

Exploring Science Classes and Science Teachers of New York Using Professional Teaching Standards by Korean Teachers

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Abstract: The purpose of this study was to investigate the difference of teachers' interaction with their students when teaching science in New York (NY) and in Korea. As part of the 2011 Korean International Teacher Fellows (KITF), supported by the Ministry of Education, Science and Technology (MEST) and the National Institute for International Education Development (NIIED), Korean science teachers observed, for six months, New York's science classes in terms of how teachers interact with their students and how students learn science during science instruction. The participants were 10 science teachers in five middle and high schools that taught Physics, Chemistry, Biology, Earth Science, and Environment Science in NY. The National Board for Professional Teaching Standards (NBPTS, 2003) and Instruction as Interaction (Cohen et al., 2003) were used as an instrument to identify each teacher's teaching and classroom interaction. Several characteristics of science classes in NY were revealed, which are different from Korean science classes. First, science teachers in NY dominantly put more focus on their subject of teaching during science interaction while, Korean science teachers not only teach science but also do counseling to students as a homeroom teacher. Second, science teachers in NY acknowledged the students' individuality and have positive experiences of professional development supported by their school and district more than Korean science teachers do. Third, science teachers in NY sometimes showed limited knowledge about the concepts of science and lack of collaboration with other science teachers. This characteristics may prevent the school from strengthening its subject program and keeping equity across the grade levels and courses.

Keywords: New York, science teaching, science teacher, professional teaching standards

Introduction

Over the past decade, much research revealed that Asian students outperform American students in Science and Math like Programme for International Student Assessment (PISA) or Trends in International Mathematics and Science Study (TIMSS). (Kim et al., 2008; Zhou and Peverly, 2004; Zhou et al., 2000; Leung, 2006) and suggested reasons why Asian and American students have different achievement gaps

(Suter, 2000; Lee, 1998). These studies have investigated a wide range of reasons and noted that teachers' quality is fundamental to ensuring students' success. Researchers have described that factors underlying the differences between East and West could center on cultural values, beliefs, curriculum, learning and teaching practices (Aunio et al., 2008; Nam and Jang, 2013).

Educators have recently shown an unprecedented interest in the role of teachers as the most important factor in influencing student achievement. In particular, concern about the quality of teachers' teaching practice has surfaced as a serious issue in the United States. While many studies have existed on the students' achievement in science between Western and Eastern context, relatively few studies have been conducted to investigate the differences in teachers' teaching and classroom interactions between American

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and Korean secondary science teachers.

Korean schools may be more teacher-oriented, which can be explained by Korea's national curriculum standards. Student-centered practices show that US teachers frequently use peer and group learning more than Korean teachers (Paik, 2004). The New York State Education Department is one of the most complete, interconnected systems of educational services in the United States. In addition to this, the New York City Department of Education is the largest system of public schools in the United States, serving about 1.1 million students in over 1,700 schools. However, nationally, there is a growing shortage of science teachers in America. As a result, many school districts are forced to hire teachers with science degrees but little training in education or experience teaching (Darling-Hammond, 2003).

In this paper, we identified certain distinctive characteristics of science classes in NY. What is offered here is by no means a definitive evaluation of teachers' professional qualities but rather an attempt to draw brief outlines of the differences. Three in-service science teachers of Korea observed science classes in NY for six months as a part of Korean International Teacher Fellows (KITF), which is supported by the Ministry of Education, Science and Technology (MEST) and the National Institute for International Education Development (NIIED). The main goal of this project is to cultivate Korean International Teaching Fellows into leaders of Korean STEM K-12 education and learn cross-national best practices. Stigler and Hiebert (1999) argue that teaching is a cultural activity that can only be improved by increased awareness of the cultural scripts and practices used by teachers and "requires comparing scripts, seeing that other scripts are possible, and noticing things about our own scripts that we had never seen before" (p. 101). Cross-national comparative studies can illuminate best practices, offer an opportunity for the generation and testing of hypotheses, and result in findings and outcomes viewed as authoritative policy makers (Porter and Gamoran, 2002).

The purpose of this study is to explore the characteristics of science teaching based on five core propositions of the National Board for Professional Teaching Standards (NBPTS) and interaction. In order to obtain this purpose, we explored the characteristics of NY science class and teachers based on each proposition and subsequent standards. In addition, we examined concrete examples about how current circumstances in NY schools affect instruction in science classes. This study would offer effective opportunities to reveal how similar and different teachers' instruction and students' participation can be identified and what the possible reasons for them are in different socio-cultural contexts.

Theoretical Background

The National Board for Professional Teaching Standards (NBPTS) is a nonprofit, nonpartisan organization governed by a board of directors, the majority of whom are practicing teacher (NBPTS, 2003). The NBPTS developed five core propositions for what accomplished teachers should know and be able to do by describing the degree of their knowledge, skills, abilities and commitments. The five core propositions that the NBPTS designates are listed as follows.

1. Teachers are committed to students and their learning.
2. Teachers know the subjects they teach and how to teach those subjects to students.
3. Teachers are responsible for managing and monitoring students learning.
4. Teachers think systematically about their practice and learn from experience.
5. Teachers are members of learning communities.

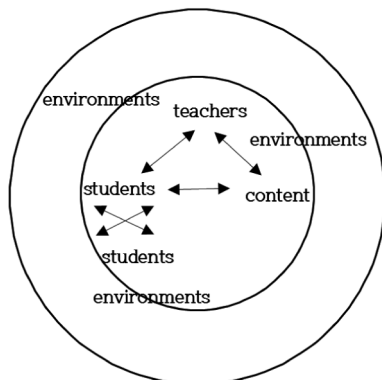
In addition, the NBPTS created field-specific standards for accomplished teaching grounded in the five core propositions, and articulated the actions that accomplished teachers take to advance student learning (NBPTS, 2003). There are, in particular, twelve science standards, which embody an acknowledgeable agreement in accordance with practice that

Table 1. Science standards in the NBPTS (NBPTS, 2003)

| Science Standards |
|--|
| 1. Understanding students |
| 2. Understanding science |
| 3. Understanding science teaching |
| 4. Engaging the science learner |
| 5. Sustaining a learning environment |
| 6. Promoting diversity, equity, and fairness |
| 7. Fostering science inquiry |
| 8. Making connections in science |
| 9. Assessing for results |
| 10. Reflecting on teaching and learning |
| 11. Developing collegiality and leadership |
| 12. Connecting with families and the community |

characterize and differentiate accomplished teaching with others in those areas. As can be seen in Table 1, they have been spread broadly for giving standards to various professionals including science teachers in America.

As well as the NBPTS five propositions and subsequent standards, we are also focusing on the diagram Fig. 1, in which 'instruction' consists of interactions among teachers and students around content and in environments (Cohen et al., 2003). In Fig. 1, 'interaction' refers to no particular form of discourse but to teachers' connected work, extending through days, weeks, and months (Lampert, 2001). Teaching is a collection of practice, including pedagogy, learning, instructional design, and managing organization (Cohen et al., 2003). This new view of instruction has helped us to keep a fresh and consistent perspective when observing American classes at school.

**Fig. 1.** Instruction as interaction (Cohen et al., 2003).

Methodology

For six months in NY, we closely observed various science classes at five secondary schools through the KITF Program, which is operated by MEST and NIIED. We were assigned to four schools in the same district located in the state of New York and one school located in the city of New York. The district of four schools (High school B and C, middle school D and E) lies 40 miles east from New York, and has received a 'Good Standing' evaluation for students' English, math and science achievements. One of the four schools was named to the Newsweek list of Best High Schools for 2007 and was ranked 209th. On the other hand, the school in New York City (High school A) is a big-sized high school with more than 4600 students, a variety of ethnic backgrounds. Besides the students, the school serves diverse teachers including Korean teachers. It has a wide range of students' level on science, so three differentiated science classes are operated in terms of repeated, regular and honored.

We analyzed different classroom situations in NY from Korean's, specifically focusing on the actual instruction among instructors, students and content, within their respective environments. Out of 50 teachers whose classes we observed at five schools, ten science teachers were selected as participants after a regular amount of close examination and scrutiny. In order not to be biased in the position of Korean teachers, we reflected the opinions of selected participants through frequent interviews. In addition, other KITF members who also observed NY classes, took part in exploring for a research to reach more reliable generalization. As can be seen in Table 2, we zoom in earth science teaching more than other science subject teachings. The contributors to our study are as follows.

For the research framework, we analyzed five core propositions and twelve science standards from the NBPTS. Since substantial differences in educational standards are related to different levels of student attainment in science, a need for appraising the standards is required (Gilbert and William, 2000).

Table 2. Participants

| Location | School | Teacher | Teaching Career | Teaching Subject |
|-----------------|-----------------|-----------|-------------------------------|-------------------------------------|
| New York Ccity | High School A | Mr. K | 11-15 yrs | 9 th Biology |
| | | Mr. M | 21-25 yrs | 9 th Environment Science |
| New York State | High School B | Mr. S | 21-25 yrs | 8 th Earth Science |
| | | Mrs. E | 16-20 yrs | 8 th Earth Science |
| | High School C | Mr. T | 6-10 yrs | 10 th Chemistry |
| | | Mrs. C | 6-10 yrs | 9 th Physics |
| | Middle School D | Mr. D | 0-5 yrs | 8 th Earth Science |
| Mrs. A | | 20-25 yrs | 8 th Earth Science | |
| Middle School E | Middle School E | Mr. P | 11-15 yrs | 8 th Earth Science |
| | | Mrs. R | 11-15 yrs | 6 th Biology |

Each standard was assigned to one of the propositions that comply with a common fundamental idea. In order to complete acceptable configuration, three researchers organized each framework separately, and afterward compared one another. We actually gained 78 percent of consensus in our first attempt. Through regular discussions, we reached a unanimous agreement on suggesting our toolkit, and eventually concluded the reconstructed framework as following Table 3. Among twelve science standards, specifically attended standards in each field are in bold type and are followed with specific explanations.

Afterwards, we made concrete questions to check how our participants embody those NBPTS standards (Appendix 1) along with the framework and came up

with the evaluation form (Appendix 2) for assessing them with objective criteria. We referred to results of the evaluation form while analyzing appraisal of NY teachers based on NBPTS standards.

Results

To deal with our research questions in a series of Propositions of the NBPTS and classroom interactions, we will state the general characteristics in NY classes and specific examples of science classes.

Proposition 1. Teachers are committed to students and their learning

When it comes to special education in Korea, the

Table 3. Reconstructed framework for science class observation

| Propositions | Science Standards | Explanation of bold typed standards |
|---|--|---|
| 1. Teachers are committed to students and their learning. | 6. Promoting diversity, equity, and fairness | Accomplished teachers are committed to the fair and equitable treatment of all students-especially in their learning. |
| 2. Teachers know the subjects they teach and how to teach those subjects to students. | 2. Understanding science 3. Understanding science teaching 8. Making connections in science | Accomplished teachers have a deep and broad knowledge of the concepts, principles, techniques, and reasoning methods, and they use this knowledge to inform curricular goals and shape their instruction and assessment. |
| 3. Teachers are responsible for managing and monitoring student learning. | 1. Understanding students 4. Engaging the science learner 5. Sustaining a learning environment 9. Assessing for results | Accomplished teachers employ multiple, ongoing methods that are fair and accurate to analyze the progress of individual students in light of well-defined learning goals, and their students achieve meaningful and demonstrable gains. |
| 4. Teachers think systematically about their practice and learn from experience. | 7. Fostering science inquiry 10. Reflecting on teaching and learning | To improve practice, accomplished teachers regularly reflect on what they teach, how they teach, and how their teaching impacts student learning. |
| 5. Teachers are members of learning communities. | 12. Connecting with families and the community 11. Developing collegiality and leadership | Accomplished teachers continually collaborate with other teachers and education professionals to strengthen the school's program, promote program quality and continuity across grade levels and courses, and improve knowledge and practice. |

focus is mainly on a gifted education rather than on special needs students. Every Office of Education in local districts has science programs for advanced learners, whereas a program for special needs students in public schools is rare and not considered critical by educators. From this aspect, science education in NY is oriented towards all students - not only to gifted students but also to special needs students. Moreover, NY students tend to have different achievement goals depending on individual abilities and they are open about their differences from other students. Students in NY can choose a class level that fits their capacity such as repeated (or blended), regular, honored, and AP (Advanced Placement) classes. Based on the NBPTS standards, most teachers recognize individual difference among their students and adjust their practice accordingly. As well, students can determine their class according to their cognitive capabilities.

The No Child Left Behind (NCLB) Act can be one of the reasons for the concern about individual learning in the U.S. The NCLB Act was signed into law in 2001. Its primary goal is to raise academic standards, reduce achievement gaps, encourage more school accountability, and offer more choices to families and students. Schools are held accountable for the achievement of students with different races, disabilities, and limited English proficiency and low income. If a school has not reached student achievement targets in the subjects of language arts, mathematics, and science, the school is labeled as a failing school and “punished through withdrawal of federal funds, pressure for privatization and public school choice” (Fusarelli, 2004, p. 72). NY is one of the largest gateways for immigration to the United States. This opportunity caused diverse cultures and languages to co-exist in a classroom. Because race and minority problems could be a basic concern, teachers tend to be fair to every student regardless of their ability, gender, and race. In other words, teachers make an effort to understand diverse student populations, and use knowledge of diversity within the school and the community to address the needs of all learners. Teachers create a sense of community among

students, and promote students’ appreciation of and respect for individuals and groups.

Commitment to Students and Science Classes

Due to less science class time being devoted to Korean students than NY ones, it is difficult for Korean science teachers to give opportunities to every student to make his/her own opinion during science class. However, American science teachers’ practices often reflect their consideration on having as much student participation as possible. For instance, when teachers ask the class about some scientific phenomenon, Mrs. A uses specific tools such as ‘name sticks’ or plastic coins to keep track that students get a fair chance at participating. A name stick has each student’s name written on it and the science teacher can select one from a container to give the students a chance to present their thoughts. Additionally, some science teachers make use of plastic coins with different colored faces. The teachers can then place a coin over the student’s photo in the attendance book when the student raises a hand and presents his/her opinion on the teacher’s question.

Another notable characteristic of science classes in NY is that all special needs students have their own individual educational plan. When unique instances are noticed, such as a student’s incredible ability to solve scientific problems, science teachers concern themselves with ensuring that such children get the special attention they need and deserve. Due to this special effort put forth, students can continue to learn and grow. For example, in Mr. P’s Earth Science class, Brent was an 8th grade student who suffered from autism, but he possessed exceptional ability in math and science. Classmates and teachers called him a walking calculator because of his unbelievably fast and accurate mental calculations. Even though Brent was lacking social skills, he was taking honor science classes with a special assistant, and was participating in a Spanish class in a high school within the same district.

Proposition 2. Teachers know the subjects they teach and how to teach those subjects to students

Based on particular standards for an instructor's knowledge in regards to his or her subject and its teaching, we focused on how they ascertain rich comprehension of subject and methods for conveying subject matter towards students effectively. NBPTS requires NY teachers to have a broad and current knowledge of science and science education, along with in depth knowledge of one of the subfields of science, which they use to set important and appropriate learning goals (NBPTS, 2003). Many teachers, however, sometimes demonstrate invalid content and hardly know the productive connections across the disciplines of their major, among other subject areas (Roehrig and Nam, 2011; Kwak, 2012). They even didn't realize their frequent mistakes and appeared to be not dedicated to inquiring their subject in greater depth. This situation is obviously exhibited in that some teachers refuse to undertake advanced courses for senior students due to lack of confidence. In addition, several teachers unqualified to teach subordinate levels were hired in secondary school due to the deficiency of personal resources.

The actual means of being selected as a public school teacher in America would result in the main cause for teachers not being knowledgeable. The NYSTCE (New York State Teacher Certificate Examination) program includes three tests that measure a candidate's knowledge and skills. It tests in sections comprising of liberal arts and sciences (LAST), teaching theory and practice (ATS-W) and in the content area of the candidate's field of certification (CST). In contrast of the absolute evaluation system towards the Teacher Recruitment Examination in Korea, NYSTCE is graded on a curve, which intimates that the process of being a public teacher in New York is a lot less competitive and straightforward than in Korea. According to Korea Daily New York (Lee, 2011), the ratio of successful applicants for NYSTCE across whole subjects records over 90 percent. This situation is opposite of Korea because

the Korean public teacher recruitment examination usually has a tough failing to passing ratio of higher than 10:1. That is, 10 people fail for each one that passes (Yoon, 2013).

Regarding the constitution of text contents, American teacher examination doesn't emphasize an applicant's specialty; rather it also highlights liberal arts and pedagogy in equal proportion. Even a specialty test in NYSTCE consists of middle or high school level of problems that do not require an intimate knowledge of an applicant's major. On the contrary, Korean teacher candidates are definitely called upon to know a college level of expertise because all the problems in a specialty test come from a college curriculum. Due to the strict process of selecting a Korean teacher, only people who have an abundant knowledge of their field can pass all the procedures, and they are admitted as professionals on teaching their areas.

Teacher Competency and Science Classes

Science teachers should strive to create opportunities for students to examine the human contexts of science: its history, reciprocal relationship with technology, ties to mathematics and impacts on society so that students can make connections across the disciplines of science, among other subject areas and in their lives. Although science teachers should use a variety of instructional techniques and assessment strategies to foster academic development among students, some of the science teachers in middle schools (6~9th) sometimes showed a lack of their subject knowledge. Consequently, they could not encourage their students' active engagement in scientific learning. For example, Mrs. R having K-6 elementary teacher certificates generally showed a lack of confidence when they taught scientific concepts. She tended to avoid science experiments or inquiry. Instead, the teachers usually listed what their students should memorize rather than inspiring curiosity. Students spent most of their time writing down what the teachers provided on the transparency or filling out blanks with the right answers on their handouts.

Mrs. R also admitted that he sometimes felt ill-prepared and often faced the extra challenge of discovering how to teach and prepare on their own. The value of lecturing is that it is the quickest way for transferring knowledge while allowing students to also learn note-taking and information-organizing skills. However, too many lectures in science classes of middle schools and high schools should be reconsidered in favor of other ways to fulfill students' understanding of the subject matter.

Also, the absence of a science assistant teacher, who helps prepare science experiments instead of science teachers alone, would be another reason that limits science teachers' ability to perform scientific inquiry in class. Unlike Korean science teachers, American science teachers felt burdened to plan hands-on activities with students because of the need to spend a lot of time to set up and clean up after. American high school science teachers showed a tendency to overburden students with the mastery of facts and technical terminology at the expense of having them actively doing science like Korean high school teachers. However, learning is best done when they are actively engaged both physically and mentally through hands-on activities rather than only minds-on activities in science classes. Mr. M complained, "we don't have any assistant to help to prepare science labs. But I can see that some assistants are hired to work with a single student, usually one with significant behavioral issues or disabilities. Well-prepared teachers have the largest positive impact on high student achievement. If we have a well-prepared teacher assistant like graduate schools then we have the largest positive impact on high student achievement and interest about science." However, The laboratory has been given a central and distinctive role in science education, and science educators have suggested that rich benefits in learning accrue from using laboratory activities (Hofstein and Lunetta, 2004).

Proposition 3. Teachers are responsible for managing and monitoring student learning

Although teachers in both countries are asked to

have a responsibility for student learning, how US teachers actually deal with their pupils in the class appears to be quite different from their Korean counterparts. Contrasting to a close relationship, sometimes beyond necessity between teachers and students in Korea, US teachers prefer to keep a professional distance from their students and would likely treat them with disinterest. Mr. K says "We are directly evaluated by results of student examination scores, which affect their next annual raise or promotion". This may cause those characteristics of NY teachers. Actually, he probed less into the student's private circumstances affecting on learning; intervening in or helping to resolve his student's own situations was discouraged as well. Surprisingly, however, he was in no way losing track of managing the individual academic progress of students and was indeed making the most effective use of his instructional duties.

Above all, teachers and students in the U.S interact with one another in their educational relationship as two equal objects. In essence, there is no cultural aspect forcing students to treat teachers more honorifically than towards other adults. In addition, students' comprehension towards teachers in America is more evident in that an instructor only exists to monitor their achievements, passing on knowledge of the subject to them. These characteristics identify the position of US teachers; they are obligated to just work along with their professional duties. At the same time, students are mandated to follow their instructions without any sense of emotional resistance. Actually, these contrast with Korean culture urging students to enact ideal attitudes towards teachers on the basis of Confucius beliefs. In turn, Korean teachers are conceived to take up a complex role in influencing their students through every perspective.

Secondly, American schools don't emphasize the significance of having a homeroom teacher like every Korean school does. Sometimes, homeroom systems are absent at plenty of schools in America, which means that subject teachers should take on student's matters instead of homeroom teachers. This allows a

subject teacher pay more attention to student learning and be more dedicated to take care of it because no one can replace their pivotal role. On the contrary, in Korea, homeroom teachers should deal with most work involving their students such as inabilities in subject learning. Subject teachers usually shift these accounts in terms of student learning to their homeroom instructors.

Responsibility for Student Learning and Science Classes

Helping students to develop healthy self-images and self-worth is integral to their learning and developmental experiences regardless of teacher subject. In NY, most schools offer health classes that address teen issues around self-image, peer pressure, nutrition, wellness, bullying, physical abuse, awareness of drugs and a variety of other relevant teen experiences. Furthermore, students are required to take a health class as a core class requirement. Unlike Korean science teachers, who are homeroom teachers at the same time, American science teachers mainly focus on instructing students in the subject matter. Although one health class seems not enough to effectively deal with the great number of issues that could contribute to psychological or physiological trauma for a teenager, science teachers do not need to spend their limited class time to give advice about individual student problems.

The classroom is a learning community where each student contributes to the goals, experiences and learning of the other members. Teachers should design learning activities that promote these common aspects amongst its members. Researchers observed team-taught science classes. Mr. S and Mrs. E were a science teacher and a special needs educator at a repeated (blended) class in a high school. They were responsible for teaching a low achievement class made up of mostly special needs students. They not only used class time effectively but also developed classroom routine with all of the students. This resulted in high student subject engagement although the students' academic achievement was predictably

not high. Mr. S addressed that If he taught the students alone, his science class would be less efficient because he might always be busy finding the necessary materials such as handouts or teaching aids during the class. The teaching team looked prepared for class. For this reason, student attention was not broken and they did not lose class momentum. If teachers lead a smooth transition from one activity to another, students tend to show that they are actively engaged and show enhanced motivation.

Proposition 4. Teachers think systematically about their practice and learn from experience

Most districts and schools in NY provide in-service professional development opportunities for teachers during the school year dealing with district objectives and expectations through relevant workshops or classes. Teachers are also required for professional development to maintain certification eligibility and job eligibility in every year. Professional development opportunities for teachers in NY and Korea seem to be essential for creating comprehensive learning communities. One of the biggest differences of Professional teacher development policy from Korean's is that American teachers could renew their teachers' certification as long as they have completed the required number of course hours. They have various certifications such as initial, professional, and permanent. Typically, 150 hours is the minimum time to provide a five-year certification renewal, so teachers must attend and complete paperwork for a diversity of workshops that range from 1 to 50 hours yearly according to the time frame of the workshops.

In promoting professional development opportunities for teachers that enhance student achievement, the bottom line is that teachers must be given the time to complete workshops at minimal costs. Therefore, school and district budgets reflect the view of teachers' professional development as a very significant issue for students' learning. In other words, teacher's professional development creates a 'win-win' learning experience for students. Through professional development course or workshop, teachers can

enhance their instructional practices and perform new ways of teaching.

Another significant characteristic is a mentor-mentee system performed by experienced and novice teachers in NY. Experienced teachers open their classes to novice teachers to get tips on teaching students. Furthermore, experienced teachers in the U.S. are proud of their professionalism and take for granted that they have more responsibility to teach students than novice teachers. In Korea, experienced teachers have fewer classes than novice teachers, while American teachers have the same classes regardless of their seniority. This differs from Korean culture in which is given to the elders; therefore less labor is given to experienced teachers at work. However, in the U.S. teacher duty looks equal regardless of teachers' age. For example, Mrs. A who was in her 50's took a same amount of classes with a young teacher Mr. D at her school. Also, interactions among teachers in the U.S seems to be more flexible and relaxed than in Korea. In other words, American experienced teachers make use of their ample knowledge and novice teachers learn the experienced teachers' know-how through the mentor and mentee relationship. A novice teacher Mr. D was actually assigned to a single class per day, and during his remaining times, he just observed other teachers' classes.

Teacher Reflection and Experience in Science Classes

Mr. K went to a conference last spring where they were asked to tweet about botany lectures. He was amazed at finding out how focused and engaged he was through trying to do this. He came back and reported to his students about this and suggested they find a way to incorporate this into their classroom learning community. He used Twitter for his own science class. He occasionally has his students tweet their notes, and then collect them for posting on their Wiki.

Mr. D tried to make calculating the science final grades as easy as possible. He simply added up the

total points received and the total points possible and divided the sum to get the total percentage. It became obvious to him after last year that this system simply wouldn't work. He was having artificially inflated grades when less-than-honest students would copy their classmates' homework but then fail the test. He knew they were not learning the material but their grades would not reflect that. He now had questions:

“Obviously, these students were not internally motivated to do well. They just wanted to pass the class and move on. Enough complaining, my questions are, how do you weigh grades in a fair manner? What categories do you use? And should I grade homework?”

After a long reflection, he told researchers what he had realized:

“Not doing the homework should have the natural consequence that it seems to have in my class-students not learning, i.e. not doing well on assessments. If a student can do well on assessments without doing the homework, so be it. Such a case presents homework being little more than busy work. Homework should have the same goals as class work and every part of my curriculum.”

Proposition 5. Teachers are members of learning communities

The interaction among teachers who are working at the same school is considered to be essential in Korea to communicate for class management plans and make decisions regarding subject department policy. In fact, there exist a number of daily or weekly discussion conferences among teachers of the same subject, homeroom teachers taking charge of the same grades and whole teachers at school. In the US, however, they rarely share their lesson materials with other teachers and would rather make a decision about a class by themselves. They rarely have a discussion about matching their pace to other teachers although they undertake the same level of a class with exactly the same course name. They are less curious on other teachers' own class management methods than Korean teachers are.

The first ground for these situations is the physical environmental conditions of American schools for teachers. Some schools surprisingly don't provide teachers' office for each subject or each grade at all, and even if they do, the teachers' office is usually small and cramped. As well, all the equipment offered by school for a class preparation, like a computer, a cabinet and many kinds of stationery are usually shared with other teachers whereas Korean teachers are given a group office and ample supplies. This poor circumstance at American schools makes it hard for teachers to get together and confer about lesson plans because there is little room for their productive discourses.

The second ground is the American traditional value towards individuality. American teachers are permitted to get to work and leave work relying on a respective class timetable regardless of that of other teachers. And they respect an individual teaching style, thereby they don't intrude into other teachers' class organization. Since a student and a parent also tend to count on a teacher's class management strategy and don't compare with other classes with mentioning about student equity, a teacher can keep an eye on their own instruction.

Teachers as Part of Learning Communities and Science Classes

Science teachers' unions such as the New York State United Teachers and other professional organizations allow teachers to work together and develop current educational standards and other developments. Unions in particular often work to make sure teachers receive fair wages and that if a teacher is facing charges for an alleged crime, he or she receives adequate legal counsel. Unions tend to be active in lobbying the legislature on behalf of the teaching community. Mr. T addressed most science teachers in his school seemed to focus on general educational policy than science curriculum in particular.

Secondly, science teachers do not need to make the mid- and final-term exams in the U.S. The district science director makes the exam problems on the

basis of the regent test in New York (Bishop et al., 2000). For this reason, science teachers rarely have gathered for teaching in similar ways for the same grade in a school. In Korea, science teachers have regular meetings to adjust their teaching materials and teaching contents to reduce complaints of unfairness from students. Rather, American science teachers looked to join up with other subject teachers such as math, science, social studies and English teachers. This collaboration played a crucial role in meeting the needs of students, and they seemed to be important to identify students with special needs. Sometimes, libraries were used for their media centers for the team project. Mr. T emphasized the importance of library as media center and mentioned he often used the library to print students' resources, to borrow topic related books and to do diverse performance tests. Next to the library, the computer lab was also available for use by the team teachers. Mrs. C also accentuated the function of a school library where students, staff, and often, parents of a public or private school have access to a variety of resources. She described that a goal of the school library media center is to guarantee that all members of the school community have equitable access to books, to information, and to technology. A school library serves as the critical center and the best coordinating agency for all material used in the school.

Discussion

In conclusion, five characteristics of science classes in NY were revealed that differed from science classes in Korea. We made several proposals for Korean science classes and science teachers through exploring NY teachers' practice.

First, a number of science teachers in NY acknowledge and value the students' individuality and worth. They tend to recognize individual differences among their students and adjust their practice accordingly. Many science teachers in NY try to consider promoting diversity, equity, and fairness to all students. Currently, Korean science teachers provide

instruction for large classes in a uniform block. There is no regard for specialized needs, including the needs of students with learning and other disabilities. Therefore, the existing system carries with it difficulties in regarding students as individuals with specific and differing needs.

The second finding is that teachers in NY in this study show strong incentive and positive experiences with professional development supported by their school and district. They were obligated to regularly renew their teacher certificate, and to evaluate their practice to improve the quality of their students' learning experiences. At the moment, there is minimal incentive for Korean teachers to participate in professional development since their teacher certification lasts for life with no requirement for renewal. Even more surprising is the treatment given to Korean teachers who pursue graduate degrees in the evenings. They face negative comments from co-teachers and principals who imply that studying teachers care less about their students than themselves and the progress of their careers. Observing co-workers imply that teachers should be working on the next day's lesson plans rather than graduate school assignments. This differs greatly from NY teachers who are supported and encouraged in their ongoing educational pursuits. In some cases in NY, principals even arrange for a substitute teacher so that a regular teacher can attend a professional development workshop.

Third, science teachers in NY do not need to take the role of homeroom teacher like science teachers in Korea do. These reduced interactions between students and teachers in NY appear to reduce unnecessary emotional conversations and scars, which often happen between teachers and students in Korea. Also, the reduction in those interactions helps teachers in NY to focus on their subject teaching for the class.

On this related note, we should not give excessive accountability to Korean homeroom teachers: pressing them to take care of students like the parents do. It has been understood for a long time in Korea that teachers should have a hand in their students' lives. The responsibility of teachers towards a student's

learning is usually taken for granted in Korea, and this social expectation tends to make them interfere with their students' private lives. At times, this causes rather awkward relationships between the two. Thus we recommend separating homeroom teachers' duties from school counselors' to reduce their workload. We would like to see counselors assume a large role in Korean schools. This would reduce the workload of homeroom teachers. We also recommend science teachers to avoid solving students' personal or non-academic problems so that they focus more thoroughly on the subject matter.

The fourth proposal is related to teacher collaboration. Science teachers in NY rarely collaborate with other teachers to strengthen the school's subject program and to promote program quality, continuity and equity across grade levels and courses. Due to this, some science classes are more effective than others within the same school. Since NY teachers do not even need to test students on the same date, nor use the same test questions in an exam. Students are evaluated with different appraisal standards, which may give rise to unfairness when they apply for a college. So, we recommend teachers share data for classes, match each other's lesson progress and most importantly, designate an official test date, so that students can take an exam at the same time with an identical test paper. This can happen only when teachers continually collaborate with other teachers to develop the school's program and consider students' fairness. We recommend Korean teachers continue following their established practice of collaborating and sharing information.

Lastly, science teachers in NY sometimes show a lack of and limited knowledge of the concepts, principles, techniques, and reasoning methods of science. We understand one of the reasons is the fact that teachers' certification exam in NY does not emphasize an applicants' content specialties, which means that content knowledge is just one third percentage of the exams. What is worse is that passing a teacher exam does not guarantee that teachers can work at school as a public teacher right away. The NY test is pass-fail. Korean testing,

however, leads to a ranking, so the best test performers in any given test are hired for teaching jobs. Furthermore, the test is given once per year in Korea, so applicants study hard. In NY, the test can be taken every month, so there is less incentive to do well the first time. When NY teachers pass their certification test, it implies nothing more than gaining a certificate qualifying them to have an interview for a job. Korean teachers, meanwhile, are guaranteed to have a job. After interviewing, NY teachers are hired respectively to the school's discretion customarily without verification on specialized knowledge.

To continue to emphasize the importance of content knowledge when we select science teachers, the Korean education system should continue its current practice. It is better to put more importance on content knowledge on teacher candidates' tests so that a more qualified person can get in the teacher's society. In addition, we recommend that teacher training for development should be encouraged in national level for ceaseless update of latest trends in content knowledge.

Although this article has explored the differences in science classes only within the context of NY and Korea, its implication should provoke science educators, teachers, and researchers to reflect on their current educational status. Through this study, they can choose the best practices to implement in the Korean K-12 education system. In addition, they can maintain a network with international collaborators and have current knowledge of advancement in other countries. This study is meaningful in that the researchers -Korean inservice teachers- are active research collaborators. As Cochran-Smith and Lytle (2009) noted, teacher researchers provide highly legitimate practitioner research about classroom practice.

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Appendix 1. NBPTS standards

Please use the following National Board Professional Teaching Standards, to learn and compare teaching aspects about your host teachers and Korean teachers as a reference to help you to understand what you learned from your teaching and learning activity.

| Standards | | Science Teacher Evaluation Based on NBPTS | 4 | 3 | 2 | 1 |
|-----------|--|---|---|---|---|---|
| I | Understanding Students | Have a broad and current knowledge of science and science education, along with in depth knowledge of one of the subfield of science, which they use to set important and appropriate learning goals. | | | | |
| II | Understanding Science | Have a broad and current knowledge of science and science education, along with in depth knowledge of one of the subfield of science, which they use to set important and appropriate learning goals | | | | |
| III | Understanding Science Teaching | Employ a deliberately sequenced variety of research-driven instructional strategies and select, adapt, and create instructional resources to support active student exploration and understanding of science. | | | | |
| IV | Engaging the Science Learner | Spark student interest in science and promote active and sustained learning, so all students achieve meaningful and demonstrable growth toward learning goals. | | | | |
| V | Sustaining a Learning Environment | Create safe, supportive, and stimulating learning environments that foster high expectations for each student's successful science learning and in which students experience and incorporate the values inherent in the practice of science. | | | | |
| VI | Promoting Diversity, Equity, and Fairness | Ensure that all students, including those from groups that have historically not been encouraged to enter the world of science and that experience ongoing barriers, succeed in the study of science and understand the importance and relevance of science. | | | | |
| VII | Fostering Science Inquiry | Engage students in active exploration to develop the mental operations and habits of mind that are essential to advancing strong content knowledge and scientific literacy. | | | | |
| VIII | Making Connections in Science | Create opportunities for students to examine the human contexts of science, including its history, reciprocal relationship with technology, ties to mathematics, and impacts on society, so that students make connections a | | | | |
| IX | Assessing for Results | Employ multiple, ongoing methods that are fair and accurate to analyze the progress of individual students in light of well-defined learning goals, and their students achieve meaningful and demonstrable gains in the learning of science. Teachers clearly communicate these gains to appropriate audiences. | | | | |
| X | Reflecting on Teaching and Learning | Continually analyze, evaluate, and strengthen their practice to improve the quality of their students' learning experiences | | | | |
| XI | Developing Collegiality and Leadership | Contribute to the quality of the practice of their colleagues, to the instructional program of the school, and to the work of the larger professional community. | | | | |
| XII | Connecting with Families and the Community | Provocatively work with families and communities to serve the best interests of each student. | | | | |

Appendix 2. Evaluation form**Survey of Quality Experience and Helpfulness of Host Teachers and Host Schools**

For each school, each supervisor of the program, each host teachers you had collaboration with, please provide the information below.

KITF Name:

Host Teacher or school:

Grade, Subject, Level:

School:

School Address:

Contact E-mail:

Phone:

Period of Collaboration (Observation, Collaboration, Co-teach etc):

Date:

Circle One

| | | High | | | Low |
|----|---|------|---|---|-----|
| 1 | ...displayed an understanding of the KITF Program. | 4 | 3 | 2 | 1 |
| 2. | ...understand Korean Education reasonably well. | 4 | 3 | 2 | 1 |
| 3. | ...understand performance of Korean students in Math and Sciences. | 4 | 3 | 2 | 1 |
| 4. | ...appreciate my presence. | 4 | 3 | 2 | 1 |
| 5. | ...displayed curiosity to learn about Korean Education or appreciate/learn your strength from you. | 4 | 3 | 2 | 1 |
| 6. | ...planned for initial needs by providing work space, textbooks, course outlines, school policies/schedules, and general information and orientation to total school environment. | 4 | 3 | 2 | 1 |
| 7 | ...made efforts to plan for my transition from assistant to full time teacher to occur efficiently and effectively for both me and student learners. | 4 | 3 | 2 | 1 |
| 8 | ...understand your goal: learning best practices, host school system in general, understanding students, family, social factors of teaching and learning, experience of planning lesson with US teaching material, assessing, and classroom teaching. | 4 | 3 | 2 | 1 |
| 9 | ...shared materials and resources with me freely. | 4 | 3 | 2 | 1 |
| 10 | ...took time to plan lessons with me. | 4 | 3 | 2 | 1 |
| 11 | ...served as an effective role model by demonstrating effective teaching methods and techniques. | 4 | 3 | 2 | 1 |
| 12 | ...gradually moved me into more teaching responsibilities. | 4 | 3 | 2 | 1 |
| 13 | ...provided time for conference for interview or exit summary. ...provided purposeful recommendations, discussion about her/his methods and encouraged interactive teaching in accordance with his/her role as my teacher during this experience. | 4 | 3 | 2 | 1 |
| 14 | ...encouraged involvement in (1) extracurricular responsibilities activities, (2) involvement/attendance at professional meetings, (3) assisted with discipline/classroom control. | 4 | 3 | 2 | 1 |
| 15 | ...accepted and included me as a professional team member in most aspects relating to curriculum and the progress of student learners. | 4 | 3 | 2 | 1 |
| 16 | Overall rating of my experience with the host teacher. | 4 | 3 | 2 | 1 |
| 17 | Overall efforts/interests of the host teacher. | 4 | 3 | 2 | 1 |
| 18 | Overall Learning experience. | 4 | 3 | 2 | 1 |

Comments: _____