliability by the Kappa statistics ranged from .785 to .983 ($p < 0.001$), indicating a very high degree of agreement between the two raters.

V. Curriculum of Teacher Education and Opportunities to Learn Teaching Mathematics in South Korea and the United States

1. Purposes of Teacher Education Programs for Elementary Teachers

- 2) Courses for performance for art and physical education are not typical in the United States because teacher certification for elementary school generally does not include these subjects. Those subjects are generally taught by teachers who majored in them or are professionals in them.



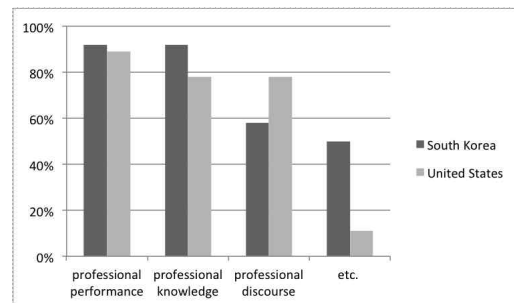
[Figure V-1] Percentages of teacher preparation programs whose educational purposes are specified

Figure V-1 shows the percentages of teacher education program whose educational purposes identified a different value for prospective elementary teachers. Teacher preparation programs are different according to their cultures, histories, and public senses about education. However, there are similarities and differences between the two countries. First, all teacher programs in both countries emphasized teachers' preparation to manage elementary classrooms for students' academic improvement. Because the purposes of education affect the content provided in the programs, it can be assumed that large portions of curriculum are related to subject matter education and knowledge for pedagogy to make teachers prepare for teaching subjects. And this expectation actually works, as is demonstrated in a later section. Second, education about being a moral person is more emphasized in South Korea than in the United States. This emphasis might be rooted in South Korea's tradition of "being a model." This tradition, influenced by Confucian culture, is one of the significant roles that elementary teachers

in particular need to have. In the United States, however, the proportion of teacher preparation programs for elementary teachers that carry on this purpose is more than two-fifths, which is not low. Third, all teacher education programs in both countries uphold all four purposes, rather than underestimating any of them.

2. Principles to Build Curriculum of Teacher Education for Elementary Teachers

Figure V-2 shows the percentages of elementary teacher preparation programs that specify their principles for designing curriculum. Generally, percentages for all three requirements of professional education are high. These high percentages work together to achieve the twin objectives—classroom management and students’ academic improvement—held by all preparation programs in both countries. A noticeable point is that approximately half the institutes in South Korea specify principles not categorized by Ball and Cohen (1999). Most of these concern executive elements, such as extending selective courses to gratify prospective teachers’ appetites for knowledge and cultivating their individuality. This might be because of the rigid regulations, exemplified by those in the Higher Education Act, that teacher preparation programs must abide by; such programs would like to clarify their efforts to be flexible with their curriculum. However, in general, many teacher preparation programs for elementary teachers in both countries uphold the three principles, professional performance, professional knowledge, and professional discourse.



[Figure V-2] Percentages of teacher preparation programs that specify their principles for building curriculum

3. Curriculum Structure of Teacher Education for Elementary Teachers

Descriptive statistics and *t*-test results were conducted to compare credit requirements allocated to different types of courses in teacher education programs for prospective teachers. Because of the small numbers of samples with respect to institutes of teacher education for elementary school in both countries (12 in South Korea and 9 in the U.S.), these statistical analyses must be used carefully, but they can shed a good deal of light on features of the curriculum structures in both countries.

Table V-1 displays the credits for different types of courses in teacher education institutes. Among these institutes, several commonalities are apparent. First, all programs in both countries include general pedagogical knowledge, knowledge for teaching subject matter, field placement, and general knowledge. Thus, preparation programs in both countries have, overall, similar structures of curriculum. Second, the total credits necessary to graduate are not statistically different, though discretely small differences exist between them.

<Table V-1> Credit Allocated to Different Types of Knowledge in Teacher Preparation Programs for Elementary Prospective Teachers

	South Korea (n =12)		United States (n =9)		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Total graduate credits	143.25	3.81	134.00	20.00	1.37	.206
General pedagogical knowledge	22.92	9.15	19.44	6.88	0.95	.353
Knowledge for teaching subject matter	68.42	9.66	62.89	32.25	0.50	.631
Field placement	4.33	0.65	18.67	4.53	-9.42	<.001
General knowledge	35.42	6.05	33.00	22.61	0.31	.762
Performance for art and physical education	10.58	3.12	0	0	11.76	<.001

<Table V-2> Credit Allocated to Different Types of General Pedagogical Knowledge and Knowledge for Teaching Subject Matters in Teacher Preparation Programs for Elementary Prospective Teachers

		South Korea (n =12)		United States (n =9)		<i>t</i>	<i>p</i>
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
General pedagogical knowledge	Theory of education	17.08	6.44	11.22	5.74	2.16	<.05
	Practical knowledge for classroom and school	5.83	3.49	8.22	4.52	-1.37	.187

Therefore, the graduation requirements in both countries look similar. Third, both countries allocate the most credits to knowledge for teaching subject matter. Both countries put substantial stress in their teacher preparation programs on knowledge for teaching subject matter. Fourth, neither are there statistical differences in credits allocated to general pedagogical knowledge, knowledge for teaching subject matters, and general knowledge. Therefore, these three types of knowledge seem to be assigned similarly in both countries. General pedagogical knowledge and knowledge for teaching subject matter are examined more carefully below.

A couple of differences are apparent. First, standard deviations for many types of knowledge in South Korea are relatively smaller, but they are really larger in the United States. This is likely due to teacher education programs in South Korea being brought under the Higher Education Act with its specific articles for teacher preparation programs; teacher education programs in the United

States are free of such articles. Therefore, institutes in the United States may emphasize what they choose in their curriculums. Second, teacher preparation programs in the United States allocate more than three times the number of credits as do those in South Korea for field placement.

As mentioned above, the countries are similar regarding general pedagogical knowledge and knowledge for teaching subject matters in both countries, but details are quite different statistically and descriptively. Table V-2 shows elaborated categorization. First, preparation programs in South Korea offer more credits related to the theory of education than do their U.S. counterparts. This tendency appears again in the knowledge for teaching subject matter. Second, in South Korea this knowledge is heavily emphasized unlike in the United States, and it is statistically different. Particularly, in the United States very small are the mean and standard deviation of the theory of subject matter education. This indicates that teacher

<Table V-3> Credit Allocated to Different Types of Knowledge Related to Teaching Mathematics in Teacher Preparation Programs for Elementary Prospective Teachers

	South Korea (n =12)		South Korea (n =12)		United States (n =9)	
	[Around 90% prospective teachers]		[Around 10% prospective teachers with advanced subject knowledge]			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Knowledge related to teaching mathematics	5.17	0.72	25.17	7.60	11.22	5.74

preparation programs in the United States rarely open these kinds of courses. Third, models of courses related to knowledge for teaching subject matter are substantially different in both countries. Each part is also statistically different. South Korea stresses (with approximately sixty credits in teacher preparation programs) knowledge about instructional method and content and students and also theory of subject matter education; the United States stresses content knowledge. Also notable is that in the United States subject matter knowledge for teaching is assigned secondly in the programs, although the standard deviation is large.

4. Opportunity to Learn Teaching Mathematics

This section carries out in two ways its investigation into opportunities to learn teaching mathematics in teacher preparation programs in South Korea and the United States. This is because of South Korea's intensive courses with advanced subject knowledge. All teacher education programs in South Korea assign courses for advanced subject knowledge in order to help prospective teachers study in depth particular subject matter knowledge. Approximately 10% of prospective teachers take courses for advanced subject knowledge in each subject. In other words and as shown in Table V-3, 10% of prospective teachers take more

courses with approximately twenty credits related to teaching mathematics.

Credit allocation related to knowledge for teaching mathematics for around 90% prospective elementary teachers in South Korea is statistically different from credit allocation in the programs in the United States ($t = -3.15, p < 0.05$). Credit allocation for around 10% prospective elementary teachers in South Korea is also statistically different from credit allocation in the programs in the United States ($t = 4.60, p < 0.01$). In other words, any comparison is substantially different. Thus, this section uses the results of analysis by percentages of credit allocated in courses for teaching mathematics.

Table V-4 shows the percentages of credit requirements allocated to different types of opportunities for learning the teaching of mathematics in elementary teacher preparation programs for 90% of prospective teachers in South Korea and all prospective teachers in the United States. Although the standard deviations are large, the overall alignments for opportunities to learn the teaching of mathematics are quite different. While in South Korea the most substantial emphasis is on the theory of mathematics education, in the United States the emphasis is on specialized content knowledge. Specialized content knowledge, knowledge of content and students, and knowledge

<Table V-4> Percentages of Credit Allocated to Different Types of Knowledge for Teaching Mathematics in Teacher Preparation Programs for Elementary Prospective Teachers

	South Korea (n =12) [Around 90% prospectiveteachers]		United States (n =9)		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Theory of mathematics education	29.88	18.59	0	0	5.57	<.001
Disciplinary mathematics	0	0	6.09	12.24	-1.49	.174
Common content knowledge	0	0	21.63	14.73	-4.41	<.01
Specialized content knowledge	24.93	6.52	38.84	6.83	-4.74	<.001
Knowledge of content and students	20.47	10.50	17.22	9.63	0.73	.477
Knowledge of content and teaching	24.93	6.52	16.24	10.34	2.36	<.05

<Table V-5> Percentages of Credit Allocated to Different Types of Knowledge for Teaching Mathematics in Teacher Preparation Programs for Elementary Prospective Teachers

	South Korea (n =12) [Around 10% prospective teachers with advanced subjectknowledge]		United States (n =9)		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Theory of mathematics education	30.39	11.69	0	0	9.00	<.001
Disciplinary mathematics	21.36	17.37	6.09	12.24	2.25	<.05
Common content knowledge	8.84	8.15	21.63	14.73	-2.55	<.05
Specialized content knowledge	21.43	10.03	38.84	6.83	-4.48	<.001
Knowledge of content and students	6.47	3.76	17.22	9.63	-3.17	<.05
Knowledge of content and teaching	11.45	5.30	16.24	10.34	-1.39	.181

of content and teaching are equivalently distributed in South Korea. Common content knowledge, knowledge of content and students, and knowledge of content and teaching are similarly given in the United States. South Korea's programs emphasize more knowledge of content and teaching than does the United States; however, the United States programs emphasize more common content knowledge. It is also noticeable that South Korea offers no credit for disciplinary mathematics and common content knowledge in South Korea and the United States offers none for theory of mathematics education.

Table V-5 shows the percentages of credit requirements allocated to different types of courses pertaining to learning the teaching of mathematics

in elementary teacher preparation programs. These are for around 10% prospective teachers in South Korea and all prospective teachers in the United States. Again, while standard deviations are large, overall alignments for opportunities to learn teaching mathematics are quite different.

The most important emphasis is still on the theory of mathematics education in South Korea. However, more opportunities to learn teaching mathematics through the courses about the disciplinary mathematics are assigned to these 10% prospective teachers in South Korea. While South Korea gives no credit for disciplinary mathematics to prospective teachers (as shown in Table V-4), this emphasis is now statistically more in the United States. In summary, approximately 10% of

prospective Korean teachers have more opportunities to learn the teaching of mathematics through more credits with the theory of mathematics education and disciplinary mathematics than other courses; however, most prospective American teachers have more opportunities to learn teaching mathematics through more credits with common content knowledge, specialized content knowledge, knowledge of content and students, and knowledge of content and teaching than other types of knowledge. The United States still lays more stress than does South Korea on common content knowledge and specialized content knowledge.

VI. Implications for Teacher Preparation Programs for Elementary Teachers in South Korea with regard to Opportunity to Learn Teaching Mathematics

Teacher education programs for prospective elementary teachers in both countries emphasize teacher preparation to teach subject matter and to help elementary students improve their academic knowledge. This emphasis is specified apparently in the purposes of the curriculum and the principles to design curriculum. While the overall structures of the curricular outlined in the programs in both countries are relatively comparable, there is quite a difference in the authentic contents offered in the curricular. This is due to the fact that teaching is cultural work (Stigler & Hiebert, 1999) and there are national differences in social expectations for

teacher knowledge (Kim, Ham, & Paine, 2011). As specified in the third chapter, because of the big culturally and societally differences about teaching positions and expectations about roles of teachers, it is reasonable that teacher education programs in both countries have different purposes of teacher education and different curriculum.

It would be also beneficial to consider placing more value on mathematics knowledge entailed in the work of teaching in the curricula of teacher preparation programs in South Korea. Mathematical knowledge for teaching is mathematical knowledge, skill, and habits of mind entailed by the work of teaching (Ball et al., 2008). It has been found that such knowledge is crucial to the improvement of teaching and learning mathematics (National Mathematics Advisory Panel, 2008) and has been shown to be associated with students' achievement gains (Baumert et al., 2010; Hill, Rowan, & Ball, 2005; Rockoff, Jacob, Kane, & Staiger, 2011). As Ball and Cohen (1999) described, teacher education as professional education needs to help teachers learn such special mathematical knowledge in and for teaching practice. In terms of offering opportunities to learn teaching mathematics, teacher preparation programs for elementary teachers in South Korea are, however, provided more for the understanding of theories and philosophy about mathematics education rather than having better mathematical knowledge for teaching, as shown in Tables V-4 and V-5.

In regard to educational theories considered to serve as professional knowledge to perform teaching, the preparation programs in South Korea might expect that prospective teachers can synthetically comprehend their learning from

courses that they have taken and later apply it in their actual mathematics classrooms. There might be an expectation for being teachers as researchers in the practical education field. Less emphasis on mathematical knowledge for teaching might be due to the high level mathematical knowledge that prospective teachers already possess. Most universities of education in South Korea recruit their incoming students from the top ten percent from each cohort that graduate from their school systems in South Korea, the top ten percent in Finland, and the top 20 percent in Singapore (Barber & Mourshed, 2007; Ingvarson et al., 2013). As reported in TIMSS study (Mullis, Martin, Foy, & Arora, 2012), students in South Korea are always highly ranked in mathematics. Although there is no comparison study to show the status of incoming prospective teachers in teacher education programs, applicants have very strong mathematics subject knowledge. Nevertheless, teachers would need to understand the mathematics they teach, in ways quite different from those they learned as students (Ball & Cohen, 1999; Rowland et al., 2005; Tatto et al., 2008).

Mathematical knowledge for teaching as professional knowledge is not always the product of conventional mathematics learning (Begle, 1979; Monk, 1994; National Mathematics Advisory Panel, 2008). This conventional learning generally does not aim at the specialized knowledge of mathematics needed for instruction (Suzuka et al., 2009). With strong evidence about the effect of teachers' mathematical knowledge for teaching, an emphasis on mathematical knowledge for teaching in curriculum of teacher education could positively influence teacher's teaching and students' learning.

Here, it seems critical to clarify that such an argument—placing more value on mathematics knowledge entailed in the work of teaching in the curricula of teacher preparation programs in South Korea—is just one of the possibilities for improvement, not a claim to share the same interests related to mathematics teacher education in both countries or to use the same criterion to measure the programs. According to Blömeke and Paine (2008), the findings of the current study would function both to recognize the diversity of cultural frames of teacher education and to deepen the understandings of curricula of teacher education in South Korea.

VII. Conclusions

It is apparent that the main strength of South Korea is its stable and government-oriented education system. However, in this centralized system, there are some implications that more opportunities could be given in terms of professional knowledge. Obviously, there is a great deal of flexibility for instructors to use and apply ideas of mathematical knowledge for teaching as professional knowledge. The current study investigated the goals and content among the main components included in the curriculum of teacher preparation programs. On one hand, it is expected that there will be research on program evaluation and curriculum of courses for learning to teach mathematics that are planned and enacted. This research can find and compare how the curricula of teacher preparation programs have achieved results. Moreover, such research can show and

differentiate, between the two countries, the actual instruction to teach and learn mathematical knowledge for teaching with actual cases. On the other hand, it is critical to gather and share ideas and cases about what curricular courses can be designed and implemented in the teacher preparation programs for prospective teachers in South Korea.

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한미 초등 교사를 위한 교육과정 비교: 수학 교수의 학습 기회를 중심으로

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본고는 초등 교사를 위한 한국의 12개 교사 교육대학과 미국의 9개 대학의 교육과정을 비교하여, 전문직 교육으로서 한국의 수학교사교육을 위한 시사점을 찾는 것을 목적으로 한다. 교사교육의 목적, 교육과정 구성의 원리, 대학이 제공하는 강좌 구성, 그리고 수학 교수의 학습 기회의 네 가지 관점에서 교육과정을 비교 분석하였다. 두 나라의 교육과정은 교과목 지도를 특히 강조하며, 궁극적으로 초등학생들의 학력신장을 목적으로 한다. 이러한 목적하에 두 나라의 초등 교사 교육과정을 전체 구조는 유사하지만, 수학 교수의 학습기회라는 관점에서 교육과정이 제공

하는 내용은 매우 상이한 양상을 보이고 있었다. 두 나라의 교육 및 교사에 관한 매우 다른 사회문화적 관점과 상황 때문에 다른 교사교육과정을 실행하는 것은 당연한 결과이다. 그러나, 여러 연구 결과에서 증명하듯 교수를 위한 수학 지식은 학생들의 수학 성취도 및 교사들의 교수와 결정적 관련이 있다. 따라서 체계적이고 안정된 체계로서 운영되고 있는 한국의 교사교육과정의 운영에 있어서 교수를 위한 수학 지식을 중요한 요소로서 고려해야 할 필요가 있다.

* 주제어 : 전문교육으로서 교사교육 (teacher education as professional education), 교사교육과정 (curriculum in teacher education), 수학 교수 학습 기회 (opportunity to learn teaching mathematics), 교수를 위한 수학적 지식 (mathematical knowledge for teaching), 비교 연구 (comparison study)

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