

Where We Are and Where We Need To Be: Pre Service Science Teacher Preparation in China & Sri Lanka

Aregamalage Sujeewa Vijayanthi Polgampala, Hong SHEN*, Fang HUANG

School of Education, Huazhong University of Science and Technology, #1037 Luoyu Road, Wuhan 430074, P.R. CHINA

*Corresponding author: hongshen@hust.edu.cn

Abstract The rejuvenation of a nation depends upon education and the development of education depends upon teachers. Thus, quality teachers are the spine for representing overall teaching levels. This is more in science education, the training of these teachers to the standards is a great need. This article discusses a proportional look into the pre service science teacher preparation in Sri Lanka and China with comparison to the National Science Standards in U.S.A. The reforms, pre service science teacher training and science teacher professional education systems contribute to producing competent science teachers to the education system in both the countries at different levels. However, it cannot meet the standards for remarkable increasing requirements of highly qualified science teachers in the context of new science education reform. More effective measures should be taken to improve pre-service science teacher education and it must also be altered, which is not easy. In this paper an attempt is made to bridge the gap between the previous reports findings, highlights problems associated with the planning and organization of in-service training and proffered recommendations towards improving classroom instruction and organization of in-service training for prospective science teachers teachers.

Keywords: pre-service science teacher preparation, national science standers, Sri Lanka, China

Cite This Article: Aregamalage Sujeewa Vijayanthi Polgampala, Hong SHEN, and Fang HUANG, "Where We Are and Where We Need To Be: Pre Service Science Teacher Preparation in China & Sri Lanka." *American Journal of Educational Research*, vol. 4, no. 16 (2016): 1138-1144. doi: 10.12691/education-4-16-3.

1. Introduction

The National Science Education Standards (NSES) are a set of guidelines for the science education in primary and secondary schools in the United States, as established by the National Research Council in 1996. These provide a set of goals for teachers to set for their students and for administrators to provide professional development. The NSES manipulate various states' own science learning standards and statewide testing. A major report of the National Research Council [1] (Computing, et al. 1999) establishes that for science teachers to be effective, they must have a profound foundation of realistic knowledge, comprehend facts and ideas in the context of the conceptual framework, and organize knowledge in ways that facilitate retrieval and application (p. 16). Since the nineteenth century, teachers have been subjected to tests of the content that the teacher was to teach an effective science program requires an adequate support system, including resources of people, time, materials and finance, opportunities for staff development, and leadership that works toward the goals of the program. It is encoded formally in policy documents such as a teacher's handbook and informally in the unwritten norms that determine routines[2]. The support system must support classroom teachers in teaching science as described in the Standards.

Education is of superior position in Sri Lanka and China. The reform of teacher education is undergoing

continuously and it is on the way to train versatile teachers with practical skills as good teaching is the key to persuade students to continue studying science [2].The pre-service education and training of teachers is central to the achievement of educational goals for developing the twenty-first century education competencies of student engagement and drive more innovation for transformation of education. Learning becomes more authentic with blended approach as it is an umbrella for several important pedagogical strategies that have great potential to deeper learning approaches which connect curriculum to life outside the classroom to the real-world application to achieve these goals meeting the demand for new teachers is a major constraint on increased access, retention and completion.[3].Gender equity ultimately requires universal enrolment; it is also likely to benefit from an increased supply of female teachers who can act as supportive role models to girls

2. Teacher Educations in Sri Lanka

Following the Hindu and Buddhist traditions of Sri Lanka, teachers are greatly respected and seen as important bearers of culture and values. All teacher recruitment and placement are done by the State Ministry of Education. Full-time teacher education is offered in four types of institutions[4]: teachers' colleges offering three years of in-service training; National Colleges of Education offering three years of pre-service training; the

National Institute of Education providing non-graduate and graduate training including distance education; and university and open university training for post-graduate diploma courses. In-service teacher education courses are conducted through the National Institute of Education in coordination with regional departments of education. Master teachers are selected and trained to provide local in-service training.

Teacher development is another area of concentration by the educational authorities. The establishment of National Colleges of Education (NCoE) (1986) recognized the importance of pre-service training of teachers. 17 NCoEs were established with all the facilities to train the teachers required for schools. In addition 100 Teacher Centers (TCs) were established to provide in service training for teachers. The National Education Commission (NEC) was established by an Act of Parliament in 1991 as the body that would formulate national policy on education [5]. The Commission is appointed by His Excellency the President of Sri Lanka and policy recommendations are submitted to His Excellency. This would ensure continuity in policy and decision-making on a consensual basis irrespective of party affiliations. Comprehensive education reforms have been carried out periodically to bring the education system on par with international trends. The reforms carried out in 1947, 1960- 61, 1972, 1981, 1997 and 2006 are some of the landmarks in the pursuit of quality improvement in education.

The execution of academic functions of the National Colleges of Education, Teacher Training Colleges and Teacher Centers established for the purpose of acquiring knowledge, skills and attitudes necessary for the teachers with a view to properly maintaining the process of learning and teaching in the schools in keeping with the national education policy and matters incidental thereto, and also, working in close liaison with the higher education institutes in order that the knowledge in the changing sphere of education is attained. (The Gazette of the Democratic Socialist Republic of Sri Lanka No. 1925/37 – Thursday July 28, 2015) [6] In Sri Lanka, National College of Educations which aspires to become the Nation's Centre for Excellence in Pre service teacher education is the heir to one of the oldest teacher training traditions in Sri Lanka, as the successor to the in-service teacher training facility.

2.1. Pre-Service Science Teacher Training in Sri Lanka

The National Colleges of Education were established in 1985 for the training of pre-service teachers recruited from among Advanced Level graduates within the age range of 18-22 years, on the merits of a comprehensive interview, in some cases on the results of both a test and an interview. In colleges of education the teacher trainees are expected to achieve an understanding of the physical, social, emotional and intellectual development of the learner, the structure of the national system of education from historical and comparative perspectives, and the fundamentals of their religion and their cultural heritage, a thorough comprehension of current theories of learning and their implications for teaching, the goals of a national system of education and the specific objectives of the

discipline in which they are specializing and acquiring a knowledge of the subject matter that they are expected to teach in the classroom (Asian Sri Lankan Teacher Education 89 Development Bank, 1989). There are different colleges of education established for different specialized subject areas such as, primary education, math-Science education, English education, religious education, home economics education and Physical education. All the colleges of education provide a residential teacher education course for the first two years of their training within the colleges. All expenditure on board, lodging and tuition is met by the central government. In the third year, when they follow the internship period in deferent schools they are given a stipend by the government. While in the colleges of education the trainees follow four broad areas of teacher education curriculum: Foundation/professional education, general education, area of specialization and unscheduled activities. Under the professional area they study psychological foundations of education, philosophical and social foundations of education, educational evaluation and measurement, educational guidance, trends in education, school and community, and educational practice. In general education they study mother tongue, English, religion and culture, hygiene and Physical education, and aesthetic education (art, dancing and music). As the area of specialization they are expected to select one of the following: Mother tongue, math, science, primary education, home economics, English, Physical education and religion. At the end of three years a diploma in teaching certificate is awarded on the merits of the grading on the continuous Sri Lankan Teacher Education assessment scheme and grading on the internship performance, results of part 1 examination and part 2 final examinations [7]. The internship grading are awarded on the consideration of four components: (a) assessment of the principal where the trainee is posted to, on a five point scale, on general and routine behavior of the trainee within and outside the classroom and trainee's personality characteristics, (b) assessment of the senior teacher and the college of education professor under whose supervision the trainee works in the school, (c) assessment of the board consisting of principal, senior teacher and another teacher in the school on a five point scale on trainees interaction with others in the school, trainee's professional attitudes, community focused attitudes, and trainees overall performance as a teacher in the school, and (d) grading awarded by the college of education supervisor to the three projects and the essay that the trainee is expected to complete within the internship period (Colleges of Education, 1987) [8].

2.1.1. Teacher Education in China

Teacher education in China has a history of 100 years. Teacher education is an important part of any education system. In the last 50 years' of development since the founding of Prof China, the government at different levels have given priorities and great cares to teacher education. China has established on the whole a teacher education system that meets the needs of basic education of different types and at different levels.

The 5th National Meeting of Teacher Education held in 1996 in China pointed out, "Teacher education should be regarded as the strategic priority for the development of

education[9]. Governments are responsible for a better teacher education system. Governments at all levels should take teacher education as a great undertaking for centuries to come that is beneficial for society and future generations." The strategic status of teacher education and the necessity and importance for its development were further strengthened. Teacher education is the manufacturing machine for the Chinese education undertaking. Teacher education in China has supported the largest basic education system in the world Its reform and development shall strongly boost the changes in the Chinese basic education and shall contribute greatly to the improvement of the quality of the nation. Teacher education in China is composed by two parts that is pre-service education and in-service training. Four-year teacher training institutions including normal universities and colleges three-year teacher training colleges and secondary teacher training schools primarily conduct pre-service education. They train respectively teachers for senior and junior secondary schools and primary schools kindergartens and special education institutions. In-service training is conducted respectively by education institutes and in service teacher training schools for teachers of secondary and primary school (kindergartens).The first normal (teacher training) university in China was founded in 1902. Because of the lag of the development of teacher education in China, preparation of science teachers cannot meet the needs of school development, many primary school and junior high school science teachers do not have their required pre-service education when they were employed. In the last 30 years, the majority of science teachers were trained in normal universities. At present, China operates about 100 normal universities, mainly to train 4-year Bachelor of Science undergraduates and 3-year graduate students with master degree, and a few schools have 3-year doctoral student programs. There are about 100 teachers training colleges, mainly cultivating 2-year students for primary school science teachers. Pre-service teachers come not only from normal universities and colleges, but also from other kinds of universities and colleges.

2.1.2. Qualifications to be a Science Teacher

In order to improve quality of teachers and accelerate teacher training on 12th December 1995 the state council promulgated the Regulations on Qualification of teachers. At present in China, to get a job as science teachers, one must have his/her teacher qualification certificate. Primary school science teachers need to have at least 2 years of higher education, and aspiring teachers in junior and senior secondary school should have 4 years of higher education [10].

2.1.3. Pre service Science Teacher Training in China

To qualify as a teacher in a junior middle school (grades 7–9), one must be a graduate of a specialized higher normal school or other college or university with at least 2 years of schooling. Nowadays, the admission into a pre-service science teachers' training institution is determined by both the candidate's university application and his/her scores on entrance exams (paper-and-pencil tests, i.e.Gao Kao in Chinese). Approaching graduation from K-12 school education, candidates need to take entrance exams for further education and apply to

institutions in which they are interested. And the institutions admit students based on their scores and grade history. Teaching practices need to be consistent with the goals and curriculum frame works. The program standards do not prescribe specific teaching behaviors, or should district or school policies [11]. There are many ways to teach science effectively while adhering to the basic tenets of the National Science Education Standards, but they must be consistent with the goals and framework of the district. All dimensions of a science program adhere to the principle of science for all. Regular time needs to be provided and teachers encouraged discussing, reflecting, and conducting research around science education reform. The transformation of schools into centers of inquiry requires explicit action to remove destructive practical and policy constraints to reform. Schedules must be realigned, time provided, and human resources deployed such that teachers can come together regularly to discuss individual student learning needs and to reflect and conduct research on practice. In a community of learners, teachers work together to design the curriculum and assessment. They also design and take part in other professional growth activities. Time must be available for teachers to observe other classrooms, team teaches, use external resources, attend conferences, and hold meetings during the school day. Teachers must be supported in creating and being members of networks of reform. For teachers to study their own teaching and their students' learning effectively and work constructively with their colleagues, they need tangible and moral support. Collaboration must be developed with outside institutions such as colleges and universities, professional societies, science - rich centers, museums, and business and industry to ensure that the expertise needed for growth and change is available from within and outside the school [12]. Teachers need the opportunity to become part of the larger world of professional teachers of science through participating in networks, attending conferences, and other means. Teachers of science also need material support. As communities of learners, schools should make available to teachers professional journals, books, and technologies that will help them advance their knowledge. These same materials support teachers as they use research and reflection to improve their teaching. Staff development through Seminars, In-service training or Workshops offer one of the most promising ways for improving class room instruction It is an attempt to assist the classroom teachers/lecturers to improve on their teaching strategies, techniques, handle new instructional materials or possessed the necessary information and skills that are required for effective lesson delivery [13]. In essence the dream of self reliance, skill acquisition and entrepreneurship trough education can only be realized through a well defined programme. In most cases, staff development activities are organized by an Institution, a Corporate body, an Associations or Government agency and is normally lasted for a short period of time. An activity similar to that but which may take a long time period is what is referred to as In-service training education. In this case workers who are already in the service go on training or course programme in order to update or acquire the intellectual and professional skills that are necessary to discharge their duties more efficiently. It must be mentioned here that the completion

of In-service education, in most cases, leads to certification which qualifies one to a new status. For example, an NCE holder who attends a Degree training course while in the service would later qualify as a Degree holder, following the completion of the In-service programme. UNESCO-IBE. Newberry, says that in-service training of teachers in primary and secondary schools can be divided into degree and non-degree education. Degree education includes not only the make-up education for in-service teachers without qualified certificates but also the upgrading education for in service teachers with qualified certificates [14].

3. What Skills are Developed by Pre Service Training Curricula?

Although the structure of training programs in different institutions appears slightly different, they share two common characteristics. First, the training programs for pre-service science teachers are constructed in alignment with the pedagogical content knowledge (PCK) perspective, especially the content knowledge (CK). The emphasis on CK could help pre-service teachers who are going to work in rural areas and might with insufficient in-service teacher training to get enough content knowledge before they graduate.

Pre service teacher education has a range of goals. Emphasis differs from programme to programme. Analyses of teacher education curricula identify common components that appear in most programmes.

- Subject content: knowledge and understanding of school subjects in the secondary curriculum such as science, mathematics, social sciences, health sciences, information communication technology etc.

- Pedagogic content knowledge (often known as methods courses): teaching methods and ways of assessing learning related to specific subject areas and matched to the capabilities of learners

- Professional Studies/Education Studies: understanding of how children learn and how cognitive, affective, psychomotor, and social development take place, knowledge and skill in classroom management and pastoral care, craft knowledge of effective techniques to promote learning, acquisition of professional identities as a teacher, awareness of relevant educational history, psychology, sociology, philosophy, legislation, responsibilities etc.

- Teaching Practice/Practicum: in school and in college opportunities to practice teaching under supervision with support from experienced mentor teachers. According to Ozigi (1977), In-service training is usually organized to:

- (a) Elicit participants' reaction to their professional training.

- (b) Introduce an innovation or to update knowledge.

- (c) Improve skills in the use of the instructional materials.

Effective teaching is at the heart of science education, which is why the science teaching standards are presented and support them rest of the educational system if they are to achieve the objectives embodied in the Standards. Reforming science education requires substantive changes in how science is taught, which requires equally substantive change in professional development practices at all levels. Prospective and practicing teachers need

opportunities to become both sources of their own growth and supporters of the growth of others [15]. They should be provided with opportunities to develop theoretical and practical understanding and ability, not just technical proficiencies. Professional development activities need to be clearly and appropriately connected to teachers' work in the context of the school. In this way, teachers gain the knowledge, understanding, and ability to implement the Standards.

3.1. Sources

The sources were collected through documents related to Pre-Service Teacher Training Manuals, Teacher's Handbook, and Teacher Guides, Curriculum Reforms in Sri Lanka and China and National Science Standards from USA [16].

The training programmes were compared of the two countries. Tingjie YU (2013) interviewed many principals in Chinese secondary schools and asked them to give some suggestions to current teacher education. According to him teacher education is a typical professional education which is quite different from other higher education. They emphasized that teacher education should care more about the needs of current school teaching [17].

The Chinese tend to favor the American education system. NYT columnist Nicholas Kristof wrote about this "paradox: Chinese themselves are far less impressed by their school system. Almost every time I try to interview a Chinese about the system here, I hear grouching rather than praise. Many Chinese complain scathingly that their system kills independent thought and creativity, and they envy the American system for nurturing self-reliance — and for trying to make learning exciting and not just a chore." [The New York Times "China's Winning Schools?" Jan. 15, 2011].

3.1.1. Science education in China

Science education in china is still driven text books written by committee of scientists and teachers The following are the major goals:

- Mastery of basic information ability to make inferences

- Develop logical methods to make analysis and formulate models

- Ability to apply knowledge to solve practical problems

- Develop skills in experimental techniques

3.1.2. Science Education in Sri Lanka

The goal of science is to understand the natural world, and the goal of technology is to make

Scientific innovations in the world to meet human needs so the vision of science education is:

- How children are taught

- Teachers perception of science

- Understanding —constructed through individual and social processes

- Relationship with students

The first priority of science education is basic science literacy for all students, including those in groups that have traditionally been served poorly by science education, so that as adults they can participate fully in a world that is increasingly being shaped by science and technology.

3.1.3. Science Teaching Standards

To the Standards for Science Education Programs, Chapter 7 science teaching standards describe what teachers of science at all grade levels should know and be able to do. They are divided into six areas:

- 1 The planning of inquiry-based science programs.
- 2 The actions taken to guide and facilitate student learning.
- 3 The assessments made of teaching and student learning.
- 4 The development of environments that enable students to learn science.
- 5 The creation of communities of science learners.
- 6 The planning and development of the school science program. National Research Council (Ed.). (Council 1996)

3.1.4. Professional Development Standards

The professional development standards present a vision for the development of professional knowledge and skill among teachers. They focus on four areas: The learning of science content through inquiry, the integration of knowledge about science with knowledge about learning, pedagogy, and students, the development of the understanding and ability for lifelong learning. The coherence and integration of professional development programs were not up to the expected standards in Sri Lankan science pre service programmes. This was evident from the content analysis of the programmes and the interviews supported this fact strongly. In china it is more or less it is the same. The prominent disadvantage in Chinese pre service programmes in education, and it is the same with science teacher training rote-memorization tradition, toward greater stress on active participation of critical-thinking skills were among the top list. As envisioned by the standards; teachers partake in development experiences appropriate to their status as professionals. Beginning with pre-service experiences and continuing as an integral part of teachers' professional practice, teachers have opportunities to work with master educators and reflect on teaching practice. (World data on education, 6th edition, 2006/7).

4. What Skills are Developed by Pre Service Training Curricula?

Pre service teacher education has a range of goals. Emphasis differs from programme to programme. Analyses of teacher education curricula (Stuart 1999, Lewin and Stuart 2003) identify common components that appear in most programmes. These are:

- Subject content: knowledge and understanding of school subjects in the primary curriculum
- Pedagogic content knowledge (often known as methods courses): teaching methods and ways of assessing learning related to specific subject areas and matched to the capabilities of learners [18].
- Professional Studies/Education Studies: understanding of how children learn and how cognitive, affective, psychomotor, and social development take place, knowledge and skill in classroom management and pastoral care, craft knowledge of effective techniques to promote learning, acquisition of professional identities as a teacher,

awareness of relevant educational history, psychology, sociology, philosophy, legislation, responsibilities etc.

- Teaching Practice/Practicum: in school and in college opportunities to practice teaching under supervision with support from experienced mentor teachers

In addition some pre service programmes comprise more general programmes for trainees to support personal growth, develop social confidence and leadership skills, and prepare young adults for taking on the responsibilities of being a teacher.

Teachers' preparation programmes should give emphasis to the coherent relationship between theory and practice. Educationist argued that teachers hardly had enough knowledge about content organization (topic selection) and about professional approaches to classroom management to facilitate student learning[19]. The program standards are criteria for the quality of and conditions for school science programs. They focus on issues at the school and district levels that relate to opportunities for students to learn and opportunities for teachers to teach science.

4.1. Implications

The following implications for action have been drawn on the basis of the findings mentioned above

- The schools and the teacher education institutions are working in isolation. Even, there is no relationship between the teacher training curriculum and the school curriculum. Both the curriculum should have close linkages and coordination. The frequency for revising the teacher training curriculum should be at least five years.
- Teaching practices need to be consistent with the goals and curriculum frameworks.
- Informal expectations of teachers must be aligned with the goals, student expectations, and curriculum frameworks.
- Teachers must be supported in creating and being members of networks of reform.
- Policy initiatives to support science education is essential
- The science programme in schools is reviewed taking into account parameters such as curriculum, teaching and learning methods, learning assessments, teaching material and deployment and training of science teachers.
- The quality of science teachers is found to be variable.
- Poor quality is attributed partly to the quality of pre-and in-service training
- Problems Associated with In-Service Education and Workshops

In addition, teacher candidates must be taught to identify, and expertly extract relevant evidence that supports students' comprehension of a scientific concept as it is being formulated. Candidates must gather information regarding what their students learned and then ask questions about the choice of methods and strategies utilized [20]

4.2. Discussion

In China, one key challenge to implementing the new science education standards is pre-service science teacher education and their professional development. In the year of 2001, the Ministry of Education released national science education standards to enhance classroom

teaching, such as Science Curriculum Standard for elementary school, Biology Curriculum Standard and Physics Curriculum Standard for grades 7–9 (Ministry of Education [MOE], 2001a, 2001b, 2001c). Three years later, national physics, biology and chemistry curriculum standards were released as well (MOE, 2003a, 2003b, 2000c). After the new curriculum came into school practice, the biggest obstacle to implementing that curriculum was that teachers faced difficulties with new content knowledge, new laboratory activities and guiding students' inquiry projects while the teachers did not have any authentic scientific research experience. The same problem also appears in the novice teachers who just graduate from the college and enter the teaching profession. This reflects teachers' pre-service education must be consistent with the basic science education curriculum changes. However, teachers in China's rural communities lack considerable content knowledge and training in math and science. The report says China's educational system could learn some important lessons from educators in the United States. Ho views on [21] Chinese teachers, "need help in transforming their instructional strategies from the didactic, rote-memorization tradition, toward greater stress on active participation of critical-thinking skills. The United States has significant strength in these areas that could be shared." states the report released June 8 by the Asia Society, a New York City. Professional development of pre service science teachers needs to focus on two dimensions shown to be important. First, science teachers need to have acquired a level learning of science content to facilitate inquiry into subject area learning in depth. Second, science teachers need to engage in professional development to enable their use of inquiry learning methods with their science classes[22]. The issue of professional development seems to be related directly to student achievement. "The CCSSO meta-analysis of studies of teacher professional development programs in mathematics and science found that 16 studies reported significant effects of teacher development on improving student achievement"[23] (CCSSO, 2009, p. 27). The Standards for Science Teacher Preparation recognize that a broad and deep understanding of content must be accompanied by explorations of how the content can be put into practice as the educator adopts their role. With years of practice, it has been proved that the current science teacher education policy and programs are valid for preparing qualified science teachers, that is, bachelor programs can help produce more science teachers for so many schools at different levels in China mainland, and master programs can enable pre-service science teachers to be more qualified or experienced in order for implementing quality education. More teacher candidates with the abilities to do science education research are necessary to implement the new science education reform and take the challenges and opportunities all over the China mainland.

Pre service science teacher education courses can contribute to the development of an understanding of effective science Teaching and Learning methods among pre service science teachers[24]. Moreover, Pre-service science teachers in this article had experienced the application approach, which consists of the identification of biological issues and then dealing with them. Further

research is also needed to verify the results of this discussion paper. The most critical issues facing Sri Lankan teacher education are the quality of education provided to teachers and efforts to increase pre-service education, and the need to allocate more financial resources, expand curricula, and adopt new teaching strategies[25].

4.3. Recommendations

The finding, interpretations and conclusions expressed herein discussed the opportunities to implement new science curriculum effectively. Therefore, it would facilitate professional development and improve science education in turn. In organizing or planning of in-service education many factors would have to be considered. However, the following questions can serve as a guide: what kinds of training processes would assist the teachers to grow in the required skills? What should be the scheduled of training? How large should workshop groups be? Which learning activities and instructional methods shall be most appropriate in achieving the proposed objectives? What, if anything, should the participants do within or after the workshop? The National Science Education Standards envision change throughout the system. The program standards encompass the following changes in emphases. Professional development has long been identified as necessary for the successful implementation of reform. "Professional development efforts should connect to classroom practice, help teachers learn their content in new ways, challenge pedagogical beliefs and practices, promote incremental change, provide for collaboration, and exist in a climate of sustained support" [26]. China uses a dramatically different approach to building students' mathematical and science skills from the United States', with strong national standards, a structured progression from easy to difficult subject matter, and extensive teacher training serving as core tenets of the communist country's educational system, a new study finds. Various types of teacher training programmes in the People's Republic of China are described. Although there are many new teacher training programmes, there is still a shortage of quality teachers. The development of education in China is an indispensable aspect of its modernization [27].

The focus on professional development to assure that the beginning science educator helps to professionalize science teacher education. Professional development remains a necessary prerequisite in both the countries Sri Lanka and China. The pre-service science teacher training programmes should be designed, in relation with the school curriculum goals refereeing to the National Science Standers of pre service teacher training programmes[28]. It was evident from the analyses of documents in Sri Lanka the NCOEs were fashioned and molded with a vision to achieve certain objectives. Therefore an attempt was made to examine whether these objectives are been achieved and whether the power structure has been sensibly constructed. It was felt that the objective of forming a developed professional is not yet been fully achieved due to lack of technology, lack of proper professional development programmes and mainly due to lack of sufficient finance to implement such programmes are major problems.

Acknowledgement

The author acknowledges with sincere gratitude to the National committee on science education standards and assessment, the assistance of Sri Lankan counterparts in the preparation of this paper and colleague who extended their support in peer reviewing and my Ph.D supervisors for constant guidance and encouragement.

References

- [1] Computing, N.R.C.C.o.I., Communications, and L.f. History, Funding a revolution: government support for computing research. 1999: National Academies Press.
- [2] Grubb, D. and L. Tredway, Leading from the inside out: Expanded roles for teachers in equitable schools. 2015: Routledge.
- [3] Darling-Hammond, L. and G. Sykes, Wanted, a national teacher supply policy for education: The right way to meet the "highly qualified teacher" challenge. education policy analysis archives, 2003. 11: p. 33.
- [4] Dharmadasa, K.H., Sri Lankan Teachers' Development. 1996.
- [5] Little, A.W. and A. Green, Successful globalisation, education and sustainable development. International Journal of Educational Development, 2009. 29(2): p. 166-174.
- [6] Lanka, S., The Gazette of the Democratic Socialist Republic of Sri Lanka. 1978: By Authority.
- [7] Tatto, M.T. and K.H. Dharmadasa, Social and political contexts of policy formation in teacher education in Sri Lanka. The political dimension in teacher education: Comparative perspectives on policy formation, socialization and society, 1995: p. 99-120.
- [8] Wijetunge, P. and U. Alahakoon, Empowering 8: the information literacy model developed in Sri Lanka to underpin changing education paradigms of Sri Lanka. Sri Lankan Journal of Librarianship and Information Management, 2009. 1(1).
- [9] Shi, X. and P.A. Englert, Reform of teacher education in China. Journal of Education for Teaching, 2008. 34(4): p. 347-359.
- [10] Liu, E., C. Liu, and J. Wang, Pre-service science teacher preparation in China: Challenges and promises. Journal of Science Teacher Education, 2015. 26(1): p. 29-44.
- [11] Danielson, C., Enhancing professional practice: A framework for teaching. 2011: ASCD.
- [12] Bragg, S., Investing in Tomorrow's Teachers: The Integral Role of Two-Year Colleges in the Science and Mathematics Preparation of Prospective Teachers. A Report from a National Science Foundation Workshop. 1998.
- [13] Desimone, L.M., Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. Educational researcher, 2009. 38(3): p. 181-199.
- [14] Ozer, B., In-service training of teachers in Turkey at the beginning of the 2000s. Journal of in-service Education, 2004. 30(1): p. 89-100.
- [15] Ozigi, A. The development and organization of in-service education programme of the institute of education, ABU, Zaria (1971-77). in Nigerian educational forum. 1977.
- [16] William, S., Nationalism and Ethnoregional Identities in China. 2013: Routledge.
- [17] McBeath, G.A., et al., Environmental education in China. 2014: Edward Elgar Publishing.
- [18] Shulman, L., Knowledge and teaching: Foundations of the new reform. Harvard educational review, 1987. 57(1): p. 1-23.
- [19] Furlong, J. and T. Maynard, Mentoring student teachers: The growth of professional knowledge. 1995: Psychology Press.
- [20] Friend, M.P. and L. Cook, Interactions: Collaboration skills for school professionals. 1992: Longman New York.
- [21] Ho, C.-L. and W.-T. Au, Teaching satisfaction scale measuring job satisfaction of teachers. Educational and psychological Measurement, 2006. 66(1): p. 172-185.
- [22] Bybee, R.W. and S. Loucks-Horsley, National science education standards as a catalyst for change: The essential role of professional development. Professional development planning and design, 2001: p. 1-12.
- [23] Futrell, M.H., The challenge of the 21st century: Developing a highly qualified cadre of teachers to teach our nation's diverse student population. Journal of Negro Education, 1999: p. 318-334.
- [24] Van Driel, J.H., N. Verloop, and W. de Vos, Developing science teachers' pedagogical content knowledge. Journal of research in Science Teaching, 1998. 35(6): p. 673-695.
- [25] Carnoy, M., J. Hallak, and F. Caillods, Globalization and educational reform: what planners need to know. 1999: UNESCO, International Institute for Educational Planning.
- [26] Trilling, B. and C. Fadel, 21st century skills: Learning for life in our times. 2009: John Wiley & Sons.
- [27] Li, D., Modernization and teacher education in China. Teaching and Teacher Education, 1999. 15(2): p. 179-192.
- [28] Bhattacharyya, S., T. Volk, and A. Lumpe, The influence of an extensive inquiry-based field experience on pre-service elementary student teachers' science teaching beliefs. Journal of Science Teacher Education, 2009. 20(3): p. 199-218.