

Advances in Research on Teaching
Volume 20

Innovations in Science Teacher Education in the Asia Pacific

Chen-Yung Lin
Ru-Jer Wang
Editors



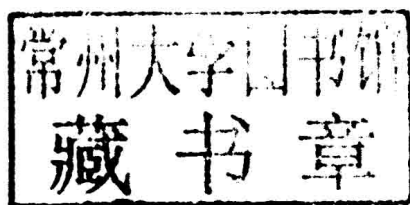
ADVANCES IN RESEARCH ON TEACHING VOLUME 20

INNOVATIONS IN SCIENCE TEACHER EDUCATION IN THE ASIA PACIFIC

EDITED BY

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THE ASIA PACIFIC

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PREFACE

This is the first book focusing on science teacher education in the Asia-Pacific Region, and represents the cooperative efforts of both teachers and researchers working in the field of science teacher education. The contributors to this volume are from China, Hong Kong, Japan, South Korea, Singapore, and Taiwan.

The overall theme of this book is innovation in science teacher education. Its main aim is to present recent theories and innovations in science teacher education in countries which have been strongly or partially influenced by Confucianism.

This project has given us the great opportunity to work together to exchange our ideas and insights about how science teacher education can be enhanced. We are grateful for the considerable efforts of all the contributors to this volume. We would also like to thank Mr. Mark Moreau and the staff at Emerald for their kind support and effective team work.

Chen-Yung Lin and Ru-Jer Wang
Editors

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CHAPTER 1

INTRODUCTION

Ru-Jer Wang

The purpose of this book is to present recent theories and innovations in science teacher education in countries which have been strongly or partially influenced by Confucianism. A growing body of research shows that student achievement is more influenced by teacher quality than by a student's race, class, prior academic record, or the school being attended. Due to the fact that students from these countries perform well in international student achievement tests, and that teachers are a key factor of student performance, it is worth paying more attention to science teacher education in these countries. Few would argue that advanced teacher training does not make a difference in student achievement. Therefore, the chapters in this book focus on preservice and in-service science teacher education.

OVERVIEW OF SCIENCE TEACHER EDUCATION IN THE REGION

In China, the main training model for junior high and elementary school teachers at teacher's colleges is called the "4 + X" model, whereby students undergo four years of comprehensive professional training followed by 2–3 years of additional study to earn a master's degree in education. At present, teacher education in China is comprised of four parts: general cultural courses, professional major courses, professional education courses, and

educational practice. Beijing Normal University can be taken as an example to explain the "4+2" teacher-training model. Currently, teacher training is carried out by the Faculty of Education, each department of which invites excellent third-year students in eight majors (mathematics, physics, chemistry, life sciences, environment resources, Chinese language, history, and philosophy) to apply to one of the school's two-year master's programs in education. Such students are admitted without examination and in their fourth academic year they continue to work on the credits necessary for completing their bachelor's degrees, and also begin to take a number of graduate courses. In the second semester of their senior year they intern at junior high or elementary schools, which ensures that they have sufficient experience in educational practice (Chung, 2009).

In the structure of the two-year post-baccalaureate course, the emphasis is on practice. The students must complete at least 41 credits, 35 of which are mandatory courses. The course structure is shown in Table 1, and is primarily comprised of public courses, basic theory courses, professional foundation courses, professional direction courses, and educational technique courses.

In Hong Kong junior high and elementary school, science teachers are generally trained in three stages: preservice training, entry-level training, and on-the-job training. Hong Kong's Postgraduate Diploma in Education (PGDE) is specifically for current teachers at junior high or elementary schools who want to upgrade their credentials, as well as for those who already have a bachelor's degree but have not received teacher training, and are interested in becoming qualified to teach at such schools. This program is divided into two groups: the elementary school group and the junior high school group, the essentials of which are as follows:

- (1) The curriculum of the elementary school group is divided into academic courses and instructional internship. Within a specified amount of time, students need to complete 22 credits in 9 subjects, and also complete specific subject and instructional internships (The Chinese University of Hong Kong, School of Education, 2010). The subjects studied are in three areas: (1) curriculum and teaching methods; (2) educational administration and policy; and (3) educational psychology and counseling. Each area has mandatory subjects, elective subjects, and guided internships (Table 2).
- (2) The curriculum of the junior high school group is also divided into academic courses and instructional internship, which have to be completed within three years, one year of full-time study and two years part-time.

Table 1. M.A. Course Structure at Beijing Normal University.

Type	Courses	
	Mandatory (credits)	Electives
Public courses	Marxist political theory (4) Foreign languages (4)	
Basic theory	Principles of education (3) Educational psychology (3) Introduction to education Research methodology (2) Curricula and instruction (3)	Case study Statistics and analysis Experimental research Theory and practice of composite courses Research design and assessment STS courses and practice
Professional foundation	Professional foundation courses (6)	Learning obstacles and diagnostics Classroom management Micro-courses (Note 1)
Professional direction (Note 2)	Professional direction course 1 (3) Professional direction course 2 (3)	Professional direction courses
Educational techniques	Introduction to educational technology (4) Instructional observation (0) Instructional internship (0)	Computer-assisted teaching Production of course items Online education

Note 1: Micro-courses are short-term courses which focus on educational practice and academic subjects, as well as educational reform related to such areas as gender education, multicultural education, and rural education.

Note 2: Professional direction courses are special subjects in such areas as mathematics and the natural sciences, such as Mathematics Curriculum and Instruction in Junior High School.

Source: Chung Bin-lin (2009, pp. 53–55).

Students in this group need to complete 22 credits in 10 subjects, as well as an internship; students majoring in English need to also complete immersion classes. The subjects studied are in three areas: (1) curriculum and teaching methods; (2) educational administration and policy; and (3) educational psychology and counseling. Each area has mandatory subjects, core electives, and electives (Table 3).

In regards to teacher training in Japan, the Central Educational Advisory Committee of the Ministry of Education, Culture, Sports, Science

Table 2. Curriculum for PGDE Elementary School Group.

I. Mandatory Subjects (Each Student Must Choose a Major and a Minor from These Three Areas)	10 Credits
Curriculum and teaching methods	6
Educational administration and policy	2
Educational psychology and counseling	2
II. Electives	10 credits
Five courses from amongst the three mandatory subjects (2 courses at most may be taken in any one subject)	
III. Guided Internship	2 credits
Full-time course: 1 credit per semester	
Part-time course: 1 credit per academic year	
Total: 22 credits	

Source: The Chinese University of Hong Kong, School of Education (2010).

Table 3. Curriculum for PGDE Junior High School Group.

I. Mandatory Subjects (Major Selected from One of These Subjects)	8 Credits
Curriculum and teaching methods	4
Educational administration and policy	2
Educational psychology and counseling	2
II. Core Electives	6 Credits
At least one course from each of the three mandatory subjects	
III. Electives	8 Credits
Four courses from among the core electives, electives, and minors	
Total: 22 credits	

Source: The Chinese University of Hong Kong, School of Education (2010).

and Technology has established the “teacher-training course committee” for evaluating teacher-training courses at universities. After universities submit an application, the main function of the committee is to conduct a review which includes:

- (1) ascertaining that the purpose and nature of the department conform to the teaching license;
- (2) education courses and study methods;
- (3) teacher organizations;
- (4) facilities and equipment (including books);

- (5) plans for implementing educational internships;
- (6) schools for internships; and,
- (7) academic regulations.

The results are divided into “pass” and “reservation” (including “suggested revocation”). Those designated as “reservation” are asked to supplement or amend their application materials. For those assessed “suggested revocation,” the Ministry needs to provide relevant reasons (Japanese Ministry of Education, Culture, Sports, Science and Technology, 2008a).

In addition, students in teacher-training programs must take a certain number of credits in “occupation-related courses” and “subject-related courses.” “Occupation-related courses” are common courses across all subjects, while “subject-related courses” are divided according to field. The mandatory subjects in “subject-related courses” for elementary school, junior high school, and high school are as follows.

Elementary school teachers who seek a Type 1 license must complete two credits in instructional methods for one of the following subjects: Japanese language, social studies, math, science, civics, music, art, family, or physical education. According to Article 4 of the Implementation Rules of the Teaching License Act, to obtain a Type 1 license for junior high school, a student has to complete at least one credit in each of the designated teaching-related subjects, for a total of at least 20 credits. Science teachers need to take at least 1 credit each in physics, physics experiments, chemistry, chemistry experiments, biology, biology experiments, geology, and geology experiments, for a total of 20 credits. Mathematics teachers need to take at least 1 credit each in algebra, geometry, analysis, computers, and probability and statistics, for a total of 20 credits. In addition, to obtain a specialized license for junior high school, science teachers need to take at least 1 credit in each of the 8 subject-related courses, for a total of 10 credits; and mathematics teachers need to take at least 1 credit in each of the 5 subject-related courses, for a total of 10 credits (Japanese Ministry of Internal Affairs and Communications, 2011a, 2011b).

According to Article 5 of the Implementation Rules of the Teaching License Act, for high school teachers to obtain a general license, they need to complete more than 1 credit in each of the teaching-related subjects, for a total of at least 20 credits. Science teachers need to complete at least 1 credit each in physics, physics experiments, chemistry, chemistry experiments, biology, biology experiments, geology, and geology experiments, for a total of 20 credits. Mathematics teachers need to take at least 1 credit each in algebra, geometry, analysis, computers, and probability and

statistics, for a total of 20 credits (Japanese Ministry of Internal Affairs and Communications, 2011a, 2011b).

In addition, after amendments were made to the Teaching License Act in 1998, elementary and junior high school teacher trainees must participate in a four-week educational internship (3–5 credits), or spend two weeks teaching at a secondary school (2–3 credits). The internship courses are divided into three stages: observation, participation, and instruction. Observation includes (1) general observation of the school's geographic location, hardware and software, community exchange, faculty, students, assemblies, classes, cleaning, and clubs and (2) class observation, which includes teacher instruction, student listening, attitudes, and learning environments. Participation refers to the guidance teachers provide to the interns. Instruction refers to the practical application of the subjects learned through the combination of existing knowledge, instructional materials, curricular ideas, and classroom techniques. However, at most schools interns do not have to immediately engage in the instruction stage, so elementary and junior high school internship classes mostly focus on observation and participation (Waseda University, 2011, pp. 14–18).

South Korea's teacher-training courses for science teachers include literacy courses, professional courses, and professional courses in education. The fields are divided into the four areas of physics, chemistry, biology, and earth science. In 2006, the Ministry of Education, Science and Technology implemented an educational reform program which stipulated that students who graduate from a teacher-training college or school of education with a GPA of less than 75 (C+) will not be awarded teaching certificates. At the same time, the reform measures adjusted the number of required credits in teacher-training courses and required city and provincial bureaus of education to establish teacher training commissions (South Korea Ministry of Education, 2006).

The curriculum of the College of Education at Seoul University is used as an example to explain the content of science teacher training courses in Korea (Table 4):

In Singapore, teacher-training is provided by the National Institute of Education in accordance with the regulations established by the Ministry of Education (Lin, 2011); Teacher training is divided into three parts:

- (1) core curriculum;
- (2) elective courses providing breadth and depth in specific academic fields and;
- (3) general electives.