

Constructivist Reflection on the Training for Secondary Science Teachers in Korea

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ABSTRACT

The enhancement of the quality of the teaching practice is a major factor in securing better schooling opportunities for students. In this article, initial teacher preparation of secondary school Earth science teachers, in-service science teacher education, and improving teacher policy are discussed. Data from in-depth interviews with exemplary science teachers were used to explore how to improve the quality of science teacher education in Korea. In terms of preservice teacher education, most exemplary teachers contended that teacher education programs should provide preservice teachers with practical knowledge by translating theory into practice. Their suggestions for how to improve in-service education are also discussed. Regarding directions of improving teacher policy in Korea, the teachers proposed an alternative teacher-promotion structure that incorporates the master-teacher position. Implications for introducing action research courses into teacher (re)education programs are also discussed.

Key words: preservice teacher education, teacher reeducation, professional development, teacher policy

I. Introduction

1. Initial Teacher Preparation of Secondary School Science Teachers

In Korea, teacher candidates enrolled in the college of education are granted an initial license after they have completed their course requirements and passed a graduation examination or thesis. Secondary school teachers are trained at colleges of education in general universities, which exist only for that purpose, in teaching certificate programs of general colleges and universities, and at graduate schools of education(MOEHRD, 2001). For example, the majority of Earth science teachers have been trained through four-year undergraduate courses at colleges of education of general universities.

The curricula of the colleges of education set the graduation credits in a range between 130 and 150, of which liberal arts credits are 20 percent, the major field 60 percent and electives 20 percent. The major field includes the study of curriculum, pedagogy of subjects, general pedagogy and teaching practice. It is important to note that across teacher education programs

and institutes, there have been variations in the curriculum of training, which in turn results in variations in the intellectual and professionalism achieved by preservice teachers. In contrast with the United States or England, Korea does not have any monitoring or review mechanism for teacher education programs (or teacher training institutes). In the United States, each teacher education program is reviewed by the state to determine whether or not the program meets minimum state standards.

All preservice teachers spend 4 weeks in a secondary school as part of their college training (i.e., student teaching experience). The school in which they do this student teaching is usually either affiliated with their college or university, or is one from which they graduated. The focus of initial teacher training in Korea is mainly on theory, with limited practical experience. During a four-week placement, the preservice teacher is only able to teach 4-10 lessons, at most, under a mentor's guidance, and spends the rest of the time in observation. Teachers trained in this way have a tendency to perpetuate the methodological status quo since they are trying to copy what they have observed (Kwak, 2001; Richardson, 1997).

Teachers for secondary schools are selected from among those who have first obtained a teaching license and then passed the employment examination. The selection and employment of teachers is done by an open test held by the metropolitan and provincial offices of education for public schools. For private schools, the institution itself selects new teachers according to their necessity. The employment tests for public schools are composed of a preliminary test on pedagogy (30%) and the major field (70%), and a second test, which is an essay test and interview. The rate of success is around 20 percent, which varies depending on the number of new teachers required for public schools for each year.

2. In-Service Training of Teachers

It is essential that secondary school science teachers continually seek to broaden their knowledge and enhance professional growth, and learn to encourage student leadership through in-service training. This training is quite useful for them because new information related to teaching materials is always necessary for the sake of increasing a teacher's competence. In-service education of teachers aims to help teachers to improve educational expertise and quality, and to cope with the rapidly changing information-oriented society (MOEHRD, 2001). Among in-service training programs for science teachers in Korea, the need for 'Training for Certificates' is occasioned by the need for promotion to a higher level. Training programs are available for Grade I and Grade II teachers, vice principals, principals, librarians and professional counselors. Each program lasts for 30 days (180 hours) or longer.

So far, I have briefly reviewed the initial teacher preparation of secondary school science teachers, and a mandated in-service training program in Korea. Against this background, this article sets out to investigate how to improve initial teacher preparation and in-service teacher training. It also explores how to improve Korean teacher policy.

II. Methods

This qualitative research is part of a larger research that investigated how to improve the quality of Korean school education. A qualitative research was conducted to investigate the common features of good teaching practices in science classrooms. The underlying assumption of this research was that the fulfillment of school education is possible with substantial instructions of each school curricular area. The substantial learning of any curricular area depends on each classroom lesson, which in turn depends on what the teacher does in his or her classroom. Improving the quality of teaching continues to be the central focus of educational reform. Therefore, improving the quality of teaching in classrooms should be the central focus of educational reform in Korea (KICE, 2002). It is certain that teacher education, development and support are imperative if curriculum development and change in the classroom are to occur.

The ultimate goal of this research was to investigate how to accomplish the goal of science education through good classroom practices. Data from classroom observations, in-depth interviews with teachers and a group of students, a collection of instructional materials and expert-group meetings were used to extract common characteristics of instructional practices implemented by 8 exemplary secondary-school science teachers. The main results of this research were presented as case studies of these eight good teachers. In the results section, these teachers' comments and recommendations about how to improve teacher education are discussed.

III. Results and Discussion

1. Constructivist reflection on pre-service teacher preparation programs

In this section, exemplary in-service science teachers' diagnoses and recommendations for improving the quality of science teacher education are discussed. In terms of preservice teacher education, exemplary teachers suggested that teacher education programs (1) ensure the teacher education program's identity and goals, (2) provide preservice teachers with practical knowledge by translating theory into practice, and (3) secure faculty members who majored in science education. The implications for preservice science teacher educators as well as for the instructional practices of preservice teacher education programs can be summarized in three points.

1) Ensuring the teacher education programs' identity and goals

Regarding the status of teacher training programs, effective teachers suggested teacher education programs ensure their identity with their characteristic curriculum. That is, the college of education should be differentiated from the college of natural sciences by providing preservice teachers with pedagogical content knowledge, which enables them to teach effectively and efficiently science content knowledge to secondary school students.

Effective teachers emphasized deep subject matter knowledge as well as instructional techniques as essential components of teachers' professionalism. These teachers suggested that

teacher education programs prepare preservice teachers so that they are well grounded in teaching. Jaewon Kim, a middle school science teacher, explains how to ensure teacher education programs identity as follows:

Departments of the science education in the college of education can be distinguished from those of the college of natural science since they provide preservice teachers with an opportunity to think about what it is to teach and what it is like to be a teacher. The identity of the college of education can be obtained by providing preservice teachers with an environment and atmosphere to discuss learning-to-teach with their peers and teacher educators.

He also emphasized that teacher education programs should provide preservice teachers with a learning community where they can discuss their learning experiences with their colleagues and use email or electronic conferencing to engage with a professional network even beyond their graduation. Byoungmoon Kim, a high school physics teacher, emphasized that teachers should care for the student and have a calling for teaching. Youngjoon Park, a high school chemistry teacher, recalls that he had learned only about chemistry at college and became a teacher without any proper preparation as a teacher. On the one hand, Sunghee Kim, a high school chemistry teacher, proposed adopting a Master of Education(M.Ed.) program to improve the quality of teacher preparation programs. In order to upgrade the quality of teachers, the level of teacher training should be made in graduate schools offering a master's degree and/or post-graduate courses in universities, with much more attention given to practical aspects.

In sum, these exemplary science teachers commonly suggested that teacher education programs should provide preservice teachers with (1) science content knowledge, (2) pedagogical content knowledge with an emphasis on effective teaching strategies, (3) a sense of commitment to teaching, and (4) a sense of belonging to a learning community of preservice teachers.

2) Emphasizing practical knowledge through translating theory into practice

Richardson(1996) contends that, except for the student-teaching element, preservice teacher education seems to be a weak intervention in that it is sandwiched between two powerful forces: one is the previous life history of being a student that sets images of teaching, and the other is the classroom experience as a [student] teacher that provides practical knowledge through the socialization process of the school. In addition, certain kinds of learning occur best in the context of real world practice. Preservice teachers learn about teaching and what to teach in the university they learn how to teach in schools (NCATE, 2001). Similarly, some aspects of student learning are best achieved by doing (NCATE, 2001).

In a similar vein, the exemplary teachers argued that the curriculum of teacher education programs should put more emphasis on practical knowledge so that preservice teachers could implement what they have learned through university coursework in real classrooms. Preservice students should have an opportunity to engage extensively in the active exploration of classroom contexts, that is, in written and videocases, discussions with practicing teachers, and field work. This process may promote the first stages in the acquisition of practical knowledge (Richardson, 1996). These exemplary teachers' suggestions as to how to improve the practicality of teacher

education programs can be summarized in four points:

First, teacher education programs should equip preservice teachers with ways to design instructional materials and programs on their own. That is, preservice teachers must have an opportunity to make their own instructional programs and implement instructional materials in a real classroom through their university training program. For example, A teacher, Jaewon Kim, explained how difficult it was for him to make ICT modules by himself without any previous experience.

We should have learned how to make these instructional materials and activities through our teacher training programs. We had just learned all those theories and fundamental pedagogical ideas, which turned out useless in the real classroom teaching context. I think, most of the teachers teach in the same way as they were taught throughout their own schooling. When I started teaching, I just copied the teachers who taught me in my high school and who showed me how to teach during my student teaching experiences.

Tr. Byoungmoon Kim confessed that he was computer-illiterate until he graduated from his teacher education program. He has taught himself about computer programming whenever an occasion demands. Tr. Kim emphasized that teacher education programs should provide methods courses where preservice teachers can learn how to utilize ICT instructional materials.

Second, teacher education programs should employ experienced in-service teachers (or master classroom teachers) as clinical educators. These experienced classroom teachers are expected to work with university faculties to improve teaching practice or the content of methods courses. For example, master teachers may team-teach courses for preservice teachers or may offer a variety of professional development activities for more experienced teachers (NRC, 2001). Preservice teachers should have chances to learn the teaching strategies and processes used by effective experienced teachers. A teacher, Youngjoon Park, insisted that preservice teachers themselves need to have an opportunity to experience effective teaching and learning methods as students. They need to directly experience models for what is possible in the classroom and to be immersed in alternative instructional methods instead of listening to theoretical lectures.

Third, these teachers reemphasized the need to extend field experiences for up to one year. Preservice teachers should spend longer periods in schools gaining first hand professional experience. Some of the teachers particularly valued field experiences, arguing learning to teach can only be accomplished through experience (Richardson, 1996). Teachers valued the field experiences over the theoretical coursework in that (1) the field experiences provided groundwork for translating theory into practice, where they could actually try things out and do their experimenting with ideas presented in the coursework and then make a link between practice and theory, such as constructivism and conceptual change theory and (2) some were able to watch positive role models (Kwak, 2001). Some teachers contended that field experiences are more beneficial than theoretical coursework because teaching is a practice type of profession, just like being a doctor. Therefore, there is nothing like being out there and practicing teaching in a true life-setting because it exposes the student teacher to the actual

processes of teaching and learning(Kwak, 2001). Some teachers valued field experiences in that during the field experiences preservice teachers could understand why they needed to know a specific learning theory. Preparing high-quality teachers requires an integration of theory and practice(Glenn, 2001). Preservice teachers need more school-based experiences whereby they can observe effective modeling of instruction and implement what they have learned in the university-based coursework.

Lastly, preservice teacher education programs should purposefully place preservice teachers in classrooms with experienced teachers who not only understand but also use new ways of teaching, such as conceptual change learning or cooperative learning approaches. These mentor teachers need to be prepared to deal with opposing beliefs rather than demand the blind conformity of preservice teachers(Kwak, 2001). What preservice teachers learn about teaching is shaped by the preferences of their mentors. The participants in Kwak's study were found to be frustrated upon confronting the inconsistency between what was advocated in the university methods courses and what was practiced in their field experiences by their mentor (or cooperating) teachers who favored traditional teaching and wanted the preservice teachers to become more like them. Faced with this inconsistency and pressure from their mentor teachers, most of the preservice teachers reverted back to their default approaches (i.e., traditional pedagogical beliefs about teaching and learning).

On the other hand, some preservice teachers were highly inspired upon meeting their constructivist-oriented cooperating teachers who had taken the conceptual change theory and implemented it in their classrooms in practical ways (Kwak, 2001). These mentors demonstrated the feasibility of the conceptual change model in their classrooms. To reduce the discrepancy between university methods courses and field experiences, a possible approach would be to reeducate in-service teachers through staff development programs that approach learning-to-teach in a constructivist manner (Borko & Mayfield, 1995; Guyton, 1989; Hollingsworth, 1988). Through staff development that is designed to inform experienced teachers about what students learn in university(i.e., the content and philosophy of university teacher education programs) and effective mentoring practices, cooperating teachers could be expected to provide both an opportunity and an expectation to apply important ideas presented in methods courses(Hollingsworth, 1989). With the support and encouragement of cooperating teachers, preservice teachers could make the transition between theory learned in the university program and classroom practice by taking risks and experimenting with new forms of pedagogy (Hollingsworth, 1989; Sudzina, et al., 1997). In trying to teach in different ways than how they were taught throughout their own schooling, preservice teachers could apply new theories and methods (e.g., the constructivist concept of learning) that supplant traditional curriculum(Hollingsworth, 1989; Borko & Mayfield, 1995).

To reduce the gap between theory and practice, previous studies on teacher education renewal have recommended the creation of professional development schools that would serve as sites for initial preparation, continuing professional education, and educational research(The Holmes Group, 1986; Reid, 1999; Glenn, 2001).

3) Securing faculty members who majored in science education

These teachers said that, to ensure its identity, the department of science education should

secure faculty members who majored in science education. Science educators are expected to provide pedagogical content knowledge to preservice teachers. That is, faculty members who majored in science education should model teaching and learning approaches advocated in their programs, rather than presenting or lecturing teaching principles and ideas as propositional statements. Kwak(2001) showed that exemplary methods courses instructors who behaved pedagogically in concert with constructivist epistemology or constructivist theories of learning had a great influence on preservice teachers' belief change towards constructivist ideas. These participants clearly indicated that consistency between the teacher education programs that espoused constructivist principles, and teacher educators' actual practices, could provide exemplary role models for learning-to-teach in a constructivist manner. Teacher education programs need to encourage preservice teachers to involve themselves as learners.

In addition, teacher education programs should provide preservice teachers with action research experiences. Preservice teachers should learn how to conduct classroom research aimed directly at improving their practice. Teacher education programs should train preservice teachers as teacher-researchers who can participate in research and use the evidence of research to improve practice. To make teaching a research-based profession, teacher education programs need to provide preservice teachers with research ability with which they can communicate their professional knowledge in the future. Action research experiences enable teachers to understand and enhance their professional practices. Teachers' participation in action research will also encourage the sharing of effective practice and professional knowledge across the wider educational community (Zeichner & Noffke, 2001).

In sum, these exemplary science teachers emphasized that teacher educators in teacher training institutes should translate theory into practice and equip preservice teachers with how to teach secondary school students science content knowledge.

2. Implications for in-service science teacher education

In-service teacher education programs in Korea are largely voluntary, except for the training program for the Grade I certificate. It is theoretically possible, therefore, that a teacher can go through his or her entire career without attending any professional development courses.

Above anything else, the exemplary teachers in this research contended that teachers should recognize the ongoing processes of their own professional development. Successful teacher (re)education programs that can foster and support quality teaching are the key to successful classroom reform.

In the following section, exemplary science teachers' suggestions for how to improve in-service teacher education programs are examined. With regard to in-service education, the teachers contended that (1) the content and method of in-service training should incorporate teachers' practical needs in the classroom, and (2) the teaching community should implement a clinical supervision to improve classroom practices.

1) Raising the practicality of in-service training program

A high level of academic ability is assumed among Korean science teachers because almost all have graduated from universities and have taken many credits in their area of specialization. Their academic knowledge should be continually replenished through interactions with other teachers, in-service training, and especially through voluntary participation in small research and study groups. It is important to note that teachers' quality practices lie at the heart of classroom change.

The exemplary teachers' suggestions as to how to improve the practicality of in-service teacher education programs can be summarized in four points:

First, in-service teacher education programs should incorporate what classroom teachers want to learn through their in-service training. A key component of professional development is figuring out what teachers need in the classroom. Teachers criticized that most of the current in-service training programs are simple repetitions of preservice teacher program curricula, or replications of a graduate school program in science education. In addition, teachers' in-service training should be an opportunity for the teachers to exchange their instructional methods and materials. Professional development should occur over an extended period of time rather than being limited to a weekend seminar or short-term training session, and it should cover topics closely tied to classroom practices (Wenglinsky, 2000).

Second, in-service teacher training programs should employ experienced teachers as teacher-educators so that the experienced classroom teachers can share their implicit knowledge with less-experienced teachers.

Third, in-service teacher training programs should encourage teachers to participate in small research and study groups. One of the major driving forces for the exemplary science teachers' good practices is the support from their colleagues who belong to the same professional community of science teachers. These teachers have formed special-interest groups to develop better teaching methods and materials. In other words, in terms of exemplary teachers' efforts for professional development, the exemplary teachers not only improved their own classroom practices, but also participated actively in various professional communities to share their practical knowledge with their colleagues. They also took an active role in in-service teacher education.

Lastly, teachers should be able to choose their own in-service training programs based on their personal needs and interests. Rather than being required to take the same program at a certain stage, teachers should be able to choose their own reeducation content among the courses offered by private institutes, universities, or related organizations. At the same time, it is essential that financial support be provided for teachers' continuing development (KICE, 2002).

2) Implementing a clinical supervision

Exemplary teachers insisted that the most effective way to improve teaching is to observe and experience other teachers' classrooms(KICE, 2002). Tr. Jungho Shim explained the current

situation of clinical supervision in secondary schools:

I have been opening my classroom to the public once or twice every year so that teachers in my school district can observe and evaluate my teaching. That could be an opportunity for me to improve my teaching methods and classroom management. However, I hardly get any professional comment or critical feedback from those supervisors and other teachers who have observed my teaching. They just say you did a good job and thats it. But thats not what I expected from them.

Exemplary teachers contended that the current classroom supervision system should change its focus from evaluation to helping mechanism. Teachers emphasized that a clinical supervision based on classroom observation is an effective means of monitoring and improving the quality of one's teaching.

Tr. Taeyoung Kim has been implementing a clinical supervision by opening his classroom to the public. He has loaded his teaching videotapes on his website and requested feedback and evaluation from other science teachers and science educators. Based on his experience, Tr. Kim suggested that the teacher education community create programs to mentor novice teachers through a clinical supervision. The teachers also strongly recommended peer reviews and supervision within a school building to improve classroom instruction. Teacher education communities should give attention to developing teachers' professional knowledge and skills beyond their initial training.

3. Improving teacher policy

In this section, exemplary science teachers' suggestions for improving teacher policy are examined. Exemplary teachers contend that we need to invent a rewarding system whereby we can recognize capable and dedicated classroom teachers. That is, to retain best-practice teachers, we should provide those teachers with preferential treatment so that they can focus on self-development.

1) Restructuring incentive systems to keep good teachers

Exemplary teachers in this study contended that there should be more explicit recognition of teachers' efforts in improving classroom teaching. At present, teachers' efforts for betterment of classroom teaching is barely noted in the appraisal process of the teacher.

Systematic arrangements should be set in place to systematize, support, recognize and reward teachers' development. We should provide incentives to retain good teachers who do more work in improving their classroom practices. Most of the exemplary science teachers complained of putting their efforts without getting any recognition. The only compensation they could get is students' positive reactions towards innovative and effective instructional activities. Therefore, there should be an evaluation system that recognizes good and accomplished classroom teachers. Policymakers can encourage these best practices by providing rich and sustained professional development that is supportive of these practices (Wenglinsky, 2000). The authorities should support teachers in the job they do best, raising standards, by ensuring that they receive better

rewards for good performance, better career prospects, opportunities to keep their skills and subject knowledge up-to-date, and the support and working environment to help them do their job (Williams, 1999).

Financial bonuses or advanced forms of certification could be provided to teachers for effective teaching. Most of the good teachers wanted to have more professional development opportunities including graduate school education, participation in educational research, and overseas training (KICE, 2002). In particular, Tr. Taeyoung Kim emphasized that university teacher education programs should offer short graduate school courses for the development of teachers' thinking and practice through reflection in critical communities. Policymakers could thus improve teacher quality by providing more opportunities for teachers to receive professional development whereby teachers can update their knowledge and skills.

2) Incorporating master-teacher position

Regarding directions of improving teacher policy in Korea, teachers proposed an alternative teacher-promotion structure that incorporates the master-teacher position (i. e., Grade II teacher - Grade I teacher - Master teacher). Other than the present promotion hierarchy which favors administrative posts (Teacher - Vice principal - Principal), we need to improve the structure of the teacher society in order to encourage the teachers to compete for professional development (Istance, 1999 Kwak, 1999). As part of master teacher entitlement, teachers should have sabbatical leave for educational research and other relevant activities. The government should be concerned to retain good teachers in schools, and also to reward excellent teachers.

IV. Conclusion

The enhancement of the quality of the teaching force is a major factor in securing better schooling opportunities for students. If we are to improve education, we need to attend to pre-service and in-service issues in improving teacher quality. There is no quick fix or simple way to improve teacher quality. As this short review suggests, efforts are required at various levels including teachers, district offices, teacher education programs, and teacher policy. Stakeholders such as teacher educators, teacher associations and policy makers should be more involved in improving teacher quality.

First of all, in-service teachers should recognize that graduation from any teacher training program is not the end of the professional development as teachers. Classroom teachers need to be life-long learners in order to improve their teaching and the quality of students learning. Furthermore, teachers should see themselves as networked professionals.

Regarding support systems for improving teacher quality, we need to provide incentives to keep good teachers who make every effort and do more work to improve their classroom practices. By introducing a master-teacher position, these best-practice teachers have the opportunity to advance in the profession without having to leave the classroom. With this career path, teachers are able to move along a continuum ranging from novice teacher to master teacher where increased responsibilities and professional development are commensurate with

compensation (Wenglinsky, 2000). The talented and experienced teachers should play an important role as leaders, decision-makers, and mentors at the school site (Weglinsky, 2000).

In addition, a national association of science teachers needs to develop professional standards of classroom practices by examining nationwide exemplary teachers' practices. There should be a national framework for the professional development of all teachers from initial entry to career end. These professional standards should provide teachers with a vision of highly accomplished practices and criteria for quality teaching. Furthermore, the ministry of education should develop a reward system that could recognize master teachers who have met the professional standards.

Lastly, a great deal of classroom research should be done by teachers, and their classroom practices should be driven by a search for more accurate means of assessment, better ways of managing students, and more effective learning (Edwards, 1996). Teachers need to become researchers to bridge the gap between research and practice. Therefore teacher (re)education courses should be restructured so that pre- and in-service teachers are made familiar with current research results and are able to conduct action research. Teachers need to be creators of their professional knowledge, not merely the recipients of educational research findings. Teachers' professional inquiry into their own practices should be actively promoted and encouraged (Reid, 1999).

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