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Development of A Model For the in-Service Training of Secondary School Science Teachers

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Abstract

The present study aimed for developing a model for in-service training for science teachers of secondary schools keeping in view deficiencies and drawbacks found in the existing model. The population consisted of 2191 secondary school science teachers of Southern Punjab and the sample consisted of 724 trainees who were imparted training under Science Education Project (SEP) in the years 2002 and 2003 from four districts Multan, Layyah, Khanewal and Lodhran that were selected by random sampling technique. The questionnaire was developed that comprised 38 items including one open-ended question regarding suggestions for improving the INSET programme. The items of the questionnaire were developed regarding various indicators like reason of participation, use of teaching method, use of A.V. Aids and information regarding the commencement of INSET. The major findings and conclusion of the study were: (i) trainees participated for their professional growth (ii) the lecture method was frequently used and (iii) trainees were informed before the commencement of the training course. They also suggested that INSET should be conducted by using modern methods of teaching at the local or tehsil level. Relevant subject teachers and highly qualified master

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trainers should be nominated for INSET. Descriptive and inferential statistics were applied to analyze the data. The proposed Model of INSET for secondary school science teachers was developed on the basis of findings, conclusions and recommendations.

Key Words: Science Education Project (SEP), Government Colleges for Elementary Teachers (GCETs); Directorate of Staff Development (DSD); Teachers Resource Centers (TRCs), in service Education for Teachers (INSET).

Introduction

Education is widely considered as the mental and moral training of persons through which their potential is developed, traits are transformed and culture is transferred to the upcoming generations as their heritage. Education not only inculcates morals into young minds but also stimulates them to fit into the fabric of social life in the most befitting manner.

Education is considered as a fundamental right, education for every youngster is at the topmost preference in the programme of the international level. In the same way, the Government of Pakistan has given the right to every child to get free education for up to 16 years. i.e. right to education (RTE). The campaign stresses government officials, teachers and parents to enforce education laws as described in the Article 25-A of the Constitution of Pakistan states "The State shall provide free and compulsory education to all children of the age of five to sixteen years in such manner as may be determined by law." Therefore parents and all other stakeholders must bring children to their nearby schools so that they may become good citizens of Pakistan.

Science education is thought to be a significant component of the school syllabi as a number of professional and useful courses directly or indirectly utilize the information and its practical applications. Science education is necessary due to its huge worth to the life of science teacher because it helps to make him self-dependent, well informed, motivated, helpful, capable of sharing, self-disciplined, analytic minded, critical thinker, competent, good evaluator and skilled person about teaching-learning process.

(Mullis et al. (2004) state uncertainties and anxieties determine science standards due to which American students lag behind their fellows in rankings of international level.
The objective of science teaching is to develop a scientific attitude. Scientific attitude makes students unbiased; facilitates them to make decisive observations, creates logical integrity, inquisitiveness and critical free thinking. A science teacher is a role model because he/ she performs different tasks like a therapist, a supervisor, a manager, a director, a guardian, a mentor, an assessor, a modernizer, a caregiver, a builder of a conducive environment, and a problem solver, etc. To carry out these roles, he/she needs some guidance for performing his/ her duties in sophisticated manners. Azer (2004) states that a science teacher is dedicated to his/her job, supports and likes diversity, encourages and motivates learners and colleagues. He also supports critical thinking, interacts, communicates and encourages creative work.

There is a need to impart in-service training to science teachers for their professional development to enhance their teaching abilities and competencies. In-service teacher training is helpful for the teachers to bring changes in the society and enables them to take an active part in the curricula development process, implementation of curricula and updating approaches to teaching. In-service teacher training is also helpful for school teachers to serve as managers, planners, administrators, teacher educators, officers, and supervisors of school education. In-service education is directly related to teacher's change and curriculum's change. Duman, T., & Karagoz, S. (2016) describe that imparting training to teachers is the most vital factor in the educational system because the success of an education system primarily depends on the supremacy of the teachers who formulate and play the most significant role in the teaching-learning process. Contrary to this, teacher training is a flexible and complex issue.

But Alwan (2000) has a different view. She says that In-service Education for Teachers (INSET) is the way of improving the teaching of traditions (p.11). Samoor (2006) defines INSET as the knowledge, activities and needs that help the teachers to get better their practice and become more proficient (p. 469). Cimer et al.

(2010) define INSET as something that is centered on learning activities due to which teachers change their ways of teaching. It may be said that INSET has consisted of those activities which are needed for professional growth and improvement in their profession. Simjee (2006) recommends that INSET is similar to various terms such as school/staff/teacher/continuous/professional development. She describes that:

> *"INSET refers to an entire array of measures for educators that are associated with the improvement of competency, broadening of knowledge and professional abilities. INSET activities are pursued to improve the quality of education and are aimed at enabling educators to be more effective in the classroom" (p. 21).*

In-service education is important for the development of teaching skills. All teachers are expected to enhance their educational and professional status. But most of the teachers think that they are professionally strong for all time to teach after receiving pre-service education but it is not true. Teachers should study recent educational literature and should change theory into practice. In this way, they can motivate their students. INSET activities must be managed to broaden the thoughtfulness of educational issues and problems. It is the ethical duty of teachers to develop lifelong education. In-service training should be arranged to improve the professional education of teachers so that they may carry out their duties and responsibilities diligently. In-service training encourages teachers to refine their abilities, competencies and responsibilities. Teachers are benefited from refresher courses and in-service training programmes either these are arranged at school or out of school. Ultimately benefit goes to students when their teachers have imparted training but Şimsek Y. (2017) describes that students cannot benefit from courses and training which are out of school hours.

As in our country, INSET is imparted to in-service teachers in different modes like seminars, symposiums, field trips, workshops, meetings, group discussions and exhibitions, etc. In the same way,

in-service training is imparted to teachers in the form of short or long courses in the same pattern in South Africa also. According to Mothatha et al. (2000), these formal programmes like 'Further Diploma in Education' are very helpful for improving teaching skills, techniques and qualifications, and sometimes the monthly income of unqualified or under-qualified teachers may be increased. However, according to the new policy of the South African Government, modern concept-based in-service training is an ongoing process of professional development for teachers (p.85). No doubt training imparted to teachers at their job place or outside their institution is beneficial. Teachers are professionally developed due to attending workshops, symposiums and seminars or even participating in the discussion.

According to South African *Government Gazette* No. 23406 (2002), through professional development teachers are enabled to make a contribution to developing the school administrators, students and other stakeholders to get control of their lives. It can be achieved by implementing Curriculum 2005 which is the best instrument to enable the young generation of democratic South Africa to be confident, independent, educated, polite, multi-skilled, sympathetic and numerate lifelong learners and may play an active role in society as vital and lively citizens (p.17). It is a call for teachers to play active roles to adopt such methods for teaching, assessment and management of the classroom in sophisticated manners to meet the international demands of the global workplace and political will of new South Africa.

We concluded in this study that the term INSET comprised those activities arranged for a short or long time that aim to improve teachers with afresh and more content-based knowledge, techniques, pedagogical skills, attitudes, learning experiences and activities.

Objectives of the Study

Following were the objectives of the study:

1. To evaluate the opinions of secondary school science teachers.
2. To develop a model for in-service training of secondary school science teachers.

3. To recommend and suggest ways for improving in-service training programmes for secondary school science teachers.

Limitations

Financial constraint is the prior most factor that affects the implementation of the proposed model. Teacher's resource centers (TRCs) are not available at the local or tehsil level. Well-equipped multipurpose laboratories and libraries are not also present at the local or tehsil level.

Methodology

To achieve the objectives, a sample consisting of 724 secondary school science teachers out of a population of 2191 teachers who got training under the Science Education Project (SEP) in the years 2002 and 2003 was taken from randomly selected four districts Multan, Layyah, Khanewal and Lodhran of Southern Punjab. In order to collect the data, a questionnaire for trainee teachers was developed having 37 items with four options and one open-ended question regarding recommendations and suggestions for improving professional development programmes and administered. Different indicators like reason of participation, prior information regarding the commencement of the course, programme schedule, commonly used teaching method, commonly used A.V. aid, duration of training course, training daily time and incentive pertaining to training course were included in the questionnaire. The response rate of trainee teachers was 78.72%. The data were analyzed by computing percentages, frequencies and a chi-square test was applied. The results were discussed to draw findings, conclusions, recommendations and suggestions for developing a model for the in-service training of secondary schools science teachers.

Finding and discussions

The findings drawn out from the data collected through the questionnaire are given below:

Table 1. *Reason of Participation*

Responses / Statement	Male = 435	Female = 135	Total = 570
	%age	%age	%age

Reason for nominated teachers participating in the training course.	For the compliance of orders	79	18.16	35	25.92	114	20
	For TA/DA	126	28.96	15	11.11	141	24.73
	For Promotion	13	2.98	10	7.40	23	4.03
	For Professional growth	217	49.88	75	55.55	292	51.22

Table 1shows that according to 51.22% of respondents (49.88% male and 55.55% female), they participated for their professional growth; 24.73% were of the view that they participated for tempting TA/DA; 20% indicated that they participated for the compliance of orders while 4.03% teachers responded that they got training for their promotion. The value of chi-square = 22.015 with an accepted value of 0.0000 indicates that there is a significant relationship between the reason of participation and training.

Table 2. *Prior Information Regarding Commencement of Course*

Statement	Responses	Male = 435		Female = 135		Total = 570	
		%age		%age		%age	
How early are you informed before the commencement of the training course?	One week	322	74.02	115	85.18	437	76.66
	Two weeks	107	24.59	17	12.59	124	21.75
	Three weeks	3	0.68	0	0	3	0.52
	One month	3	0.68	3	2.22	6	1.05

Table 2 reveals that according to 76.66% of respondents (74.02% male and 85.18% female) information regarding the commencement, of course, was given one week before; 21.75% stated that they were informed two weeks before; 1.05% indicated

that the information was imparted one month before while only 0.52% were of the view that information was given three weeks before the beginning of training course. The value of chi-square = 7.176 with a significant value of 0.0074 shows that there is a strong association between prior information regarding the commencement of course and trainees.

Table 3. *Programme Schedule*

Statement	Responses	Male = 435		Female = 135		Total = 570	
			%age		%age		%age
Are you provided the schedule of programme for training course?	Often	222	51.03	45	33.33	267	46.84
	Seldom	68	15.63	15	11.11	83	14.56
	Always	135	31.03	68	50.37	203	35.61
	Never	10	2.29	7	5.18	17	2.98

Table 3 shows that according to 46.84% of respondents, they were often provided with a schedule; 35.61% opined that they were always provided with a schedule; 14.56% responded that a schedule was seldom provided and only 2.98% indicated that they were never provided with a schedule. 51.03% male trainees indicated that they were often provided schedule while 50.37% female respondents declared that they were always provided a schedule of programme of training course. The value of chi-square = 10.245 with p-value 0.0165 indicates there is a significant association between programme schedule and training.

Table 4. *Commonly Used Teaching Method*

Statement	Responses	Male = 435		Female = 135		Total = 570	
			%age		%age		%age
Commonly used	Lecture method	192	44.13	63	46.66	255	44.37

method during the training was.	Activity method	120	27.58	50	37.03	170	29.82
	Project method	24	5.51	5	3.70	29	5.08
	Demonstra-tion method	99	22.75	17	12.59	116	20.35

Table 4 reveals that 44.37% teachers responded that commonly used was lecture method; 29.82% viewed that activity method was commonly applied; 20.35% opined that they commonly used demonstration method while only 5.08% stated that project method was commonly used in the training course. The value of chi square= 9.131with an acceptable value of 0.0275 shows that there is a strong impact of frequently used teaching methods in the training.

Table 5. *Commonly Used A.V. Aid*

Statement	Responses	Male = 435		Female = 135		Total = 570	
			%age		%age		%age
The commonly used A.V. aid during the training was.	Computer	10	2.29	5	3.70	15	2.63
	Over head projector	87	20	25	18.51	112	19.64
	Chart	110	25.28	15	11.11	125	21.92
	Writing board	228	52.41	90	66.66	318	55.78

Table 5 shows that 55.78% of trainees commonly used writing board; 21.92% opined that they commonly used charts; 19.64% stated that overhead projector was commonly used while only 2.63% of teachers viewed that computer was the commonly used as an A.V. aid during the INSET. The value of chi-square = 14.081with a significant value of 0.0027 indicates that there is a strong impact of the most frequently used A.V. aid during the training course.

Table 6. *Duration* of *Training Course*

Statement	Responses	Male = 435	%age	Female = 135	%age	Total = 570	%age
Duration of training course should be.	Two weeks	66	15.17	53	39.25	119	20.87
	Three weeks	99	22.75	17	12.59	116	20.35
	One month	237	54.48	50	37.03	287	50.35
	Two months	33	7.58	15	11.11	148	8.42

Table 6 shows that 50.35% of respondents suggested duration of the training course should be one month; 20.87% proposed that training should be conducted for two weeks; 20.35% opined that the duration of training should be three weeks and only 8.42% were of the view that training should be conducted for two months. 54.48% male teachers declared that duration should be one month while 39.25% female trainee teachers suggested duration of the training course should be two weeks. The value of chi-square = 41.611 with an accepted value of 0.0000 shows that there is a strong relationship between duration and training.

Table 7. *Training Daily Time Span*

Statement	Responses	Male = 435	%age	Female = 135	%age	Total = 570	%age
Daily time span of training should be.	Three hours	96	22.06	43	31.85	139	24.38
	Four hours	10	2.29	5	3.70	15	2.63
	Five hours	56	12.87	27	20	83	14.56
	Six hours	273	62.75	60	44.44	333	58.42

Table 7 reveals that 58.42% of trainees (62.75% male and 44.44% female) were of the view that the daily time span of the training course should be six hours; 24.38% suggested daily time span should be three hours; 14.56% indicated that daily time span should be five hours while only 2.63% teachers opined that daily time span of training should be four hours. The value of chi square = 14.324 with a significant value 0.0025 reveals that there is a significant relationship between daily time span and training.

Table 8. *Incentive Pertaining to Training Course*

Statement	Responses	Male = 435		Female = 135		Total = 570	
			%age		%age		%age
What incentive ought to be given on completion of a training course?	Advance increment	172	39.54	73	54.07	245	42.98
	Promotion to next grade	88	20.22	50	37.03	138	24.21
	Cash award	22	5.05	5	3.70	27	4.73
	Merit certificate award	153	35.17	7	5.18	160	28.07

Table 8 indicates that 42.98% of trainee teachers (39.54% male and 54.07% female) stated that an advance increment may be granted to them on completion of training; 28.07% viewed that merit certificate may be given; 24.21% indicated that trained teachers may be promoted to next grade while only 4.73% trained teachers opined that they may be awarded cash on completion of a training course. The value of chi square = 50.487 with an accepted value 0.0000 shows that there is a valid association between incentives pertaining to training courses and trainees.

Table 9. *Suggestions for Improvement*

Sr. No.	Suggestions of trainees for improvement of training programme	Male = 435	%age	Female = 135	%age	Total = 570	%age
1	Training centers should be established at the local or tehsil level.	405	93.10	105	77.77	510	89.47
2	Modern A.V. aids and technology should be used.	400	91.95	102	75.55	502	88.07
3	Relevant subject teachers should be	398	91.49	99	73.33	497	87.19
4	nominated for the training programme. Pre-test and post-test should be held on a compulsory basis to know the academic and pedagogical status of trainees.	395	90.80	97	71.85	492	86.31
5	Schools should be provided with science apparatus and equipment so that teachers may apply newly learned skills in the classroom and laboratory.	390	89.65	96	71.11	486	85.26
6	Modern methods of teaching should be introduced during the training course.	386	88.73	91	67.40	477	83.68

7	Master trainers should be competent and highly qualified in their respective subjects.	301	69.19	85	62.96	386	67.71
8	Practical work should be included in the training course.	280	64.36	84	62.22	364	63.85

Table 9 indicates the suggestions given by trainees to improve the training programme, 89.47% respondents were of the view that training course should be conducted at local or tehsil level; 88.07% suggested modern A.V. aids and technology should be used and 87.19% respondents suggested relevant subject teachers should be nominated for training programme while 83.68% respondents were of the view that modern methods of teaching should be introduced during the training course, 67.71% trainee teachers opined that master trainers should be competent and highly qualified and 63.85% trained teachers suggested that practical work should be included in the training programme.

Conclusion

1. Majority of teachers expressed the views that they participated for their professional growth and the lecture method was frequently used during the training. They were informed about the commencement of the course and a writing board was frequently used during the training programme.
2. Most of the trainee teachers suggested that:
    i) Modern A.V. aids and teaching methods should be used, relevant subject teachers should be nominated and highly qualified master trainers should be appointed for training programmes.
    ii) Practical work should be included in the training course and an advance increment should be granted to the trainees on successful completion of a training course.

iii) Schools should be provided with science apparatus and equipment so that teachers may apply newly learned skills in the classroom and laboratory.

iv) Training centres should be established at local or tehsil level and duration of the training course should be one month.

Existing Model

Analysis of data indicates that the existing model of in-service training of secondary school science teachers makes the teachers leave their institutions, get training and come back to classrooms. There is no proper procedure for the nomination and selection of teachers for attending in-service training programmes. Training programmes are conducted at the Directorate of Staff Development (DSD) or district headquarters. In this way, students' studies suffer and there is a financial loss of government also. It is unrealistic to expect that government may increase the budget for teacher training programmes. There is a need to adopt meaningful and suitable strategies to cater to the needs of INSET programmes.

Recommended Criteria for Devising an Effective In-service Training Model for Secondary School Science Teachers

It is suggested that the INSET model for secondary school science teachers should meet the following criteria:

1. Trainees should be informed well in time before the commencement of training course and the training centres should be established at local or tehsil level.
2. Lecture method should be focussed to least extent and modern methods of teaching e.g. demonstration and activity methods should be used during the training programmes.
3. Relevant subject teachers should be nominated for INSET programmes and highly qualified master trainers and resource persons should be appointed for the training programme.
4. More practical work should be included in the training course, schedule of the training programme,

clear objectives of training, modern technological facilities i.e. use of science apparatus & equipment, A.V. aids like computer, internet, TV, VCR, slide projector and overhead projector etc. should be ensured in training centres.

5. Schools should be provided with science apparatus and equipment so that teachers may apply newly learned skills in the classroom and laboratory.
6. In-service training programmes should be managed in summer vacations so that the academic loss of students may be avoided.
7. Pre-test and post-test may be designed and administered on a compulsory basis to know the academic and pedagogical status of participants.
8. There should be continuous monitoring, evaluation and feedback system for INSET programmes.

In-service training is not effective unless science teachers, head teachers and officers of education department work together to achieve the ultimate goals (e.g. improvement in classrooms).

Description of the Proposed Model

A broad framework of the INSET programme is presented below:

Objectives of Training Model

The objectives of the proposed model of the INSET programme are given as under:

1. To upgrade the academic and professional competencies of secondary school science teachers.
2. To orient the secondary school science teachers in the areas of contents, pedagogy, technological developments, repair and maintenance of apparatus & equipment, and ethics.
3. To bring positive change in the behaviour of teachers.
4. To help the teachers to improve their ability to organize science laboratories effectively.

Management Set-up

The following management set-up is recommended for effective implementation of the proposed model:

1. DSD should act as responsible authority for management and funding.
2. Education department should be responsible for the provision of academic support, development of teaching material and the conduct of training programmes.
3. Each Government College for Elementary Teachers (GCET) should be responsible for arranging training programmes at the Teacher Resource Centres (TRCs) located within its jurisdiction.
4. Executive Education Officers i.e. EDOs (Education) should be responsible for professional supervision, implementation and assurance of participation of trainees in training programmes within the district.
5. Senior teachers of each GCET should be imparted training for the new approach and be responsible for monitoring and evaluation of INSET activities at TRCs located within GCETs' jurisdiction.

Hierarchy of Training

In order to implement the proposed model, it would be necessary to arrange in-service training programmes in the following phases:

(i) Training of Lead Trainers
(ii) Training of Master Trainers
(iii) Training of Trainees

Training of Lead Trainers

The qualifications of lead trainers should be at least M.Phil. /Ph.D. in a relevant subject. There should be specific criteria for the selection of lead trainers. They should have at least 10 years' experience asr training.

Lead trainers should be trained in the following areas:

(a) Content 40% (b) Pedagogy 20% (c) Computer 15% (d) Practical Activities 10% (e) Ethics 10% (f) Repair and maintenance of apparatus & equipments 05%.

Training of Master Trainers

The qualification of master trainers should be at least M.Sc.; M.Ed. Highly qualified master trainers should be preferred. Weight-age for areas of training for master trainers should be of the same

pattern as described for lead trainers. They should be trained in GCETs equipped with all facilities.

Training of Trainees

Proposed INSET model for secondary school science teachers suggests a 4-tiers training programme for trainees.

1st Stage

In-service training should be imparted to all secondary school science teachers whenever there is a change in contents, methods and types of test items for examinations and it should also be repeated after three years on regular basis or as and when required. In-service training should be conducted in TRCs at local or tehsil level in those institutions where multiple purpose science laboratories, well-established libraries and other facilities have been provided by SEP II. The number of participants should not be more than 30 in a batch. The qualification of the participants should be at least B.Sc.; B.Ed. The weight-age of areas of training should be the same as described for lead trainers and master trainers.

The duration of the training course should be one month and the daily time span of training should be 6-8 hours including a general discussion between master trainers and trainees.

2nd Stage

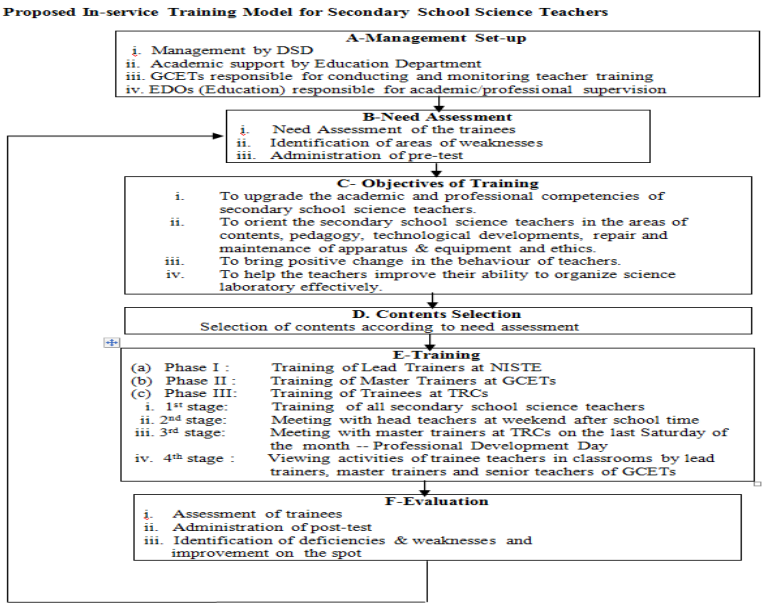
Proposed INSET model suggests that the trainees should meet their headteachers each weekend after school time and discuss administrative and academic problems.

3rd Stage

Proposed model suggests that trainees should approach their respective TRCs on the last Saturday of the month to discuss their needs and problems with master trainers to take guidance in this regard. This meeting should be arranged for at least two hours after school time. This day should be named Professional Development Day.

4th Stage

Lead trainers, master trainers and senior teachers of GCETs should occasionally view the activities of teachers during the teaching process in their schools. Deficiencies and weaknesses during teaching should be pointed out and improved on the spot.



Suggestion for Future Studies

i. Further researchers may choose all districts of Punjab.

ii. The scope of the study is limited to secondary school science teachers teaching the subjects of Physics, Chemistry and Biology. Secondary School Science teachers teaching the subjects of Computer Science and Mathematics may be involved.

iii. Future researchers may include an interview schedule with the questionnaire to take deep insight of the research study.

iv. Future researches may include further indicators to enhance the scope of the study.

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