

PROFESSIONAL DEVELOPMENT OF SCIENCE TEACHERS: AN ANALYSIS

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Abstract

Teacher plays the most pivotal role in achieving quality in an educational system. The current science education reform movement emphasizes the importance of professional development as a means of student's science achievement. Every Science teacher needs to be aware of the rapid advancements in educational theories, methodologies and practices, increase in students' enrolment, range in interest and abilities of students and the ramification of role of education due to change and advancements in science and technology. Continuous learning is essential in order to improve the quality of teachers and educational system. Basing on data collected from thirty-one science teachers of secondary schools of Orissa, the study analyses status of the professional development of secondary school science teachers. It is found that 48.38 percent sample science teachers attended seminar, 32.25 percent workshops, 29.03 percent attended refresher course, 3.2 percent summer institute and continuing education centre. Six percent teachers attended conferences and no teacher symposia. Almost 58.06 percent of the sample teachers were used to consult college teachers, 41.94 percent other science teachers of the school, 25.80 percent teacher educators, 32.25 percent agricultural scientists and only 16.12 percent university teachers regarding various aspects of teaching science. It is also found that moderate number of sample teachers discussed with other science teachers regarding method of teaching, problem of experimentation and problem of evaluation etc. In-service teacher training should be made mandatory and compulsory for all science teachers. There should be a vigorous follow up programme with a view to helping the teacher to continuously apply the new knowledge in the class room. In order to keep the teachers aware about new developments, concepts and problems in their areas they should be provided opportunity to attend/participate in seminar, workshop, conference, refresher course, summer institute etc.

Introduction

"A teacher can never truly teach, unless he is learning himself. A lamp can never light another lamp unless it continues to burn its own flames. The teacher who has come to the end of his subjects, who has no living traffic with his knowledge, but merely repeats his lessons to his students, can only load their minds, he cannot quicken them. The greater part of our learning in the schools has been a waste because, for most of our teachers, their subjects are like dead specimens of once living things." -- Rabindranath Tagore

The comments of the great Nobel laureate are the reflection of teacher in the contemporary education system. The Vishwaguru (universal teacher) not only expressed his dissatisfaction but demonstrated an ideal education system through his dream child, the Viswabharati in Santiniketan that attracted the eminent personalities at international level.

Teacher plays the most vital role in any education system. "A teacher is not mere provider of knowledge and lessons in the classrooms but moreover he is a person involved and interested in the wholesome development of students; he is accordingly supposed to have some qualities and characteristics like proficiency in the subject, moral health, physical and mental fitness, professional training and devotion to the profession, for becoming an impressive and ideal person for his students." Kakkar (2001) With the passage of time, reformation in all aspects of human life, acquisition of knowledge, development in the fields of science and technology, global changes in the pattern of social and economic life and growing aspiration for higher knowledge, educational reform has been felt inevitable from the middle of the preceding century. To keep pace with the changed scenario much improvement in teacher competence is essential.

To step up teacher competence, in-service training of teachers was visualized by the University Education Commission as back as 1949 and as the first step 74 Extension Services Centers and 23 Extension Units were established in between 1955-58. Establishment of National Council for Educational Research and Training (NCERT) in 1961 with The National Institute of Education and four Regional Colleges of Education (RIE) was a massive step. The Education Commission (1964-66) in its recommendations laid stress on in-service education for teachers. National Council for Teacher Education (NCTE) was established in 1973, followed by setting up of State Councils of Educational Research and Training (SCERT) by the States. Implementing the observation "Teacher Education is a continuous process and

its pre-service and in-service components are inseparable” and the vision of the land mark National Policy on Education (NPE) 1986, District Institutes of Education and Training (DIET) in each district and 50 Institutes of Advanced Studies in Education (IASE) were established, 250 colleges of education were upgraded as Colleges of Teacher Education (CTE), and SCERTs were strengthened. The IASEs and CTEs have been imparting in-service training to secondary school teachers and DIETs to elementary school teachers.

The Curriculum Framework for Teacher Education (CFTE) 1996 (Para-1.28) says:

“Globally, teaching is now being recognised as a profession. But the education of teachers in our context has yet to develop the main attributes of a profession, such as, the systematic theory, authority, community sanction, ethical code and culture, generating knowledge through research and specialization.”

According to Glatthorn (1995) “Professional Development, in a broad sense, refers to the development of a person in his or her professional role. Teacher professional development is the professional growth, a teacher achieves, as a result of gaining increased experience and examining his or her teaching systematically.”

The NCF-2005 in paragraph 5.2.2 stipulates a teacher to be:

- ☞ encouraging, supportive and humane facilitator in teaching-learning situations to enable learners (students) to discover their talents, realize their physical and intellectual potentialities to the fullest, and to develop character and desirable social and human values to function as responsible citizens; and
- ☞ active member of a group of persons who makes a conscious effort for curricular renewal so that it is relevant to changing societal needs and the personal needs of learners.
- ☞ It further requires the teacher to be prepared to:
 - ☞ Care for children, and should love to be with them.
 - ☞ Understand children within social, cultural and political context.
 - ☞ Be receptive and be constantly learning.
 - ☞ View learning as a search for meaning out of personal experience, and knowledge generation as a continuously evolving process of reflective learning.
 - ☞ View knowledge not as an external reality embedded in text books, but as constructed in the shared context of teaching-learning and personal experience.
 - ☞ Own responsibility towards society, and work to build a better world.
 - ☞ Appreciate the potential of productive work and hands-on experience as a pedagogic medium both inside and out side the class room.
 - ☞ Analyze the curricular framework, policy implications and texts.

Teacher professional development needs to encompass the attributes prescribed by the NCF-2005, over and above, continuous learning, acquisition of pedagogical skill, mastery over the discipline (subject or subjects) and pride as a member of the teaching profession, experiences and knowledge from in-service trainings, and awareness of the rapid advancements in educational theories, methodologies and practices, increase in students' enrolment, range in interest and abilities of students and the ramification of role of education due to changes and advancements in science and technology and in the society.

Professional development of a science teacher, in addition, must cover acquisition of thorough practical knowledge and experience in research and laboratory experiment, improvisation of apparatus and up-dated knowledge of the scientific and technological inventions, discoveries, innovations and concepts. The educational qualifications of science teachers, their ways of presenting science to their students and their attitudes toward science have all been shown in various studies to have a significant impact on the achievement of their students. Thus, there is a great deal of interest in ensuring that the pre-service and in-service education of science teachers is as effective as possible. Of all these factors, the one which is perhaps most frequently overlooked is the quality of the science teacher

The Logic of Professional Development

Across the world science is increasingly being viewed as a subject of lifelong utility to all students. With the liberalized global competition, the growing Indian economy witnesses rapid changes, in scientific, technological and industrial fields and the general aspiration to improve the quality of life, overcoming poverty, as a result the education system is under tremendous pressure to facilitate the young school leavers to acquire higher level of knowledge and skills, for a better earning on the one hand and to excel in higher education and research in scientific and technological fields, on the other. Among many factors to consider achieving quality science education, professionally developed science teachers are the most important. The implicit logic of focusing on professional development, as a means of improving student achievement is that high quality professional development will produce superior teaching in classrooms, which in turn, can translate into higher levels of student achievement. This chain of logic is graphically represented in Figure-1.

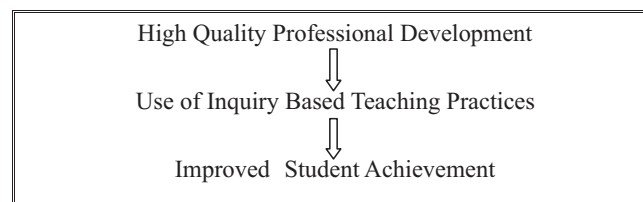


Figure -1 Chain of Logic

Liethwood (1992) recommends that programmes which promote professional development should focus on the following:

- ✍ Developing survival skills
- ✍ Becoming competent in the basic skills of teaching
- ✍ Expanding one's instructional flexibility
- ✍ Acquiring instructional expertise
- ✍ Contributing to the professional growth of colleagues, and
- ✍ Exercising leadership and participating in decision making.

The NCTE envisages the following components of National Initiatives for teacher professional development:

- ✍ School based programmes.
- ✍ Short term courses.
- ✍ Long term courses.
- ✍ Attachments.
- ✍ Visits.
- ✍ Exchange programmes.
- ✍ International initiatives.

These components contributing to teacher development are displayed in Figure-2

COMPONENTS CONTRIBUTING TO TEACHER DEVELOPMENT

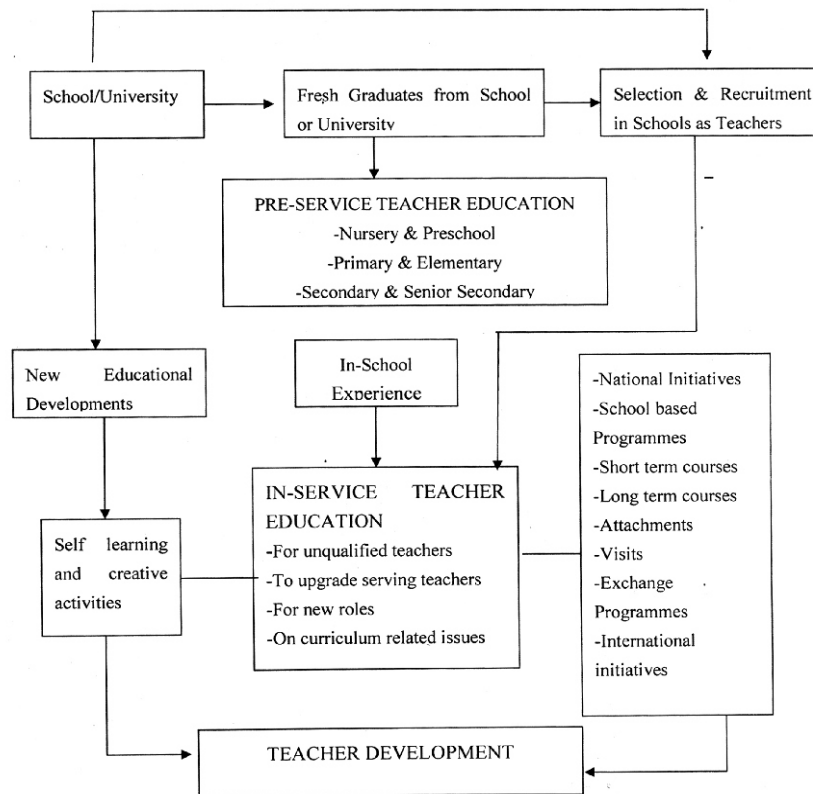


Figure-2 Components Contributing to Teacher Development
(Source-Curriculum Framework for Teacher Education 1996, Page-33)

Teacher professional development embraces the programmes like Content courses, Refresher courses, Summer institutes, Short term courses, Orientation courses, Sandwich courses, Workshops, Seminars and symposiums, Demonstrations, Correspondence courses, Evening courses, Conferences and lectures, Group discussions, Study groups, Study of professional writings and publications, Extension centers, Experimenting, Science clubs, Project work, Panels, Directed practice activities, Field trips, Distance education and Exchange of teachers.

Review of Literature

Few studies have been carried out in India and abroad on professional development of teachers.

Reimers (2003) conducted research study on 'Teacher Professional Development; An International Review of the Literature' and produced a plethora of information on the status of various aspects of the issue and concluded with worthwhile recommendations. The research located as many as twenty-two models of teacher professional development scattered on the globe. In view of limitation of this paper only one of the concluding remarks is reproduced:

“Teacher professional development has a significant impact on the success of educational reform and on students' learning. The more opportunities the teachers have to be, both subjects and objects, and objects of educational reforms, the more effective the reform and the teachers' work is”. Jamil, Atta, Ali, Baloch & Ayaz (2010) conducted the study on Effect of in-service training in meliorating teacher performance at secondary level in Dera Ismail Khan, a southern district of KPK (Pakistan). The findings of the study were (i) in-service

training had some positive effects on the performance of teachers; academic side of the effectiveness had not been much endorsed by the respondents (ii) training did not improve the secondary teachers' expertise in the subject matter, addition to the latest knowledge and becoming a better source of information for the educational satisfaction of students (iii) effect of in-service training on the organizational or administrative side of the teachers' performance had been found more positive (iv) in-service-training added to the confidence of the teachers, and helped them maintain better discipline in the class and (v) in-service training helped teachers improve their teaching methods and interaction with students. It also equips the teachers with more effective means of getting feedback by the students which is ultimately related to the removal of errors and improvement of students' achievements.

Sharma (1992) conducted a study on Impact of in service education on professional efficiency of teachers of PGT scale working in Kendriya Vidyalayas of Lucknow region. The major findings of the study were (i) 85 percent of the teachers could get their concepts (in their subject) clear through in-service education (ii) 75 percent teachers got useful reference material during the in-service education course (iii) 80 percent teachers felt more confident and competent due to in-service education course and (iv) 89 percent teachers could get the opportunity to discuss the syllabus they taught.

Kaur (1988) studied on 'Development of professional competency of social studies and mathematics teachers as related to process and structure variables of educational environment in government in-service training centers'. The findings of the study were (i) in-service education and training significantly contributed to the development of professional competency of social studies and mathematics teachers as related to process variables- that is, teaching effectiveness and educational awareness of teachers and structure variables-that is teacher attitude and rigidity-flexibility of teachers (ii) process and structure variables had a positive bearing on product variables, that is, achievement of teachers and school results of teachers.

Thamilmani (1990) conducted a study on 'Competency and teacher personality in relation to achievement of high school students in science.' It attempted to study whether the teaching competencies, interpersonal and human relation skills of the teacher influence the learning of science concepts by the high school students. Major findings of the study were (i) teacher competencies of science teachers were related to the academic achievement of high school students (ii) teacher personality was not related to student's academic achievement in science and (iii) both male and female science teachers were similar in their teaching competencies, personality, human and interpersonal skills.

Need and Significance

The scenario discussed, so far, created a situation to conduct an overview on the status of professional development of secondary school science teachers.

Objective

To analyze the status of professional development of science teachers in secondary schools.

Methodology

Method

Researcher used descriptive survey method for this study.

Sample

Eleven high level schools (securing more than 80 percent result), ten average level schools (having 40-60 percent result) and ten low level schools (with result below 30 percent) were selected. The sample consisted of both Government and Private Schools, was drawn from both Urban and Rural areas and included Boys, Girls & Co-educational schools.

Tools

Questionnaire as a tool for collecting both qualitative and quantitative information was developed to elicit information from science teachers working in secondary schools. Thirty one science teachers were contacted personally to obtain first hand information through questionnaire.

Delimitation

The study was conducted on science teachers serving in Odia medium secondary schools affiliated to Board of Secondary Education, Odisha.

Analysis**Qualification of Science Teachers**

The qualifications of the science teachers of sample schools were of various types. It ranged from untrained undergraduate (+2 Science) to trained science graduate with post graduate qualifications in Arts, Science, Education and computer etc the configuration of which is presented in table-1

Table-1
Qualification Configuration of Sample Teacher

Qualification of Teachers	Percentage of Teachers
Untrained undergraduate	1
Untrained graduate	17
Trained graduate	53
Trained graduate with P.G qualifications	29

Participation in in-service training Programmes on Science

The number of sample teachers participated in various in-service training programmes for their professional growth is furnished in table-2

Table-2
Participation of Teachers in Different In-service Training Programmes

Programme	High Level Schools	Average Level Schools	Low Level Schools	Urban Schools	Rural Schools	Total
	N=11	N=10	N=10	N=16	N=15	N=31
Symposia	Nil	Nil	Nil	Nil	Nil	Nil
Seminar	8 (72.72)	5 (50)	2 (20)	11 (68.75)	4 (26.66)	15 (48.38)
Workshop	4 (36.36)	6 (60)	Nil	6 (37.5)	4 (26.66)	10 (32.25)
Summer Institute	1 (9.09)	Nil	Nil	1 (6.25)	Nil	1 (3.22)
All India Science Teachers' Associations	1 (9.09)	Nil	1 (10)	1 (6.25)	1 (6.66)	2 (6.45)
Lecture Programme	2 (18.18)	1 (10)	1 (10)	2 (12.50)	2 (13.13)	4 (12.90)
Continuing education centre	1 (9.09)	Nil	Nil	1 (6.25)	Nil	1 (3.22)
Conferences	2 (18.18)	Nil	Nil	2 (12.50)	Nil	2 (6.45)
Refresher course	3 (27.27)	5 (50)	1 (10)	4 (25)	5 (33.33)	9 (29.03)

(Figures in parentheses indicate percentage of sample teachers)

The table-2 conveys that overall picture of participation of teachers in programmes for professional growth was unsatisfactory varying from 48.38 percent to 3.22 percent. The science teachers of 72.72 percent high level schools had attended seminars. 60 percent and 50 percent of average level schools had attended workshops and refresher courses respectively.

Consultation with Educationist / Specialist

The science teachers used to consult some other experts and personnel in their respective field for solution of difficulty or problem and enriching their knowledge and behaviour. The facts in this regard have been presented in the table-3.

Table - 3
Consultation by Teachers for solving difficulty and problem in teaching Science

Persons	High Level Schools	Average Level Schools	Low Level Schools	Urban Schools	Rural Schools	Total
	N=11	N=10	N=10	N=16	N=15	N=31
Science teachers of other school	8 (72.72)	3 (30)	2 (20)	9 (56.25)	4 (26.66)	13 (41.94)
College teachers	7 (63.63)	5 (50)	6 (60)	10 (62.5)	8 (53.33)	18 (58.06)
Head of the school	2 (18.18)	4 (40)	3 (30)	4 (25)	5 (33.33)	9 (29.03)
College Science method teachers	3 (27.27)	4 (40)	1 (10)	3 (18.75)	5 (33.33)	8 (25.80)
Agriculture Scientists	3 (27.27)	4 (40)	3 (30)	4 (25)	6(40)	10 (32.25)
School Inspector	3 (27.27)	3 (30)	2 (20)	5 (31.25)	3 (20)	8 (25.80)
Scientists	1 (9.09)	Nil	Nil	1 (6.25)	Nil	1 (3.22)
University Lecturers	4 (36.36)	1 (10)	Nil	4 (25)	1 (6.66)	5 (16.12)

(Figures in parentheses indicate percentage of sample teachers)

A close look at the table shows that 58.06 percent and 41.94 percent sample teachers, in general, had consulted college teachers and science teacher of other schools respectively, regarding teaching science.

Discussion with other Science Teachers

While discussing with the counterpart the science teachers had discussed different aspects of teaching learning process. The summary of their areas of discussion have been presented in the table-4

Table-4
Topics Discussed with Other Science Teachers of the school

Topics	High Level Schools	Average Level Schools	Low Level schools	Urban Schools	Rural Schools	Total
	N=11	N=10	N=10	N=16	N=15	N=31
Selection of methods of teaching	5 (45.45)	6 (60)	5 (50)	6 (37.5)	10 (66.66)	16 (51.61)
Improvisation of apparatus	6 (54.54)	2 (20)	Nil	6 (37.5)	2 (13.33)	8 (25.80)
Problem of Experimentation	8 (72.72)	6 (60)	5 (50)	10 (62.5)	9 (60)	19 (61.29)
Problem of evaluation	6 (54.54)	6 (60)	2 (20)	8 (50)	6 (40)	14 (45.16)
Problem of Co-scholastic activities	5 (45.45)	3 (30)	4 (40)	5 (31.25)	7 (46.66)	12 (38.70)
Solution of different problems	6 (55)	6 (60)	3 (30)	8 (50)	7 (46.66)	15 (48.38)
Selection of ancillary book	4 (36.36)	5 (50)	1 (10)	6 (37.5)	4 (26.66)	10 (32.25)
Selection of teaching aids	8 (72.72)	4 (40)	4 (40)	8 (50)	8 (53.33)	16 (51.61)

(Figures in parentheses indicate percentage of sample teachers)

The table-4 indicates that 61.29 percent and 51.61 percent teachers, in general, had discussed with other science teachers regarding problems of experimentation and selection of method of teaching and teaching aids respectively. Less than average number of teachers had consulted on other topics.

Discussion

The in-service training is the major component of science teacher professional development. The successive Education Commissions have laid stress on imparting in-service training to all the teachers. The NCF-2005 reaffirms "In-service education can play significant role in the professional growth of teacher and function as an agent for change in school-related practices." In the past findings, Sharma (1992) found that through in-service training teachers got useful materials and their concepts clear, felt more confident and competent and could get the opportunity to discuss the syllabus they taught. Kaur (1988) in her study observed that in-service training significantly contributed to the development of professional competency of social studies and mathematics teachers. In the international research Reimers (2003) observed significant impact on educational reform and on students' learning, and Jamil, et al (2010) in their study in Pakistan found positive effects on the organizational or administrative side of the teachers' performance, added confidence and helped the teachers maintain better discipline in the class, improved their teaching methods and interaction with students, equipped with more effective means of getting feedback and improvement of students' achievements.

The collected data discloses that still there are 18 percent untrained teachers and less than average number of the sample teachers participated in seminar, workshop and refresher course and very few attended other venues.

It is remarkable that 72.72 percent teachers of high level schools and 68.75 percent of urban schools attended seminar, as against participation of only 20 percent of low level schools and 26.66 percent of rural schools. The recommendations of the Education Commission (1964-66) that every teacher to receive two to three months of in-service training once in five years, which has been reaffirmed in NPE(1986) and NCF-2005. The data transpires that, in the first place, opportunity for in-service training has not been extended, so far, to majority secondary teachers, in general, and those of rural schools had been almost neglected in the matter of all in-service training programmes, that can be correlated to the unsatisfactory performance of the students of the rural and low level schools at the final examinations. Thus though positive effect of in-service training was found in the international field including the neighbouring country, Pakistan, and even in other parts of the country, the schools, teachers and the students of the region of the present study have been deprived of the legitimate advantage of improved science education apparently due to negation of in-service training to the teachers.

So far other components of professional development of science teachers, almost 58.06 percent of the sample teachers were used to consult college teachers, 41.94 percent other science teachers of the school, 25.80 percent teacher educator, 32.25 percent agricultural scientists and only 16.12 percent university teachers, regarding various aspects of science teaching. It is also found that moderate number of sample teachers discussed with other science teachers regarding method of teaching, problem of experimentation and evaluation etc. It was the best way adopted by the teachers because discussion could solve many problems and make them more confident and competent. Here again, in consulting problems, the science teachers of rural and low level schools mostly in rural area, lagged behind apparently for distance and lack of affordable access.

Though competence of science teachers was related to good quality education and academic achievement of the students, still there was existence of untrained teachers which was not conducive to quality science teaching. It was a prerequisite to organize in-service training and orientation programmes to improve teachers' core competence before introduction of the new curriculum. The NCF-2005 in paragraph 5.2.5 also prescribes that "Any curriculum renewal effort needs to be supported with a well thought-out and systematic programme of in-service education and school-based teacher support." But in reality the new syllabus was introduced in secondary schools without reorienting the teachers with the new text books. Kothari Commission truly comments "The need of professional training is most urgent in teaching due to rapid advances in the field of knowledge. He can learn of use of newly developed aids and their preparation also. He may develop ability for organizing various co-curricular activities in science. He may develop ability in teacher for new methods of evaluation."

The Acharya Ramamurti Review Committee (1990) recommended that in-service and refresher courses should be related to the specific needs of the teachers, and that evaluation and follow-up should be part of the scheme. On implementation of the in-service training programmes, the NCF-2005, paragraph 5.2.5 comments "In spite of the wide spread efforts and specific geographical areas which have shown improvements, by and large, the in-service inputs have not had any noticeable impact on teacher practice.... with little opportunity for trainees to actively participate. ... Teachers require first-hand experience of making programmes themselves in order to develop an interest in the new technology." It follows that the few in-service training programmes, practiced in a very sluggish manner since the last four decades, could not cover about half of the secondary teachers, have been conducted in a very haphazard manner neither in conformity with the norms nor to fulfill the objectives outlined. The Framework for Implementation of Rashtriya Madhyamik Siksha Abhiyan (RMSA) envisages modifying the existing curriculum of in-service training programmes those will also embrace Guidance and Counseling, strengthening the training institutes and imparting five days in-service training to Principals, Vice-Principals and all the teachers every year. It also entrusts the NCERT to plan and operationalize the Orientation programmes for secondary school teachers.

As reported by Reimers (2003) as many as twenty two models in large number of component programmes are being organized in very effective manner in the U.S.A, Japan, Western and African countries for professional development of teachers, even in Public Private Partnership(PPP) and N.G.O partnership modes. Such of those modern innovative programmes operated abroad considered suitable in our context could be advantageously tried as pilot programmes to assess impact factor, over and above the traditional in-service

training programmes. The RMSA also recognizes the PPP as an important tool for improving over all quality of education. Some teacher professional development programmes could also be operationalized in PPP mode as in vogue abroad.

Science laboratory is a prerequisite for quality science education at secondary level. But there was no laboratory or even a store in 80 percent sample schools. So also there were no Teacher's Hand Books which were essential for efficient accomplishment of curricular functions. These deficiencies have strong adverse impact, not only on the teachers' professional development, but also on the students' achievement. Of course, the ambitious RMSA scheme makes elaborate provision for science laboratory with required equipments, attendant and consumables for the secondary schools that can address the major deficiency.

Teacher professional development has remained an unsolved problem for nearly half a century. Large numbers of students are passing out from a good number of training schools and colleges every year and there is no dearth of candidates in the country for recruitment as teachers, at any level. But the number of professionally unqualified/under developed teachers is rising year to year by recruitment of untrained candidates as teachers. This trend adds to the complexity of the problem of teacher professional development.

Conclusion

In-service training for teacher professional development shows very good impact on all-round improvement of education system, including teaching-learning process and students' achievement, in both developed and developing countries: U.S.A., Western and African countries, Australia, Japan and Pakistan etc. In our context, all the secondary teachers could not be covered by in-service training within a long period of about forty years. Few programmes so far organized have no considerable positive impact on class room transaction and students' achievement. With exception of few pockets, the over all status in our country is unsatisfactory. Much has to be done for teacher professional development.

Recommendations

1. In-service teacher training should be made mandatory and compulsory for all science teachers.
2. Need- based, active participatory and innovative in-service training programmes should be designed and organized under a target oriented time bound micro action plan to cover all the teachers within a definite time frame.
3. Vigorous follow up programmes with a view to helping the teachers to continuously apply the new knowledge in the class room should be introduced.
4. To facilitate teachers' awareness of the new developments, concepts, theories and problems, etc, seminars, workshops, conferences, refresher courses, summer institutes etc. should be organized in their locality at regular intervals and they should be provided opportunity to attend/participate.
5. To ensure competence of teachers for better class room output and to obviate further deterioration of the problem of professional development of teachers, a policy decision should be taken to ban recruitment of candidate(s) without requisite teacher training qualification to any post of teacher.
6. In the greater interests of the school children, Teacher's Hand Books should be supplied to all teachers.

References

- NCTE (1996). *Curriculum Framework for Teacher Education-1996*. New Delhi: NCTE.
- Education Commission (1964-66). *Education and National Development*. New Delhi: Ministry of Education, Govt. of India.
- Glatthorn, A. (1995). *Teacher Development* In: *Teacher Professional Development; An International Review of the Literature*. International Institute for Educational Planning, Paris.
- Jamil, A., Atta, M. A., Ali, U., Baloch, J. R. & Ayaz, M. (2010). Effect of In-Service Training In Meliorating Teachers' Performance at Secondary Level. *International Journal of Academic Research, vol-II(2)*.
- Kakkar, S.B. (2001). *Educational Psychology*. Pentice-Hall of India (Pvt) Ltd, New Delhi.

- Kaur, A. (1988). Development of Professional Competency of Social Studies and Mathematics Teachers as related to Process and Structure Variables of Educational Environment in Govt. In-service training Centers. In: *Fifth Survey of Educational Research 1988-92 vol-II* (pp1450). New Delhi: NCERT.
- Leithwood, K.A. (1992). *The Principal's Role in Teachers' Development*. In: *Teacher Professional Development; An International Review of the Literature*. International Institute for Educational Planning, Paris.
- Mangal, S. (2001). *Teacher Education: Trends and Strategies*. New Delhi: Radha Publications.
- NCERT (2005). *National Curriculum Framework*, New Delhi: NCERT.
- Reimers, E.V. (2003). *Teacher Professional Development; An International Review of the Literature*. International Institute for Educational Planning, Paris.
- Sharma, S.C. (1992). A Critical Study of In-service Education on Professional Efficiency of teacher of PGT Scale Working in Kendriya Vidyalayas of Lucknow Region. In: *Fifth Survey of Educational Research 1988-92 vol-II* (pp1484). New Delhi: NCERT.
- Thamilmani, P. (1990). Teacher Competency and Teacher Personality in Relation to Achievement of High School Students in Science. In: *Fifth Survey of Educational Research 1988-92, Vol-II* (p.1926). New Delhi: NCERT.