KAERA
Research Forum

Special Issue:

International Comparative Education
Korea and Others

KAERA
Korean-American Educational Researchers Association

EDITORIAL

Dear Educational Researchers,

It is our pleasure to present the compilation of four research papers for the third issue of the *KAERA Research Forum*, an open access online scholarly forum published by the Korean-American Educational Researchers Association (KAERA).

The KAERA Research Forum is a research report series that discusses a variety of topics in educational research and disseminates high-quality examples of theoretical and empirical research studies to inform the larger community of educational researchers and practitioners. The purpose of the KAERA Research Forum is to create a venue of ideas by publishing and disseminating information about the most up-to-date scholarly endeavors and experiments pursued by members of the KAERA community and beyond. The KAERA Research Forum provides an opportunity to both established scholars and emerging researchers.

While this forum focuses on the topic of *"International Comparative Education-Korea and Others,"* the papers in this forum cover a wide array of research topics on understanding and interpreting similarities and differences in education between different countries. The collection of papers addresses various topics, including:

- A cultural immersion program where US teachers stay in South Korea to experience Korean education and culture
- Education for North Korean refugee children in South Korea compared with refugee education in the US
- Educational contexts and science teachers' teaching practices in Finland and South Korea
- Elementary mathematics curriculum programs in South Korea and the US

The papers are presented in alphabetical order of their titles. The first paper is presented by Suhyun Suh, Jung Won Hur from Auburn University and Jae Hoon Lim from University of North Carolina at Charlotte. They describe preliminary findings of the effects of an immersion program in which US teachers experience Korean education and culture by comparing their educational experience in the US.

The second paper by Shin Ji Kang from James Madison University examines an alternative school in Korea where North Korean refugee students are enrolled. The study is informed by the literature on refugee education as mainly studied in the US.

The third paper by Nam-Hwa Kang from Korea University of Education compares Finnish and Korean education in an effort to understand the high performance of students in each country. The two countries have been of interest to many countries including the US for their continuous high performance in international assessments.

The last paper by Ok-Kyeong Kim from Western Michigan University and Jee Hyeon Lee from Seoul Women's University compares mathematics curriculum programs run in South Korea and the US. By focusing on how a specific mathematical topic is addressed in different programs, the study provides specific ideas about curricular programs in mathematics.

We hope that this issue of the KAERA Research Forum on *"International Comparative Education-Korea and Others"* presents opportunities for rich scholarly discussions on comparative education that productively inform the larger community of educational research, policy, and other related areas.

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RESEARCH ARTICLE

K-12 Educators' Transformation Experience through Participation in an International Immersion Program

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This qualitative study explores the experiences of 23 educators who participated in an intensive cultural immersion program abroad. Although student populations in the United States are becoming diverse, teachers' multicultural competencies and global awareness are still lacking. To address this issue in a local community that experiences a significant increase of Korean transnational students, the Global Studies in Education- South Korea Initiative was launched supporting local educators' international travel and cultural immersion experience overseas. The evaluation data suggest that the participants gained a deeper understanding about cultural influence on education by witnessing significant differences between US and Korean schooling practices and people's beliefs/attitudes toward education. Most important, the participating educators later exhibited a growing sense of advocacy and commitment to better support ESL and new immigrant students in their schools.

Despite the cultural landscape of U.S. classrooms becoming increasingly diverse in recent decades, K-12 educators remain primarily White, middle class females (Sleeter, 2001). This lack of diversity has created a potential dissonance between the educational perspectives and values of educators and their culturally diverse students and families (Kwon, Suh, Bang, Jung, & Moon, 2010). Responding to such challenges, the importance of providing teachers with multicultural tranings has been widely recognized in the U.S. schools (Banks, 1997a; Iverson, 2012; Scott & Pinto, 2001). The multicultural education movement no longer accepts assimilation epitomized by the melting pot perspective but instead pursues its ultimate goal of promoting a society where socioeconomic equity and social justice are practiced for all members of society (Iverson, 2012). This ultimate goal can be achieved through a transformation in the educational system by supporting educators to become changing agents, and to transform their students, schooling, and schools (Ameny-Dixon, 2004).

Researchers postulate that the development of multicultural competencies entails a continual acquisition of awareness, knowledge, and skills in working with students of different cultures (Banks, 1997a; Sue, Arrendondo, & McDavis, 1992; Sue & Sue, 2013). Awareness

includes self-awareness, the status of understanding one's own culture and its impact on the development of their own beliefs, values, stereotypes, and biases one may have about students from other cultures (Nieto, 1992). To educators, awareness also refers to the capacity to be able to identify social, institutional, and economic inequity and injustice prevailing in the educational system (Banks, 1997b; Banks, 2004; Iverson, 2012). Knowledge includes learning about others' cultures and understanding the similarities and differences by comparing them to one's own. Skills are abilities to communicate effectively across cultures, and to empower students to practice sound decision-making behaviors and to take proper social actions to combat prevailing educational inequity and injustice (Banks, 1997b; Iverson, 2012). It also means that educators advocate for positive changes in school curriculum and instructional practices by serving as a change agent. The needs for multicultural education apply equally to teachers from both a majority and a minority ethnic group (Montecinos, 1994).

Unfortunately, although multicultural education training has been growing, research findings often present educators' dissatisfaction with their training in relation to the level of training opportunity and diversity of instructional strategies (Miller, Miller, & Schroth, 1997; Pang, 1994; Scott & Pinto, 2001; "Should Teachers," 2006; "Teachers Unprepared," 2008). In recent years, the paradigm of multicultural training for educators has shifted from academic assignments to a stronger emphasis on cultural immersion experiences, such as traveling abroad. Through the first-hand experiences of working with people in different cultures, individuals can naturally develop their cultural awareness and knowledge (Alexander, Kruczek, & Ponterotto, 2005). Banks (2004, 2013) also state that global trainings can help students develop an in-depth understanding of the similarities and differences of various cultures. Echoing Banks' perspective, Ameny-Dixson (2004) highlights the needs for broadening the scope of multicultural education to include global perspectives considering the rapidly increasing interconnection among nations in the world and many global issues challenging the welfare of all human beings on earth.

In order to promote educators' multicultural competencies and global awareness, we have developed a cultural immersion program, Global Studies in Education- South Korea Initiative in the year of 2011. This program included a semester-long pre-departure program and 16-day trip to South Korea. In this report, we introduce the program and highlight some unique insights, particularly the program's preliminary impacts on the educators' multicultural awareness, knowledge, and skills including commitment to advocacy.

PROGRAM DESCRIPTION: GLOBAL STUDIES IN EDUCATION SOUTH KOREA INITIATIVE

Global Studies in Education-South Korea Initiative is a professional development program for local K-12 educators developed by university and local business leaders in order to address the diversifying population issues. The rise of Korean automakers in the Southeastern region of the U.S. in recent years has increased the influx of Korean employees and families. As a result, the enrollment of non-English speaking Korean K-12 students increased, growing from less than twenty in 2005 to approximately 400 in 2011. With a sudden influx of a Korean English as a Second Language (ESL) student population, local schools struggled to accommodate their educational needs. This program, Global Studies in Education: South Korea Initiative, was developed to provide local educators with an opportunity to visit Korea and to learn about the Korean school system, educational expectations for students, and other cultural knowledge that they need to better understand and serve the growing Korean ESL students. This program also intends to expand the overall multicultural competencies of teachers including but not limited to

acquiring a better understanding of the needs of Korean students and parents, and serving them with heightened cultural sensitivity.

The program included a semester-long pre-departure educational class and 16 daylong abroad educational and cultural activities during a summer of 2011 and 2012. Pre-departure orientation was provided during a semester long session in the Spring. Classes met for two hours every other week. All activities and lectures focused on the general goal of increasing participants' knowledgebase about Korea. Class topics covered Korean culture, religion, education, history, politics, geology, and various topics that the participants brought to the class for discussion. Basic Korean language was also taught. Additionally, participants read and discussed the Korean bestseller, *Please Look After Mom by* Kyung-sook Shin in order to understand family values and social norms in Korea. Two faculty members, including one Korean American, served as coordinators. The program was financed by the joint efforts of a local automotive company, the Office of University Outreach, and the College of Education at Auburn University.

A total of 23 educators participated in the program for the two years. They included 14 subject area teachers, three ESL teachers, two school counselors, and four administrators including one principal, two assistant principals, and one central office administrator. A majority of the educators came from a city school district with a high-density Korean student population, while four teachers were selected from two other neighboring school districts. All program applicants were interviewed and selected by a group of interviewers including program coordinators and high level district administrators. Each year, roughly half of the applicants were selected based on their potential for contribution to the transnational or immigrant community in the region which includes a large number of Korean transnational families. Approximately 70% of the program participants had international travel experience to regions such as Western Europe, South America, and Africa, but only one had traveled to Asia before. Whether they had prior international experience or not, all expressed an appreciation for their first-hand international experiences through immersion. They saw it as an opportunity to increase their awareness and knowledge about newly arrived Korean transnational students prior to enrolling in the new American school. All participants had the experience of teaching English language learners (ELLs) but recognized their limited experience and knowledge to assist Korean students and families. Most international students that they had known were children of university faculty and staff members. Very few had prior experience working with a large group of Koreans unaffiliated with a university. Thus, although they were willing to help, participants had experienced difficulties in supporting Korean students and families due to their limited understanding of Korean culture and the educational system as well as a lack of school level professional development on ELL education.

METHOD

An exploratory qualitative study was conducted with all 23 participants in order to understand their overall perceptions and experiences and possible impact of the program. Multiple types of data were collected throughout the program, including a short demographic/professional background survey, an application statement detailing the participants' interest in the program, daily reflection journals during the 16-day trip, and small group interviews conducted during or immediately after the trip. For the current study, small group interviews were used as the primary source for data analysis. A loosely structured interview protocol was used for all of the five small group interviews, and each interview took approximately one and a half hours. The interviews

were tape-recorded and later transcribed verbatim for data analysis. In order to document follow-up advocacy activities executed by the program participants, we consulted with one participating teacher and one Korean bilingual staff member who has worked as a liaison for the city school system. Consequently five small group interviews, two consultation interviews, and follow-up email exchanges were used as the main source of data for the current study.

Qualitative data analysis followed the guidelines of thematic analysis (Ezzy, 2002) and identified major commonalities across the five group interviews. In order to ensure the quality of our findings, we employed a collaborative, iterative analytic approach as a team consisting of three faculty members from different disciplinary backgrounds. Two authors (the second and third authors) of this paper read all interview transcripts and exchanged their initial understanding about the data (e.g., possible themes found in the data). We identified two main foci for further analysis, one examining the educators' perceptions about positive and negative aspects of Korean education and its cultural contexts, and the other exploring the preliminary impacts of the cultural immersion experience upon their multicultural competencies.

Once the focus of analysis was set, we used Atlas.ti program to conduct a more systematic analysis of the data. Within the Atlas.ti program, many open codes were created under each of the two large themes explained above. The first analysis naturally generated binary categories, positives and negatives, each holding 10-13 small open codes. The second analysis ultimately yielded two sub-categories, increased self-awareness and commitment to advocacy, each featuring 5-7 smaller open codes. Based on the code output from Atlas.ti, we summarized findings using three sub-headings: positives and negatives of Korean education/culture, increased self-awareness, and commitment to advocacy.

FINDINGS

Positives and Negatives of Korean Education and Culture

During and after the cultural immersion experience, the participants naturally engaged in conversations discussing some unique aspects of Korean education and Korean society. In general, they elaborated a relativistic view about culture and tried to express a more positive outlook about their observations during the program.

As a whole, the participants perceived that Korean society is rich with historical knowledge, and characterized with the sense of pride and futuristic orientation. They also found that Korean's hospitality is exceptional and considered it as part of the society's long-time cultural traditions that emphasizes the importance of relationship building and courtesy. The participants also felt that Korean teachers receive more respect, yet the teacher and student relationships seem to be closer and richer than those in typical American schools. One teacher commented, "It looked like they did have a wonderful relationship with their teachers and were not afraid to ask questions."

The participants were highly impressed with the level of "independence," "enthusiasm" and "passion" reflected in the everyday attitude of Korean students, parents, and school professionals. They were surprised to see Korean students voluntarily engage in intensive study schedules without the direct supervision of their parents. "I think a lot of the Korean culture is independent. Our parents feel like they have to be sitting there helping kids with homework. I don't see that that happens in this culture, because we have kids here that voluntarily stay after school to study. That doesn't happen for us." Several other participants positively recollected that "when they (Korean teachers) were talking about their school and what they do, it was with

passion." The American teachers felt that Korean educators seemed to be "competitive within their spirit" having "an intrinsic motivation to be the best you can be." "They're just trying to be the best. It's not being better than somebody; it's just being the best that you can be, and how eager they are to share that."

While holding a relativistic view about culture, the American educators still found several aspects of Korean education and society not positive or in need of changes in the future. They equivocally expressed that the high academic pressure given to Korean students was beyond their imagination. It was hard for them to understand that Korean students hardly enjoy family time, reading for pleasure, and/or romance during their high school years. They are also troubled to know about little support available for special education and career technical education. They also discussed the ramification of the recent policy banning corporal punishment in Korean schools and predicted that such policy would bring in a new challenge to Korean educators.

Increased Self Awareness

During the group interview, the participants described multiple benefits that they earned from their cultural immersion experience. They explained that the immersion experience helped them increase their self-awareness and self-reflection. Even though they were constantly escorted by a bilingual faculty member and other bilingual guides, they had, for the first time, the uncomfortable and awkward experience as a person unable to comprehend the conversation around them and to communicate their basic needs (e.g., finding a restroom). Through this first-hand experience, the American educators gained a deeper understanding for how new immigrant students with limited English proficiency feel like in their new schools/classrooms. One participant said that the immersion experience was a "kind of an empathy lesson" making her feel a similar kind of insecurity and anxiety that ESL students experience in her classroom. They also acknowledged that this was their starting point. One participant said, "I thought I had a pretty good grasp on things, but I don't. I still need to grow so much more, being in a totally different culture, being immersed in their culture."

Commitment to Advocacy

The participants returned from Korea started to work as change agents by creating new initiatives for Korean students and their parents. They launched various school-based projects and promoted international parents' active involvement in school. For example, an international parent's organization was created at each of the elementary and secondary levels with the help from the participant teachers. Through these organizations, parents were invited to multiple school functions throughout the school year. Parents with limited English skills assisted teachers in organizing books in the library, developing bulletin boards, and preparing other class materials. Parents with English fluency skills served as a teacher assistant in classes. The school expanded and diversified informational meetings for parents of students with limited English language skills as well.

In the beginning of each new school year, the school system offered an informational meeting to all parents of students who use English as their second language to explain how the school system would work. They also held monthly parent meetings by school level and provided presentations on selected topics (e.g., state exams, course of study, college application)

appropriate to each school level. Some meetings were offered only to Korean parents and provided translation services. In addition to the efforts to support parent groups, participating educators held an in-service day for other educators in the school system to share the knowledge that they gained about Korea during their trip. A teacher at a secondary school, in collaboration with ESL teachers in the system, created a Korean club for students. The club was open to all students regardless of ethnic background and taught Korean language, culture through Korean music and drama, and other experiential activities such as home visits.

Along with all these systemic changes, advocacy for students also took place on an individual level for teachers. A teacher shared that her immersion experience helped her become an advocate for students from other cultures by increasing the sensitivity to cultural differences and developing an attitude of carefully evaluating a controversial situation before making a quick judgment. During a post-trip interview, a teacher shared a story where she advocated for a Korean student who was accused by a bus driver of being verbally offensive to another student in a school bus. After talking with the accused Korean student, the teacher learned that he used a Korean word that sounded like a curse in English language. The teacher stressed the importance of "being advocates, for not only our Korean students, but for any student that can be misunderstood" because "that (experience in Korea) just translates so much to any kid who just listen because that's what we want them to do. And sometimes as adults we jump to conclusions first."

DISCUSSIONS AND CONCLUSIONS

The Global Studies in Education-South Korea Initiative was created to help local K-12 educators develop multicultural awareness, knowledge, and skills including commitment to advocacy. The evaluation data demonstrated that the participants were able to gain insight into themselves as a product of culture and upbringing by being intensely exposed to foreign and different perspectives. They also had opportunities to learn about differences in educational practices, attitudes, and behaviors towards education among students, teachers, and parents between the US and South Korea. Major findings of this study support prior research, namely, immersing oneself in a different culture and directly experiencing other cultures for oneself is a powerful way for K-12 educators to develop multicultural competencies and global awareness (Ameny-Dixson, 2004; Banks, 2004, 2013). Even though they were exposed to one particular culture (in this case South Korea), the participants also used their new knowledge and skills and practiced advocacy stance to assist many other groups of students (e.g., ESL students in general including Hispanic students and new immigrant students). We can express our wish that this type of cultural immersion program is available to more teachers and school administrators considering its effectiveness.

Our findings are based on a preliminary analysis of the past two years' program evaluation data, and therefore present several limitations. In the future, we hope to carry out a more in-depth analysis of participants' immersion experience illuminating the complex and intricate dynamics among their professional backgrounds, cultural immersion experience, and development of multicultural competencies during and after the trip.

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RESEARCH ARTICLE

Refugee Education in Korea: Considerations from the US Cases

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While political tensions involved with North Korean nuclear weapon have been the major focus highlighted in mass media, it calls for international attention and action to defend the rights and well-beings of North Korean children who defected from their homes. The purpose of this paper is to better understand education for North Korean refugee children settled in South Korea. Empirical data on North Korean youths enrolled in a South Korean alternative school will be compared with the literature of refugee education of the US. Implications for policy, research, and practice will be addressed.

Keywords: refugee education, teacher development, North Korea

According to the population statistics of the UNHCR in 2009, 15.2 million were refugees among 43.3 million displaced people. In the following year in 2010, more than 15,500 asylum applications were lodged by unaccompanied and separated children in 69 countries (UNHCR, 2010). Children refugees are the most vulnerable group to human exploitation, abuse, and various types of violence. Their education is disrupted during conflict and displacement, and thus easily exposed to academic failure in foreign host countries (Demirdjian, 2012). Drawing upon the idea that 'education is a basic human right' as stated in Article 26 of the Declaration of Human Rights, quality education should be the top priority to resolve refugee problems.

The purpose of this paper is to better understand education for North Korean refugee children in South Korea by reviewing the research and drawing theoretical and practical implications from the refugee education cases in the US. I attempt to place current empirical data on North Korean youths enrolled in a South Korean alternative school in the context of refugee education literature.

APPROPRIATE PRACTICE FOR RESEARCH

Theoretical Perspectives

This study is grounded on ecological theory of human development (Bronfenbrenner, 1979). The ecological theory suggests that socially organized surroundings matter in human growth as developmental settings. Anderson et al. (2004) and Hart (2009) agree that ecological perspectives allow a full picture of the influences on refugee children's development by considering direct and indirect environments and that these perspectives enable holistic support

in their approach. Anderson et al. (2004) revised Bronfenbrenners' original model to better explain refugee children's development, in particular, by addressing pre-migration, trans-migration, and post-migration ecologies. This model will help better explain characteristics of refugee children's experience that occurred prior to leaving their home (i.e., pre-migration), during the transition from home to host country (i.e. trans-migration), and after arrival in the host country (i.e., post migration).

Refugee Education in Literature

Challenges and barriers in refugee education.   There are two major challenges identified in the literature: teaching the language of the host country while not deserting refugee student's own culture and satisfying their psychological and social well-being (McBrien, 2005). Cultural, linguistic, and religious dissonance between the refugee's and the hosting country's systems may be the overall obstacle that causes misunderstandings and tension that refugee children and their families face in educational settings. The barriers in educating refugee children reviewed by McBrien (2005) include the followings: negative influence of trauma on the refugee children's academic achievement and social emotional development, family conflicts due to trauma and cultural dissonance, and stereotypes/ discrimination/ rejection held by the hosting community.

Research on refugee students in US schools.   Little qualitative empirical research is available to review on refugee youths' lives in the recent US schools. Two studies are introduced to highlight the comparable aspects of refugee education in the US.

Roxas' (2011) year-long participatory research on teachers working with Somali Bantu refugees in an urban high school addresses instructional and relational challenges of the teachers. He suggests teacher's mistrust and low morale of the school as critical hindrance in effectively working with the refugee students. Without knowing students' backgrounds, the teachers tended to avoid addressing specific learning needs of their students but to verbally blame them "[being] disinterest[ed] in studies and acting out in school" (p.522), "not [being able to] comprehend the text, …not handing in many of the homework assignments…, and sleep[ing] through classes" (p.524) . As a result, teachers developed frustration and disappointment toward these students but at the same time regretted over not being able to match their refugee students' wide ranging needs. Roxas concludes that institutional supports, resources, time, and professional development should be in place in order for teachers to be able to be culturally relevant in their instructional approaches.

Rana and the associates' (2011) interviews with Sudanese refugee youths living with American foster families report possibly important insights for those working with refugee students. When asked about their goals, Sudanese refugee students responded that they would want to "further their education" in a safe environment and to "help relatives and friends who were left behind, typically by wiring money to them" and to "rebuild the infrastructure of their war-torn native country" (p.2091). The students reported, however, limited English skills and academic and cultural challenges in schools were the major hindrance to reaching their goals. Rana et al. (2011) also found that schools' lack of resources and programs meeting the needs of the refugee students contributed to low efficacy of the teachers. Some other risk factors within schools were identified: mental health issues caused from trauma, being bullied by non-refugee peers, and educational progress interrupted by pregnancy and child rearing.

Methods

Based on the empirical data collected from a preliminary explorative research, relevant literature were searched to better explain the findings and to derive meaningful implications.

The university team (i.e., the author as leader researcher and two undergraduate students) spent 6 weeks at the research site, YMS (i.e., an alternative school serving North Korean refugee students and those whose parents having North Korean refugee status), while teaching English courses, offering extra-curricular activities, consulting administrative agenda, and helping out school chores. Semi-structured interview was conducted with 7 full-time and part-time teachers during this period. Each interview took approximately an hour. All interviews were audio-taped and transcribed in Korean. The school documents (e.g., brochure) and project journals written by the team members were also treated as data.

SYNOPSYS OF A RESARCH STUDY TO BE COMPARED WITH THE LITERATURE

Alternative Schooling for North Korean Refugee Students in South Korean

As of 2010, children at school age (PreK-12) were about 80% of the entire North Korean refugees settled in South Korea (Education Support Center for North Korean Refugee Children, 2010). Typically, these children are developmentally and academically disadvantaged before they get reenrolled in South Korean schools: Many were from the families of low socio-economic background that had to be economically active in order to support their families in North Korea. Thus, many late adolescent North Korean refugees often fail in presenting compatible academic competences of their South Korean peers. The school age refugees experienced average 3 years and 10 months of absence in school during their defecting period mostly in China or the third countries such as Thailand (Ma, 2005). More seriously, but not surprisingly, there exist significant gaps in both school enrollment and dropout rates between North Korean refugee students and their counterparts, the South Korean peers. This may mean that the North Korean refugee students' learning needs were not successfully met in the South Korean regular schools (Cho, 2010).

During the past 10 years, North Korean refugee students have begun to leave their regular schools and reentered into alternative schools in order to improve their educational outcomes. YMS is one of these schools to serve North Korean refugees and those whose parent having North Korean refugee status. The data to be compared with the literature were collected at YMS in 2013. It is located in downtown Seoul where most advanced urban and cultural resources are conveniently accessible. It is one of a few government-sanctioned private institutions granting high school diploma that is well known to the North Korean refugee communities. According to the school brochure published in 2013, out of total 62 students, only 39 students defected with at least one legal guardian to South Korea. The other 23 students are either leading their household, living alone, or living in a group home provided by the school. The school has 32 full time and part time faculty and staffs and numerous long-term and short-term volunteers, all South Koreans.

Depending upon individuals' past schooling experience either in North Korea or other countries, students are placed in different classes for middle or high school curriculum. The curriculum consists core subjects, specialized subjects (i.e., foundational subjects, advanced subjects, and enculturative & therapeutic subjects), and extracurricular activities.

North Korean Refugee Students Perceived by the South Korean Teachers

Social and Emotional Characteristics and Behaviors.   The teachers mentioned negative qualities more often than the positive qualities of the students. In NVivo, qualitative data analysis software, 12 references were found in positive qualities while 42 were in negative qualities. Students were found to be genuinely sociable, friendly, and appreciative to their teachers, sponsors, and volunteers. Students enjoyed playing sports and games with their teachers. They would voluntarily write thank-you note to their sponsors they have never met before and treat classroom volunteers with ice cream during the break. Students tend to be sincere and affectionate in relating with people. One teacher told he was deeply moved in tears by his students' love shown on the Teacher's Day with a letter, present and songs. He acknowledged such sincere affection as positive emotional capital that he rarely observed from South Korean students.

Negative qualities of the students' social emotional characteristics include violence, anxiety, loneliness, lack of autonomy, and lack of self- control. In teacher interviews, more information on the causes or roots of their violence was shared than about the actual violent event observed in the school. Teachers addressed family as the major issue: Many students were often abused or abandoned by their families during their childhood and were not getting along even after they resettled in South Korea together. A teacher shared a student story:

> "The saddest story I have ever heard is from one of my former students. When he was young, his bother might have some psychological problems. His brother beat him every day. He ran away because he did not want to be beaten. One day when he returned, he found his mother was lying in the room dead and his bother fled to South Korea alone. When he took a closer look, he found the mother's body was already decaying. This was the scene he remembers. Then, he later also defected to South Korea and met with his brother. But the brother again beat him and said, "I hate you to death, so you should die!" His brother coerced him to eat crushed glasses and he ate them thinking it is better dead than living. I cried for several days and won't forget him…"

Before students came to YMS, many had become targets of bullying in their first South Korean schools. Their defenses were viewed violent and their appeals were mistreated. Due to the repeated discrimination and harass in South Korean schools and society, student anxiety naturally increased. They would hide their identity, quickly pick up South Korean accents and styles, and lie about their backgrounds in order to protect themselves.

Teachers especially see loneliness is the most serious problem which might cause or be related to all the other troubles they observe. Again, teachers view that loneliness is not a new problem suddenly came but started from their students' early childhood. Addictive behavior was pointed out as a serious symptom of loneliness.

> "The biggest problem in our students is video gaming of boys, to ease their feelings of loneliness. You see that. If they would find a moment during the class, they would do it. They are restless. I think it is because their attachment with their parents was unstable. You know, mother feed and father protect… I don't think such things exist in North Korea. Almost everyone was out searching food, selling stuffs here and there all day long. Children are at home alone with little care by adults. So, attachment with their

parents was not in place and they now tend to cling to something like smartphones, games, and sexual relationships."

Loneliness Coping.   Loneliness and other mental wounds have been handled and processed in certain ways by the students: disguise, distancing, ignoring, withdrawal, rejecting, and distrust.

Most students could hide their psychological burden in '*disguise*' as joyful and happy person thinking that nothing is wrong. A volunteer teacher testified: "Deep inside, they feel immense and inescapable memories of the past experiences and that makes them develop masked depression that prevents them not only from showing their true emotions to other people but also to themselves. It becomes the stem of all sorts of other problems such as negative self-image, low confidence, and distrust." Teachers suspect that their students oppress these issues also because venting out them may make them look vulnerable.

When, students might have courage to reveal themselves in a safe space, they would come out from the hidden selves but still maintaining '*distance*' from their memories. A volunteer notes her observation: "As I carried out my lesson plans with my middle school students, I was faced with spontaneous disruptions of my mental state. My students would share where they had come from, how they escaped and what had happened to them along that vigorous journey so apathetically as if they're telling stories that are not their own."

Or, they would completely '*ignore*' or clear their emotions and memories and act as if nothing happened in reality. This type of behavior often could make their teachers confused. Example happenings such as having a student who made serious misconduct came to school next day relating their teachers as usual and observing a student who showed deep appreciation one day to the teacher and furiously challenge the same teacher the next day. Teachers suspect that the prior emotions are erased somehow voluntarily or involuntarily because they see both contradicting emotions were true both times.

'*Withdrawal*' is another common response in dealing with social and psychological challenges. Teachers assumed at the beginning that these students would be more enterprising and enthusiastic for a better life in a new society since they were strong enough to survive all the hardships and obstacles. Teachers found more students, however, in the opposite spectrum. A teacher notes, "Here's what it is. And this is what I concern the most. These children escaped from the threat of death. You would think they are tenacious and full of spirit. But it's not that way here. Because they were wandering for a long time hiding, there are some biting the bullet and confront the problems to wrestle, but more children would pull out right away, to be honest." Students also withdraw in their current social emotional spaces fearing that their identity being North Korean defector would lead themselves to discrimination, bullying, and being alienated.

Teachers found that students would '*reject*' the relationship and/or discipline from their teachers and shut down. This type of response creates tensions not only between the teachers and students but also between the teachers and administrators. From the experience with the students rejecting teachers or those with long-term absence, teachers developed guilty feelings and sense of incompetence, which they partially believed coming from the administrators' judgment.

'*Distrust*' between peers and toward South Koreans in general is prevalent among the refugee students. One teacher notes that the background of distrust is starting from the political practice called 'Saeng-hwal-chong-hwa' in North Korea. They were raised by evaluating and criticizing self, family members, friends, and co-workers against the communist principles. This teacher believed that this practice is grounded in self-doubt and distrust from the students' early childhood and it is difficult to break it even in the new society. Oppression and violence they experienced from other South Koreans also influenced these students not to trust others.

Academic Aptitudes and Non-Academic Assets.   At YMS with less than 80 students, there is a wide spectrum in student motivation and academic proficiency, which creates a great deal of instructional challenges for the teachers. Some students speak proficient Korean, making a desirable progression in the program of study, and are preparing for college entrance exams. Some students struggle in all classes due to linguistic, cultural, and academic disparities they currently face in a new setting. Especially Chinese speaking 'Bi-bo-ho' students who were born and raised in China by their North Korean defecting parents, struggle more than the North Korean refugee students do. 'Bi-bo-ho' literally means 'not protected' in Korean and has become a label calling the Chinese student whose parent (usually mother) is North Korean refugee. Legally, they are not refugee themselves but because of their parent's status as North Korean refugee, YMS accepts 'Bi-bo-ho' as their students. Since they are treated as Chinese, foreigners, no refugee support is provided by the South Korean government such as health insurance, resettlement financial support, or affirmative action. 'Bi-bo-ho' students are ethnic minority at YMS and are exposed to be bullied by the North Korean students. The number of this group of students is growing, which naturally created a need for differentiated instruction. Teacher interview excerpts suggesting academic skills both for North Korean refugee students and 'Bi-bo-ho' students are found in table 1.

TABLE 1
Teacher Interviews

English Classes	Korean/Social Studies Classes	Mathematics Classes
"practice pronouncing letters" "briefly introduced ourselves…[following] an outline on what to say" "shyly made the effort to say a full sentence about themselves" "preparing college entrance exam… she struggled in finding which part is subject, verb, object in sentences. She was guessing by the meaning of each vocabulary." "She does not know how to read at all… 3 other students in that class could do a little bit of reading but not writing. If I ask to write 'happy', they would not know if it is 'happy' or 'hepyy'." "She learned Alphabet for the first time here. She is 23 years old." "They[Bi-bo-ho students] speak in Chinese to each other but their English pronunciation is much better than those coming from North Korea." "I even think it might be better for those (Bi-bo-ho students) going back to their native countries. It's too hard for them to pass GED here. Their national identities are not South or North Korean, nor Chinese. They are late teens and have to study English on top of Korean languages."	"lacking vocabulary…they don't know the common words we use every day such as *seniority*." "absolute shortage of vocabulary. I think it is partly because of limited access to books when they were young." "[T]heir understandings are pretty much fragmentary. They take passages at face value and can't read between the lines." "You know, the schema, they don't have it, the foundation. They would never suspect why such historic event happened, why people responded that way. They would just simply say it is just what it is."	"most students are in elementary level and mathematical understandings are not coded yet in numbers or symbols" "Their math skills are very basic." "While in North, they were not always come to school because they had to make money. So, some students officially graduated from middle school actually can't confidently do the 4 arithmetic operations, only could do addition and subtraction…"

Although the teacher-student ratio was low at YMS, the teachers were struggling in accommodating students' learning needs: A wide spectrum existed among the students in their languages, socio-economic status, social emotional capital, family/financial support, and academic aptitudes. At YMS, students were placed in grade levels not based on common standards (e.g., South Korean curriculum standards) but the students' previous schooling experiences before they defected. That is, students could transfer into the same grade level that they left in North Korea. The problem on this placement that the teachers stated was first, the academic curriculum and standards between North and South Koreas cannot be compatible. Educational standards based off opposite philosophies run in irreconcilable systems. Before defection, many students were actually out of school while officially enrolled to make money and search food to survive. This kind of schooling condition in their home country also explains the wide gap of academic attainment between the two Koreas in the same grade level.

Absenteeism was another contributor to making the existing academic attainment spectrum wider. Some students were absent often or longer periods of time for health, family, or mental health related issues they deal with. Teachers responded to this issue by making home visits and phone calls, but when their efforts did not bring desirable results, it became a major source of guilt feeling and low sense of efficacy.

The teachers also recognized their students' non-academic assets and qualities distinguished from general South Korean students: genuineness in relationships, manual dexterity, and great aspirations for reunification of Korea and for contribution to their home communities.

DISCUSSION AND IMPLICATIONS

Commonalities exist: Both in the US refugee education research and the current study on North Korean refugee students, trauma is recognized as a unique background and challenges that the refugee students carry. However, it is not yet properly addressed in the context of teaching and learning. Without understanding what role trauma plays in the victim's development and academic achievement, teachers could easily misinterpret trauma related symptoms as misbehaviors or lack of effort (Roxas, 2011). Recognition of trauma as a risk factor for the refugee student development (Rana et al., 2011) should be followed up with actions in teaching and learning. Teachers' professional development is warranted to enhance knowledge about the refugee students' previous educational and cultural backgrounds and skills that could nurture the positive identities as learners. It may not be ideal or realistic to say that it is teachers' responsibilities. Refugee issues are complex and education and schooling could be counted as a response of many. Collaborative, ecological, and interdisciplinary approaches among researchers, educators, and supporting agencies are recommended.

Institutional policy should also be carefully reviewed given that none of the research presented report conducive systems in effectively working with refugee students. Questions to be considered may include: Does the school allow time for teachers to be innovative in working with refugee students (e.g., home visits, bilingual education, team-teaching with special education professionals)? Does the school offer resources and opportunities for teachers' professional development (e.g., workshops for culturally relevant teaching or assessment)? Does the school allow a strength-based approach in the curriculum? Teachers are in front line in the school settings and cannot be left alone without institutional support. Given that the signs of

teachers' low efficacy both in the US and Korean studies, it may be important to attend the mental health and stress of the teachers working with refugee students.

Tensions between refugee students and their peers or teachers from the hosting communities appear to be a challenge both in the US and Korea. Alternative schooling had to be in place partly because of the diversity issues poorly handled in regular public schools. Even in the small alternative school, tensions between ethnic groups (i.e., North Koreans and *Bi-bo-ho* students) exist. This phenomenon is observed in the US refugee education literature and this study, but much more research is warranted in order to understand the specific dynamics and contexts and to promote cultural pluralism and identity safe environment in schools.

SIGNIFICANCE OF THE STUDY

The current study addresses a pressing issue at least for the following reasons. First, North Korea is the most closed country in the world with the worst human right records. Human Right Watch (2013) reports that "more than 200,000 North Koreans, including children, are imprisoned in camps where many perish from forced labor, inadequate food, and abuse by guards…There is no independent media, functioning civil society, or religious freedom. Government policies have continually subjected North Koreans to food shortages and famine" (para 1). One of the most needed areas is the least known to educational researchers, practitioners and policy makers. As the defection of North Koreans continues to increase, it is necessary to understand them to promote desirable transitions for both sides—arrivers and hosts.

Second, the majority resources and research on refugee education have been produced by working with refugees from African (e.g., Somalia and Sudan), Middle Eastern (e.g., Iraq and Syria), and Asian countries (e.g., Afghanistan and Viet Nam) settled in Western developed countries such as UK, Australia, and the US. There have been a number of initiatives and programs aimed for effective educational interventions for refugee children in these countries (Hart, 2009; Matthews, 2008; McBrien, 2005). Yet, one should be cautious in generalizing the field tested findings in other refugee education contexts since each refugee situation is unique in its own ways (Demirdjian, 2012). Given the historical, cultural, and linguistic circumstances that distinguish Korean peninsula from other countries, extensive documentation is warranted.

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RESEARCH ARTICLE

Complexity of Education: Sociocultural and School Contexts of Finnish and South Korean Cases

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This study examined science education contexts and a sample of science lessons of Finland and South Korea in search of possible connections among contexts, teaching practices, and student performances. PISA 2006 survey data, documents, observations and interviews were collected and analyzed. Findings revealed some commonalities in cultural, social and school contexts between the two countries. Cultural commonalities such as the high value of education and the national curriculum might be related to high student performance in the two countries. Two major differences of school contexts including class size and teacher role were found to mediate learning. This study revealed the intricate relationships among sociocultural and school contexts, teaching practice, and student performance.
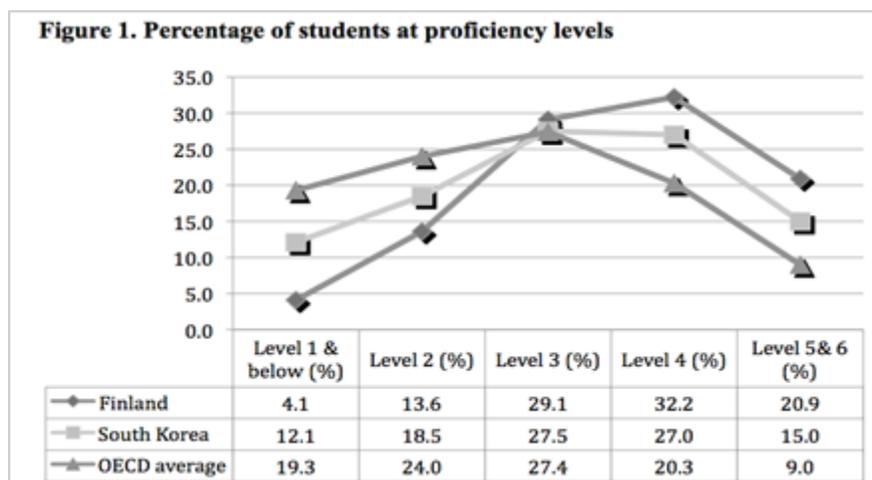
Finnish and South Korean students have repeatedly shown high performance in scientific literacy (e.g., OECD, 2007a). In particular, Finnish students performed on top in science with a large performance gap from the other countries in PISA 2006. The high achievement of Finland and South Korea are commonly attributed to excellence in the teaching workforce (Kang & Hong, 2008; Simola, 2005) although Finnish students performed significantly better than Korean students. This raises questions about the science education in the two countries: To what degree do they demonstrate similarities and differences from each other? How do teachers in the two countries teach science? Answers to these questions will provide insight into the connections among science education systems, classroom teaching, and student performance. They will also shed light on ways to improve educational systems as well as teacher education.

The purpose of this study was to examine educational contexts and science teachers' teaching practices in Finland and South Korea to gain insight into how those mediate student performance. We first examined each nation's educational contexts relevant to understanding science education in Finland and South Korea. Based on the contextual comparisons, we focused on three research questions: (a) How are the school contexts of the two countries similar and different? (b) How do teachers teach science in each country as shown in a sample of lessons? (c) How do teaching practices relate to the national and school contexts in each country?

FINNISH AND KOREAN STUDENT PERFORMANCE ON
PISA 2006 SCIENCE ASSESSMENT

The Programme for International Student Assessment (PISA) examined students' scientific literacy at six proficiency levels, with level 6 representing that students can consistently demonstrate scientific competencies and scientific knowledge across various situations and level 1 representing that students have very limited scientific knowledge and competence in applying knowledge. Finland and South Korea demonstrated a similar trend in student performance (Figure 1).

Figure 1. Percentage of students at proficiency levels

	Level 1 & below (%)	Level 2 (%)	Level 3 (%)	Level 4 (%)	Level 5& 6 (%)
Finland	4.1	13.6	29.1	32.2	20.9
South Korea	12.1	18.5	27.5	27.0	15.0
OECD average	19.3	24.0	27.4	20.3	9.0

PISA 2006 also assessed students' affective learning in science using both general and contextualized questionnaires (Table 1).

TABLE 1
Student Affective Responses in PISA 2006

	Science Support		Self-belief		Interest		Motivation	
Affective construct	GV	PV	SE	SC	GI	ES	MU	MF
Finland	0.07	-0.09	0.02	0.06	-0.25	0.11	-0.22	-0.17
South Korea	0.27	-0.06	-0.21	-0.71	-0.24	-0.17	-0.26	-0.25

The two countries demonstrate similarities and differences in affective measures. The students in both countries appreciate the value of science in society (indices in GV) but they see the relevance or importance of science in their personal lives less than the international average (negative indices in PV). Similarly, students in both countries perceive less usefulness of studying science (negative indices in MU) and future science related activities (negative indices in MF) than the international average. Also, they are less interested in learning science than the international average (negative indices in GI).

Given these similarities in terms of less personal value of science and science learning and less interest in science learning, students in the two countries demonstrated differences as well. Finnish students indicated higher self-efficacy (SE) and self-concept (SC) in science learning and enjoyed learning science (ES) than the international average. In contrast, Korean

students indicated much less self-efficacy and self-concept and enjoyed science learning less than the international average. In short, regardless of less personal value and low interest Finnish students perceived more confidence and enjoyment in science learning. On the other hand, regardless of high performance, Korean students perceived less confidence and enjoyment in science learning than the international average.

EDUCATIONAL CONTEXTS

Social and Cultural Contexts

Both countries are largely culturally homogenous and education is highly valued (Kang & Hong, 2008; Simola, 2005; Tuovinen, 2008). The appreciation of education was corroborated by a similar economic condition of each country that is relatively poor in natural resources. Both countries have no other option but to invest in developing human resources (Kyro, & Nyssol, 2006; Seth, 2002). They were relative latecomers to industrialization, being largely agrarian countries until the 1950s. Their rapid economic development is, therefore, attributed to strong human resources while education is strongly linked to the opportunity for upward social mobility. This public perception has continued through the 21st century (Kang & Hong, 2008; Tuovinen, 2008).

The high value of education in both countries is evidenced in recent data. In year 2007, 97% of students graduated upper secondary schools in Finland and it was 91% in South Korea. In the same year, the entrance rates into academic universities were 71% in Finland and 61% in South Korea, which were above the OECD averages of 56% (OECD, 2009).

School Systems

The compulsory education in Finland offers a nine-year comprehensive school system. The comprehensive school system is uniform in that all children follow the same national curriculum to ensure equal educational opportunity (EURYDICE, 2010). Similarly, the compulsory education in South Korea offers nine years of schooling in which six-years of elementary and three-years of middle schools are offered based on a uniform national curriculum (Korean Ministry of Education, Science and Technology [MEST], 2010).

After the comprehensive school Finnish students normally pursue three-year- long general or vocational upper secondary education. Students apply for upper secondary schools, which motivates some students who want to enter special schools. Graduates from both types of schools are eligible for tertiary education of two types: polytechnics and universities. Upper secondary graduation diploma is enough to enter polytechnics while most students should take a national matriculation exam to be eligible for universities. University entrance is very competitive. Student admission to a university is typically decided based on the grades attained in the national matriculation exam and an entrance exam designed by each university (EURYDICE, 2010). Similarly, after nine-years of compulsory schools students in South Korea pursue general or vocational upper secondary education. Students are assigned to general high schools based on residential areas but they apply for vocational schools or specialized schools such as arts, science, or foreign language. South Korea also has two types of tertiary education, i.e., vocational colleges and academic universities, and all students should take a national matriculation exam to be eligible for either type of tertiary education. Similar to Finland, university entrance is very competitive and each university has its own additional exams or procedures for student selection.

Teacher Quality

Teachers in both countries are socially respected, which attracts the best people. Teaching in both countries is one of the most popular careers as evidenced by the strong competition in university entrance examinations for teacher education programs (Kang & Hong, 2008; Simola, 2005).

Teacher qualification criteria are different between the two nations. In Finland, science teachers in secondary grades are certified to teach two subjects that they majored and minored through undergraduate courses. In addition to the subject matter preparation, courses are designed and required for teacher certification such as content courses focused on school science content or methods courses (Kaivola, Karpijoki, & Saarikko, 2004). This two-subject area certification system ensures teachers' content knowledge preparation by focusing on two science content areas instead of all. This contrasts to Korean approach. In South Korea, preservice science teachers are required to major in one science subject area through undergraduate courses along with one year of basic sciences in the other three science areas (8 semester credit science courses with labs for each science, a total of 24 credits). For example, a preservice teacher may major in physics while taking basic courses in chemistry, biology, and earth sciences for a year. In doing so, they are certified to teach the major subject and general science. From these qualification systems, most principals of Korean and Finnish schools (85% and 82% respectively) were satisfied with their teacher quality in the OECD survey data (OECD, 2007b).

METHODS

A generic qualitative study approach (Merriam, 1998) was used to gather and analyze qualitative data. Selected data from PISA surveys (OECD 2007) were used and analyzed using statistical analysis (Black, 1999).

Participants

A convenience sampling method was used to select teacher participants. In South Korea, random letters of recruitment were sent to schools of various school districts in Seoul (capital of South Korea with a population of about 10 million) and in a smaller city (0.7 million). Five and two middle school (grades 7-9) teachers in each city respectively volunteered for observations and interviews. The teachers had 4 to 23 years of science teaching experience, and two of them were male. All the teachers completed a science teacher education program at the bachelor's degree level and one of them had a master's degree in science education. In Finland, five teachers, teaching grades 7-9 in two public comprehensive schools (grades 1-9) in Helsinki (capital of Finland with a population of about a half million) and one in Tampere (0.2 million) participated. They had 3 to 32 years of science teaching experience, and two of them are male. All of the Finnish teachers completed a master's degree teacher education program.

From the PISA survey data items relevant to this study were selected and responses from participating students and school principals were analyzed in this study. A total of 4,714 students responded to the survey in Finland (about 88% were grade 9) and it was 5,176 in South Korea (about 97% were grade 10). These students were from various sizes of community but only South Korea had students from cities with over a million.

Data Collection

In addition to the PISA database, data sources included documents, classroom observations, and interviews with Finnish and Korean science teachers. For school contexts, data on science curricula and school resources were mainly collected through relevant documents including OECD publications, journal and newspaper articles, curricular documents, and websites of educational agencies. For data on teaching practices, one (75-minute class period) or two lessons (45-minute class period each) of each participating teacher were observed. After the observations, formal semi-structured interviews were conducted with a set of guiding questions about the teachers' perceptions about teaching conditions, instructional decisions, and views of students. All observations were video-recorded and all interviews were audio recorded. Both types of recordings were fully transcribed into English for analysis by researchers of the two countries. Researchers of each country arranged the data collection procedures in their country, and one Korean researcher participated in all the procedures of the observations and interviews in both countries.

Data Analysis

Content analysis method (Miles & Huberman, 1994; Patton, 2001) was used for qualitative data analysis to find patterns. In the analysis of student survey responses, mean and standard deviation were calculated for the frequency data from each country and Cohen's d (Warren, 2008) was used to compare the mean difference between the two countries and between each country and the OECD mean. Cohen's d was used because it indicates not only statistically significant difference but also it provides ideas about whether the difference is meaningful by its size: large ($d > 0.8$), medium ($0.5 < d < 0.8$), small ($0.2 < d < 0.5$), or no difference ($d < 0.2$).

Credibility

Data from multiple sources were triangulated (Patton, 2001). The data on school contexts were collected from documents and triangulated with teacher interviews. The data on science lessons were triangulated with document data such as PISA survey in which occurrence of various types of classroom activities were examined. Throughout triangulation processes divergences as well as convergences of the findings were actively examined (Mathison, 1988) to gain a deeper insight into science teaching in the two countries.

FINDINGS

School Context: Science Curriculum

Both Finland and South Korea adopt a uniform education system based on common national curricula. The Finish National Core Curriculum for Basic Education (NCCBE) describes underlying values and missions of basic education, educational environment, and instructional approaches followed by statements of general and subject specific goals, basic concepts in each subjects, cross-curricular themes, and final assessment standards. In addition, the government determines subject specific minimum numbers of lesson hours or courses. Similarly, the Korean national curriculum describes guiding values and principles, general educational goals, distribution of lesson hours among subjects, and basic contents and achievement standards for each grade, instructional approach and guidelines, and assessment guidelines. In both

countries, the national curricula dictates most aspects of science education to ensure uniform opportunities provided for all students.

Structure.   Some structural and content of national curricula in the two countries are different. Structurally distinct differences include compositions of science subjects and required lesson hours. In Finland, students in grades 1-4 take an integrated science named as environmental & natural studies and in grades 5-9 students take science courses in which two science disciplines are combined into one course such as biology & geography (grades 5-9) and physics & chemistry (grade 5-9). In addition, health education (grades 7-9) is included as a science subject in later grades. In contrast, students in Korea start learning science in grade 3 as an integrated subject until grade 10. The content of integrated science, however, has four areas that are aligned with typical science disciplines: energy (physics), matter (chemistry), life (biology), and earth (earth science).

In terms of required lesson hours, total instructional time for students of ages 9-14 in Finland is 1,512 compared to that of 1, 570 in South Korea (OECD, 2009). Students in South Korea spend more time during school lessons. However, among these instructional hours students in Finland spend more time on learning science (about 209 hours over six years) while those were much less in South Korea (about 166 hours over six years).

Content.   In terms of science content required by the national curricula of the two countries, science contents rooted in the traditional science disciplines such as physics, chemistry, and biology are similar but Finnish science curriculum has more content on ecology, environmental protection topics, and human biology. This difference might explain the PISA results in that the difference of performance between Finnish and Korean students is 2.5 times bigger in biology than in physical science assessments.

School Context: Resources

Teacher Role.   In Finland, teachers are expected to distance themselves from students to exert professional attitudes and authority. On the other hand, Koreans have traditionally considered that teachers are like parents who are expected to take care of their students, just like parents, in all aspects of child development including character as well as intellectual development. This different role expectation is evidenced in the OECD survey about who is responsible for career counseling and discipline issues in schools (OECD, 2010). In South Korea, students have homeroom teachers who take care of all aspects of student school life. In contrast, Finish teachers specialize teaching and counseling separately.

Different teacher role expectations in the two countries are related to the teacher work patterns and workload (OECD, 2008). At the lower secondary level, Finland and South Korean teachers' yearly teaching hours are similar (589 vs. 549 hrs.). However, Korean teachers are asked to work for additional 1,006 hours in the school building for administrative work, student counseling, and instructional planning. On the other hand, Finnish teachers stay in their school buildings only during their teaching hours except voluntarily staying after school to help students study or extra curricula activities (interviews).

Material resources: lab facility and class sizes.   As far as concerns for science lab facilities, about 42% Finnish and 48% Korean principals indicated concerns for inadequate lab facilities to some degree or a lot. This level of concern is similar to the OECD average and apparently putting both countries on the same level of resources as far as lab facilities concerned. The class size of South Korea is the largest

among the OECD countries while that of Finland is among the lowest (class size of 16-25 in Finland vs. 31-35 in Korea).

Another significant difference in school resources is Finnish schools' strong support system for academically struggling students through "individual pedagogical support" (Kivirauma & Ruoho, 2007). Finland has unusually high percentage of students designated as special education students (almost 20%) because below average performing students are included in the pool as well as students with behavioral issues. Schools are required to have special education teachers who are specially trained to help low performing students within or after class. This supporting system is compulsory in nature when they are categorized as special needs students. The teachers during interviews mentioned that special education teachers helped student learning as well as behavioral or disciplinary problems during or after lessons. Many of them also mentioned that they regularly helped students afterschool and noted it as subject teachers' responsibility to help struggling students.

In contrast, Korean teachers have a large number of students with varying degrees of ability without any special assistance within class while Finnish teachers have a small number of students and can have a special education teacher help struggling students in class. Students in Korean science classes can get lost easily in the crowded classroom.

Connections between Teaching Practices and Educational Contexts

Similarities between the countries.   Despite the small samples from the two countries, we found patterns across the lessons within and between countries. The first was a ritual that resonated authority of the teacher that was rooted in social respect. In Finnish classes, students chatted until the teacher called their attention to start the lesson. Once the students were focused, they were asked to stand up and were greeted by the teacher. In response, students greeted the teacher in unison and then sat down at the teacher's request. In South Korea, the teacher asked the class captain to start the lesson. The captain stood and asked the class to greet the teacher. These procedures helped students switch gears for class.

As for teaching patterns two common features of the two countries were identified: dominance of a teacher-centered approach and review emphasis. In most classrooms of the two countries, students were sitting in rows to look at the front of the classroom and doing the same activities in the same way. Verbal interactions were dominated by teacher talk while student talk was mostly limited to answering teacher questions. In addition, both Finnish and Korean teachers spent some time reviewing in each lesson.

As argued in the literature (O'Connor & Michaels, 1993), IRE type interaction allowed the teacher to control the flow of information and advance the intended academic content. Therefore, in the lessons observed, new concepts were developed in a conceptually well-connected manner.

The teacher-centered approaches were also evidenced in the PISA student survey data in which students were asked how frequently they participated in inquiry activities, i.e., scientific investigations of their own initiation. Both countries demonstrated significantly lower frequency on the scale than the OECD average frequency. The flow of ideas in lessons of both countries was mostly controlled as the teachers followed the set curriculum and the students were passive.

Differences.   The review sessions also demonstrated differences between the two countries. Finnish lessons always started with a homework review. Typical homework was reading textbooks and/or completing review worksheets. With the exception of one lesson, homework was assigned at the end of each lesson. The role of in-class review thus was for students to confirm their answers to review questions and to learn what they have missed. This was different from Korean lessons because Korean teachers rarely assigned homework. One main reason commonly mentioned during interviews was a lack of time to

provide feedback on students' homework. The reason was related to the large class size. The teachers had an average of 200 students to teach. A teacher succinctly answered, "Examining student lab reports and other performance assessments are more than enough. There is not enough time to check homework. Students will not be serious about homework if it will not be checked, so there is no point in assigning homework" (YC). On the other hand, Korean teachers expected that students study for themselves regardless of homework. This was related to the ample opportunities Korean students have for after school academic lessons.

Given the prevalence of IRE pattern of classroom interaction between the teacher and students, students rarely initiated interactions with the teachers in both countries. However, Finnish students reacted to lesson tasks with questions such as "Why do we need all this information?" "How can you know…?" and teachers responded to them whether those questions were rhetorical or originated from intellectual curiosity. This responsiveness was identified frequently in all the Finnish lessons indicating it was a common practice. On the other hand, such reactions to tasks were rarely observed in the Korean lessons. Individual students were hidden among so many peers and hardly voiced. During interviews, Korean teachers regretted student passivity and attributed it partly to the big class size in which their individuality was discouraged and students had relatively less opportunities to interact with the teacher.

PISA student survey data corroborated this insight. While Finnish students' perceptions were not significantly different from the OECD average Korean students perceived significantly less opportunities to voice their ideas and opinions in science classes.

CONCLUSION

Finland and South Korea share some commonalities in cultural, social and school contexts of education such as the high value of education, cultural homogeneity, and high dependency on human resources. These must have raised the standards and expectation for the education. The differences between the two countries found in this study suggested how teaching practices are mediated by its contexts. For example, the large class size in South Korea might be related to a lower ranking than Finland in student performance reported by a recent PISA (OECD, 2007a). Korean students are hidden in a crowded class and have less opportunity to be responded to by their teachers. Also, Korean students have less opportunity to be guided by homework. Therefore, they would be less engaged or need more self-motivation for learning than their counterparts in Finland. Without individualized formative feedback, Korean students have less opportunity to see their capacity to become confident science learners. From a different perspective, however, it might be viewed that class sizes might be less relevant to student performance because even in the most crowded classrooms Korean students performed very well on the PISA assessment.

This study revealed the intricate relationships among cultural and school contexts, teaching practice, and student performance and how global contexts mediated teaching at the micro-level. Further in-depth research on the mechanism of how cultural and school contexts mediate classroom teaching and learning would shed light on understanding student learning and ways to improve science education.

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RESEARCH ARTICLE

Representations of Angle and Lesson Organization in Korean and American Elementary Mathematics Curriculum Programs

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Curriculum programs communicate content goals and pedagogical approaches in order to guide teachers to design and enact instruction. Examining written curriculum helps envision what potential teaching and learning look like. This study examines lessons on angle in the Korean government-designated and three American elementary mathematics curriculum programs. By examining representations of angle, and lesson activities and organization, we account for how the concept of angle is presented in each program and what students are expected to learn. The comparison illuminates the characteristics used in each program to represent and develop the concept of angle in a series of lessons, including strengths and weaknesses of each program, and provides implications for curriculum design

Keywords: representation, angle, elementary, mathematics, Korean mathematics curriculum, curriculum comparison, curriculum design

Curriculum programs[1] communicate content goals and pedagogical approaches. They guide and inform what teachers should do in instruction and what students are expected to perform and achieve. Therefore, teachers heavily rely on them as resources for teaching. In this sense, a written curriculum is considered as a "potentially implemented curriculum" (Schmidt et al., 1996). As such, examining a curriculum program is one way to infer the kind of teaching and learning that is promoted. Comparing curriculum in different countries is crucial in that investigating others' curricula helps us examine and improve our own practice. It provides new insights and different approaches to looking at the phenomena familiar to us, which may not be available otherwise. While previous comparative studies regarding the curriculum have primarily focused on content coverage, they have seldom investigated instructional activities and representations used

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[1] In this study, a *curriculum program* refers to a set of written curricular resources for daily teaching and learning, not one-day resources or supplemental materials.

in the curricula in order to account for what kind of learning is envisioned (Kajander & Lovric, 2009).

This study compares lessons on angle in terms of representations, activities, and content organization in four elementary mathematics curriculum programs: the government-designated program in South Korea and three programs in the U.S. Whereas Korea uses only one elementary mathematics program published by the government, the U.S. has a range of programs published by private companies and research groups. We chose two reform-oriented and one commercially developed curriculum programs that represent the variety in the U.S.

We chose curriculum programs from Korea and the United States for a couple of reasons. The United Sates is one of the countries in which reform efforts in mathematics education have been extensively made over decades (e.g., National Council of Teachers of Mathematics, 1989) and has a range of elementary mathematics curriculum programs. On the other hand, Korea is one of the countries whose students have performed at the top in various international mathematics achievement tests (Martin, Mullis, & Chrostowski, 2004; National Center for Education Statistics, 2013; Provasnik, Gonzales, & Miller, 2009) and yet Korean mathematics curriculum programs have not been given much attention internationally, compared to other top performing countries, such as Singapore.

Moreover, research on Korean elementary mathematics curriculum tended to examine overall content coverage and teaching approaches in a broad content strand, such as algebra (e.g., Lee, 2004), rather than a focused topic in-depth. In this study, we concentrate on lessons on angle to compare the four curriculum programs since the concept of angle is crucial in learning geometry, not only at the elementary level, but also in an advanced level of mathematics, such as differential geometry. According to Jones and Fujita (2013), geometry is one of the two major content areas in school mathematics along with algebra across countries. We examine the characteristics used in each program to represent and develop this important concept in a series of lessons. A set of questions guided this comparison: What are similarities and differences in the four programs in terms of key mathematical ideas and their representation, development, and organization in the lessons? What characteristics (including strengths and weaknesses) does each program exhibit in those lessons? What can we learn from these programs regarding curriculum design?

THEORETICAL FOUNDATION

By analyzing and comparing written lessons, we explore intended curriculum in the four programs from Korea and the United States. Remillard and Heck (2014) define mathematics curriculum as "a plan for the experiences that learners encounter and the actual experiences that are designed to help them reach specified learning goals for mathematics" (p. 125). This definition highlights both intended and enacted aspects of curriculum. Our analysis centers on "planned" learning experiences for students from the four curricula.

In our analysis of the written lessons on angle in the four programs, we focus on two particular aspects of the programs: (1) representations used and (2) the organization

of instructional activities in individual lessons and across lessons. In doing so, we examine the meaning of angle that students are to learn and how it is embedded in representations and lesson activities.

Representations

The way angles are represented in the curriculum affects students' learning of and thinking about the concept. Behr, Harel, Post, and Lesh (1992) explain the importance of not only using various representations, but also translating various representations. By adapting Bruner's modes of representation, they suggest written symbols, pictures, manipulatives, real-world situations, and spoken symbols for important representations for mathematics instruction. They also argue that students need to represent a given concept various ways within the same mode and reconceptualize it in a different mode, which promotes a deep understanding of the concept.

This view of representations is supported by the standards and mathematical practices that the National Council of Teachers of Mathematics (2000) and the National Governors Association Center for Best Practices and Council of Chief State School Officers (2010) put forth. They emphasize representing the concept in various modes and using representations in doing mathematics. Creating students' own representations and using representations to solve problems and model mathematical ideas illustrate students' active role in using various representations when needed, rather than a passive role, such as knowing and replicating representations given in the textbook. As such, we examine the kinds of representations of angle that each program includes and ways in which teachers and students are expected to use them.

Lesson Organization

The span of the content across lessons tells the overall mathematical goals that each curriculum program envisions. Therefore, examining the content span helps one to infer how mathematical content builds up as lessons move forward and learning progresses. In fact, knowledge developed through prior lessons serves as a resource to develop a new understanding in later lessons (Davis, 2001; Kajander & Lovric, 2009). In this perspective, the correlation between prior and later lessons or content is crucial. This relationship influences the trajectory of student learning and thinking (Steffe, 2011). That is why some researchers focus on the lesson segments and their linkage, and the lesson sequence or the flow (e.g., Howson & Mellin-Olson, 1986; Stigler, Gonzales, Kawanaka, Knoll, & Serrano 1999). Each lesson can be considered as a set of distinct yet interrelated segments (Steffe, 2011). In this study, we examine content organization within and across lessons and the flow of each lesson to examine the proposed learning progression in the curricula.

Dual Meaning of Angle

Researchers argue that the concept of angle is critical to the learning and understanding of geometry (Clements & Burns, 2000; Mitchelmore, 1998). The concept of angle builds the foundation to explore 2- and 3-dimensional shapes from elementary to advanced levels. Angle is an important characteristic of shapes, which leads to many principles, axioms, and theorems that are fundamental to exploring geometry. Angles are defined in two different ways, which may affect students' understanding as well as misconceptions. A static definition of angle is "a part of the plane included between two rays meeting at their endpoints" (Clements & Burns, 2000, p. 31); a dynamic definition is the amount of turn/rotation from one of the rays to the other within the plane. Although the two definitions of angle may look disparate, they should be considered as complementary. In fact, this relationship between the two definitions can be understood as the dual nature (i.e., process and object) of mathematical concepts that Sfard and Linchevski (1994) explained using examples in algebra. According to them, students need to experience a mathematical concept from both perspectives. For example, students see that $2x + 5$ is a series of operations with the unknown (i.e., a process) on the one hand, and is the result of the operations, or an entity itself (i.e., an object) on the other. Applying the same dual nature in angle, students should learn angles as a process (turn/rotation) and reify them as objects (the part between two rays sharing the same endpoint). This means that students need to be able to see angles as processes as well as objects to fully understand the concept of angle. A common misconception students have is that an angle is the distance between the two rays, which comes from exploring angles in only static ways. In contrast, students who see angles only as processes will have difficulty later when angles operate as objects. Therefore, we examine how the dual nature of angle is embedded in representations and lessons of the four programs

METHODS

The four elementary curriculum programs we analyzed are: (1) *Mathematics* (MATH), based on the national curriculum of Korea; (2) *Math Trailblazers* (MTB) and (3) *Investigations in Number, Data, and Space* (INV), both reform-oriented; and (4) *Scott Foresman-Addison Wesley Mathematics* (SFAW), a commercially developed, traditional program (see Table 1). For the analysis, we utilized curriculum materials/resources for both teachers and students that were needed for day-to-day teaching and learning, such as teacher guides and student books. These materials provided the details of the mathematical content and context for each lesson and organizations of the lessons. Using the materials, we identified lessons on angle in each program to analyze. Table 1 indicates how many lessons/sessions on angle each program incudes.

In the analysis, each lesson was described in terms of the main concepts, representations used, and student activities. The flow of each lesson was examined, and then the sequence and emphases of the entire lessons on angle in each program were studied in terms of the key content and its development through the lessons. Common features and differences in the two main aspects of analysis (representations and lesson organization) were compared among the four curriculum programs.

TABLE 1
Four Curriculum Programs

	MATH (Korea)	MTB (U.S.)	INV (U.S.)	SFAW (U.S)
Edition	2009 revision	3rd Edition (2009)	2nd Edition (2009)	2009
Developer	National team using the Korean National Curriculum	University project funded by NSF, based on reform movement	TERC, funded by NSF, based on reform movement	Charles, et al., commercially developed
Publisher	Ministry of Education, Science, and Technology	Kendall/Hunt Publishing Company	Pearson	Pearson
Materials analyzed	Teacher guide, student textbook, student workbook	Teacher guide, student guide, Discovery Assignment Book	Teacher guide, student workbook	Teacher guide, student texts, practice problem books
Lessons analyzed	8 lessons/sessions in one unit on angles in grade 4	3 lessons (7 sessions) in two geometry units in grade 4	3 lessons/sessions in a geometry unit in grade 4	3 lessons/sessions in geometry chapters in grades 3, 4, and 5 (1 lesson per grade)

RESULTS

In all of the four programs, right angles are introduced in grade 3 in the context of exploring polygons (e.g., triangles). Angles are extensively explored in the lessons for grade 4 in MATH, MTB, and INV, whereas SFAW provides only three lessons on angle with minimal content throughout the program. Common key content in the angle lessons from the curriculum programs includes: identifying right, acute, and obtuse angles, and representing angle measures in degrees. Even though the programs contain similar key content in their angle lessons, they exhibit different approaches to teaching such content and distinct organization of the lessons. Since SFAW includes minimal content and takes an approach similar to MATH, and INV shares many similar characteristics with MTB, we use mainly MATH and MTB to summarize our findings. In fact, MATH and MTB include the most content on angle among the four programs.

Table 2 summarizes how the concept of angle is introduced and represented in the lessons of MATH and MTB. MATH introduces angles using real-life examples (e.g., two folding fans opened in differing degrees) and asks students to compare sizes of angles intuitively and then by using transparent paper. Such activities lead to the use of a tool (protractor) to measure angles precisely. MATH uses the static meaning of angles and operates on angles as objects from the beginning, using protractors early on and finding the sum of and difference in angle measures. In contrast, MTB introduces angle as the amount of turning and asks students to do motions to represent angles, such as making a complete turn. In the last lesson, angles are described as the amount of opening as well as the amount of turning. MTB promotes dynamic as well as static meanings of angle, with much emphasis on dynamic interpretation of angle throughout the lessons.

TABLE 2
Angles Represented in MATH and MTB

	MATH (Korea)	MTB (U.S.)
Definition of angle	No explicit definition discussed or used in grade 4; "a shape composed of two lines" in grade 3	The amount of turning; the amount of opening
Introducing angle measures (degrees)	One right angle is 90° and 1/90 of one right angle is 1°.	One complete turn around a circle (clock face) is 360°. Halfway around a circle is 180°; a third of the way around is 120°; a quarter of the way around is 90°.
Notations	Angle 가 or Angle 나가다 (using Korean alphabets)	Angle A, ∠A or ∠BAC ∠A = 90°
Representations of angles (in order of appearance in the lessons)	Folding fans, clock face, protractors, examples of angles in real life	Clock face (curved arrows representing angles), two rulers or two pencils, angle circles, scissors, examples of angles in the classroom, pattern blocks, protractors
Contexts representing angles	Folding and opening fans in different degrees, angles in parts of a bicycle frame	A complete turn in ballet, airplanes taking off at different angles, different shapes of sandboxes, angles in pattern blocks, angles in polygons

The contexts and representations used in the two programs share some similar forms, such as clock faces and examples of angles in the classroom and real life. MATH uses physical and concrete representations at the beginning and moves quickly to symbolic notations with diagrams of angles to discuss and to precisely measure sizes of angles. MTB focuses on the notion of turning throughout the representations. In general, MTB provides more diverse representations and contexts to illustrate the concept of angle in a dynamic (rather than static) way.

The ways in which each of the two programs introduces angle measures and degrees are distinct. MATH introduces a right angle as 90° and then defines 1° by using 1/90 of one right angle. This curriculum program also introduces protractors very early in the lessons. MTB defines one complete turn as 360° and then introduces half turn, quarter turn, and a third of a complete turn. MTB does not uses 1° until the last lesson, in which students start to use protractors to measure angles. In the meantime, MTB uses expressions like "a little more than 90°" and "a little less than 180°" to show or estimate angles.

Just as they exhibit different approaches to representing angles, the two programs' activities and organization of lessons reveal distinct characteristics (see Table 3). The activities in MATH are organized very carefully from beginning to higher levels and move by small steps toward the advanced level. For example, in the lesson on drawing angles, MATH has several specified activities to draw angles, ranging from drawing angles intuitively, to drawing angles with one side and the vertex given and with the side given and no vertex, to drawing angles from scratch. In contrast, MTB has a somewhat looser organization. Unlike MATH, MTB does not contain all the lessons on angles within one unit. The lessons on angles are in two separate units, two early in the school year and the other much later. Consequently, the last lesson includes frequent reviews of some concepts taught in the previous lessons to remind students.

TABLE 3
Lesson Activities in Sequence in MATH and MTB

MATH (Korea)	MTB (U.S.)
• Compare the various sizes of angles using transparent paper/sample	• Compare pairs of shaded angles pictured on clock faces (which has more turning)
• Use protractors to measure the sizes of angles	• Create angle circles using two same-sized, different-colored circles (green and white); Use them to show and compare different-sized angles
• Draw given angles with/without protractors (find various ways to draw angles without a protractor using intuition; draw angles with given base line with/without vertex; draw precise angles without any given)	• Use angle circles to show angles larger or smaller than the given ones; Draw angles larger or smaller than the given ones and label them
• Estimate the size of angles and then measure the actual size	• Explore right, acute, and obtuse angles
• Find the sum of and difference in angle measures	• Estimate angles by using 45°, 90°, and 180° as benchmarks; Use angle circles to make angles in various sizes (e.g., a little less than 180°)
• Find the sum of all the internal angles of a triangle; Cut out the three angles and put them together to see their sum; Find the size of one missing angle or the sum of two missing angles in a triangle	• Explore angles in pattern blocks (equilateral triangles, trapezoids, hexagons, rhombi, squares) – angle measures of those shapes using the relationships among them
• Find the sum of all the internal angles of a quadrilateral; Cut out the four angles and put them together to see their sum; Explore the relationship between the sum of the internal angles of a triangle and the sum of the internal angles of a quadrilateral; Find the size of a missing angle in a quadrilateral	• Use protractors to measure angles and practice
	• Measure three overlapping angles and see that the sum of the two smaller angles are the measure of the larger angle
	• Construct a sandbox (polygon) with a specific angle (e.g., 50°)
• Extension - Explore the sum of the other two angles and external angles of a triangle; Explore the sum of internal angles of other polygons	• Explore internal angles of polygons (quadrilaterals)

MATH has a typical format in its lessons: facing perturbation, reasoning intuitively, sharing of possible solutions, exploring the main activity with teacher's guidance, and final checking (closure) and practice. These main steps are listed in the student book as well, which may help students see the flow of their exploration. In contrast, MTB does not have a common format throughout the lessons, except that MTB has an extensive student exploration segment. One potential reason for this difference in lesson flow is the length of individual lessons. MATH has lessons organized by sessions (i.e., one lesson is one session), whereas MTB has longer lessons with multiple activities or activities requiring more than one session to complete. This means that MATH has lessons segmented by session, yet they build on the previous ones and move toward the goals of the entire lessons, i.e., the unit. MTB's lessons are less hierarchical, even though they build on previous learning.

Precision and approximation are appropriate words to describe overall characteristics of MATH and MTB, respectively. MATH emphasizes and promotes accuracy and exactness throughout the lessons. Estimating, thinking intuitively, and manipulating angles are often required in order to emphasize the necessity of using protractors. MTB uses approximation

extensively throughout the lessons. Using benchmarks, such as 90°, to estimate, show, and sketch angles is a core activity in the lessons. Also, expressions such as "little more/less than 90°" are commonly used to describe angles.

IMPLICATIONS

Comparing the lessons on angles in the South Korean and the US elementary mathematics curriculum programs revealed stark differences as well as common features among them. This effort is significant not only to help enhance the quality of the mathematics curriculum in each country, but also to promote international perspectives and discussions on the mathematics curriculum, which can help establish a common ground to investigate issues related to curriculum.

This study reveals a few issues related to mathematics curriculum design. First, the dual nature of a mathematical concept needs to be addressed appropriately. This means that instructional activities should be organized in order for students to experience mathematical concepts as processes, as well as objects. Second, there should be a balance between precision and approximation in representing mathematical concepts. Mathematics needs accuracy and precision as well as approximation and estimation. Both are useful tools to explore mathematics and goals to be met. Third, how to organize lessons on a topic is also an area of concern. Whether to include all the lessons in a single unit or in multiple units affects students' learning progression; in each case, a careful examination of potential learning paths is required. Fourth, the format and length of individual lessons should be considered thoroughly. Is it important to have the same flow in each lesson? If so, what format is desired? If not, what justifies the variations in the flow? Should individual lessons aim at one-day teaching? What if a lesson activity requires extensive time for exploration? These are some of the questions that need to be considered regarding the format of the lesson.

We envisioned what the teaching and learning of angle would look like based on the written curriculum in this study, and yet the actual practice is unknown. We need to examine what teachers actually use from each program to teach angle and what students actually learn from the lessons. Also, for a better understanding of the programs and further implications for curriculum design, more lessons, perhaps on other critical topics and broad content strands, need to be examined.

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