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Role of Science Education Projects for the Qualitative Improvement of Science Teachers at the Secondary Level in Pakistan

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Abstract

This study was aimed at describing the role of science education projects for the qualitative improvement of science teachers at the secondary level in Pakistan. All the heads of institutions and science teachers of secondary schools in Pakistan constituted the population of the study. Hundred heads of institutions and 100 science teachers from one hundred institutions were selected as a sample of the study from all over the Pakistan. Two questionnaires (one each for heads of institutions and other for science teachers) were developed and validated through pilot testing and administered to the sample for collection of data. Researcher personally visited respondents and thus 100% data were collected. Collected data were tabulated and analyzed by using chi square.

Introduction

Teacher plays an important role for the delivery of education. The quality of education is deteriorating in Pakistan. Two science education projects have been launched to improve the science education in Pakistan. The major objective of the present study was to investigate the role of science education projects for the qualitative improvement of science teachers at secondary level in Pakistan.

Since 1947, two Science Education Projects have been launched. In its "Action Plan for Educational Development for the Period 1983-1988", the Government proposed to upgrade science education by developing an institutional base; improving the quality and relevance of science education by revising science curricula; and providing in-service training to science teachers, and science laboratories to 3,000 middle schools and 500 high schools and science equipment to selected schools in the country. The project was designed to assist the Government in implementing the Action Plan by undertaking a part of the plan (Asian Development Bank, 1995).

In specific objectives, two objectives are closely related to the quality of science teachers. These are

- To develop manpower in science education through.
  a) Higher studies leading to MS/Ph.D. in science education.
  b) Short visits by attachment or study of program in neighboring countries similar to the project;
  c) In-service training of 9885 middle and 7415 high schools science teachers.

"To improve the quality of science teacher training by strengthening 105 teacher training institutions/ college/IERs in the provinces and increase the supply of trained professional science educators to sustain improvement efforts on long term basis f Pakistan, 1986). The most noteworthy … achievement of the Project was the establishment of an effective system for the in-service training of science teachers under the direction of IPSET (Govt. of Pakistan, 2005a).

The government is aware of the fact that an increased and adequate availability of qualified Scientific and Technological manpower is important to the social and economic development of the country. The government, therefore, intends to strengthen Science Education and increase its quality and relevance at all levels. The staff development

program of SEP-II is geared to assist the government to improve Science Education at secondary level by contributing to the development of skilled man power at higher levels by producing students with a better knowledge of basic sciences.

About 3 million science students of Standards V-X are being benefited due to the fact that 32,000 science and math teachers, Principals/head masters of elementary and secondary level have been provided in-service training on various aspects of science, math and computer education.

The beneficial effects of nature and the natural sciences on the development of thinking, speech, attention, memory and imagination are clearly and comprehensively reflected in the general teaching theory and practice of science. A great deal depends on the teacher's skill in presenting scenes from nature during his lessons, using living specimen and talking about them in an interesting way (UNESCO, 1987).

The skills and techniques of imparting useful scientific knowledge are also evolving and the classroom lecture and the textbook as the sole sources of knowledge will be supplemented, and perhaps, replaced by newer educational techniques grounded by learning research (Meyer, 1983).

Successful classroom instruction depends upon the technique of teaching; through it, the learning activity of the pupils is guided. It is teaching technique that provides this guidance for the pupils, therefore, the instructional period should be a learning period for the pupils. The general principles of learning should have specific application in every actual teaching situation.

Since the outcomes of teaching and learning are both in pupil achievement, the technique of teaching as well as that of learning depends upon the learning outcomes being sought by the pupil at any time. This gives the teacher his opportunity to determine the method of teaching that should be used (Chand, 1990).

Technology media and materials useful in the instructional process are manifold. These range from simple varieties of helping teachers to developing and presenting their lessons more effectively in traditional classrooms to sophisticated machines and mechanisms, completely changing the classroom teaching structure and situation.

The teacher of today has at his command an array of aids, some ready made and some fabricated by the teacher. Using these teaching aids, the teacher can plan learning situations and be sure of realizing his objectives. The teacher can make use of specific audio—visual aids to suit his purpose. The aids being concrete will be able to secure the attention of pupils, motivate, enable the pupils form accurate concepts and ensure permanent retention of the knowledge gained. A teacher using appropriate aid can make clear a difficult concept even to a below average pupil very easily (Sampath, 1990).

The idea of teaching science by enquiry with an emphasis on problem solving, which means to find out how students process and interpret an information. Problem solving includes an attitude or predisposition toward inquiry as well as actual processes by which individuals attempt to gain knowledge. Usually when teachers discuss problem solving on the part of pupils, they anticipate pupils will become involved with the thinking operations of analysis, synthesis and evaluation (Edline, 1989).

The scientific method is universally held to the logical system underlying scientific progress. It enables us to identify a problem within the field of natural sciences, formulate a working hypothesis as a tentative explanation leading to possible solution, carry out experiments, which enable us to support or eliminate the working hypothesis; enlarge the conclusions from individual cases to general ones; and establish new theories on the basis of the conclusions (Harre, 1970).

Bashir Pervez, Project Advisor (World Bank, Resident Mission in Pakistan), stated that the basic issue is that teacher education in Pakistan is facing an identity crisis, essentially because teaching skills have erroneously been accepted to be synonymous with teacher training skills. Every teacher trainer is a teacher of a sort, but every teacher is not and cannot automatically be a teacher trainer. In addition, while teacher training is a professional discipline it is not recognized as such.

The subsidiary issues are as follows:

- Content knowledge weakness
- Pedagogical competence gap
- In-service training deficiencies
- Lack of ongoing classroom support

Shami and Hussain (2005, p.20) found that during field visits it was observed that quality of education is deteriorating due to non availability of required training to teachers. They suggest that if we want to improve quality of education then teacher training should be designed according to the practical requirements of the teachers.

Procedure of the Study

Heads of institutions and science teachers of secondary schools constituted the population of the study. One hundred heads of institutions and one hundred science teachers were randomly selected as sample of the study from all over Pakistan. Two questionnaires were used at five points and two points rating scale in order to collect the views of heads of institutions and science teachers. These questionnaires were validated through pilot testing and administered to the sample for collection of data. Researcher personally

visited respondents and thus 100% data were collected. Collected data were tabulated and analyzed by using chi square.

Results

In this section, firstly the combined responses of heads of institutions and science teachers were analyzed. Secondly, separate responses of heads of institutions were analyzed and lastly, separate responses of science teachers were interpreted.

Responses of Heads of Institutions and Science Teachers

Table 1. Scholarship is needed for science teachers.

	SA	A	UD	DA	SDA	Total	$\chi 2$
Heads of institution	62	26	0	8	4	100	5.60
Science teachers	57	31	4	6	2	100	

Non-Significant df=4 χ^2 at 0.05 level = 9.49

Table 1 indicates that the obtained χ^2 value (5.60) showed non-significant difference at 0.05 level. Thus, both the respondents heads of institution and science teachers agreed that scholarship was needed for science teachers.

Table 2. Quality of science teaching is up-to-the-mark.

	SA	A	UD	DA	SDA	Total	$\chi 2$
Heads of institution	4	70	8	16	2	100	22.17
Science teachers	6	37	18	35	4	100	

* Significant df=4 χ^2 at 0.05 level = 9.49

Table 2 indicates that the obtained $\chi^{2\ \text{value}}$ (22.17) showed significant difference in the opinions of heads of institutions and science teachers about the quality of science teaching at 0.05 level. Heads of institutions perceived that quality of science teaching was up-to-the-mark while science teachers gave less weight age in favor of the statement.

Table 3: Science teachers for the subject of physics are available.

	Yes	No	Total	χ^2
Heads of institutions	80	20	100	5.98*
Science teachers	92	8	100	

* Significant df=1 χ^2 at 0.05 level = 3.841

Table 3 indicates that the obtained χ^2 value (5.98) showed significant difference in the opinions of heads of institutions and science teachers about the availability of science teachers (physics) at 0.05 level. This shows that science teachers for the subject of physics were available in schools.

Table 4: Science teachers for the subject of chemistry are available.

	Yes	No	Total	χ^2
Heads of institutions	82	18	100	10.01*
Science teachers	96	4	100	

* Significant df=1 χ^2 at 0.05 level = 3.841

Table 4 indicates that the obtained χ^2 value (10.01) showed significant difference in the opinions of heads of institutions and science teachers about the availability of science teachers (chemistry) at 0.05 level. This shows that science teachers for the subject of chemistry were available in schools.

Table 5: Science teachers for the subject of biology are available.

	Yes	No	Total	χ^2
Heads of institutions	86	14	100	9.78*
Science teachers	98	2	100	

* Significant df=1 χ^2 at 0.05 level = 3.841

Table 5 indicates that the obtained χ^2 value (9.78) showed significant difference in the opinions of heads of institutions and science teachers about the availability of science teachers (biology) at 0.05 level. This shows that science teachers for the subject of biology were available in schools.

Table 6: Science teachers for the subject of mathematics are available.

	Yes	No	Total	χ^2
Heads of institutions	80	20	100	0.13
Science teachers	82	18	100	

Non-Significant df=1 χ^2 at 0.05 level = 3.841

Table 6 indicates that the obtained χ^2 value (0.13) showed non-significant difference in the opinions of heads of institutions and science teachers about the availability of science teachers (mathematics) at 0.05 level. Thus, both the respondents intended that science teachers for the subject of mathematics were available in schools.

Table 7: Science teachers for the subject of computer science are available.

	Yes	No	Total	χ^2
Heads of institutions	54	46	100	0.02
Science teachers	53	47	100	

Non-significant df=1 χ^2 at 0.05 level = 3.841

Table 7 indicates that the obtained χ^2 value (0.02) showed non-significant difference in the opinions of heads of institutions and science teachers about the availability of science teachers (computer science) at 0.05 level. Thus, intension of both the respondents showed that half of the schools have had science teachers for the subject of computer science.

Heads of the institution

Table 8. Responses of heads of institutions about the role of Science Education Project-II for improvement of science teaching

Statement	SA	A	UD	DA	SDA	Total	χ^2
1. Science teachers are professionally qualified through Science Education Project-II	28	66	0	4	2	100	158.0
2. Science teachers are academically qualified through Science Education Project-II	38	54	2	4	2	100	119.2

3. An integrated management structure for the training of science teacher, development and monitoring of science, mathematics and computer education has been established through Science Education Project-II	0	60	20	20	0	100	24.0

* Significant df=4 χ^2 at 0.05 level = 9.49

Statement 1 (Table 8) reveals that the obtained value of χ^2 was found to be significant at 0.05 level. Hence the statement "Science teachers are professionally qualified through Science Education Project-II" is accepted.

Statement 2 (Table 8) indicates that the calculated value of χ^2 was found to be significant at 0.05 level. Hence the statement "Science teachers are academically qualified through Science Education Project-II" is accepted.

Statement 3 (Table 8) depicts the obtained value of χ^2 was found to be significant at 0.05 level. Hence the statement "An integrated management structure for the training of science teacher, development and monitoring of science, mathematics and computer education has been established through Science Education Project-II" is accepted.

Science Teachers

Table 9. Opinion of science teachers about teaching methods and teachers training

Statement	**SA**	**A**	**UD**	**DA**	**SDA**	**Total**	χ^2
1. Modern teaching methods are used to teach the science subjects	12	45	12	27	4	100	52.90
2. Audio / visual aids are used in the school to teach the science subjects	9	37	14	31	9	100	34.40
3. In-service teacher training in science subjects is arranged in Regional Training Centers under SEP-II.	5	52	12	27	4	100	80.90
4. Refresher courses for teaching science are conducted regularly in Regional Training Centers under Science Education Project-II.	14	52	8	21	5	100	71.50

* Significant df=4 χ^2 at 0.05 level = 9.49

Statement 1 (table 9) that the obtained value of χ^2 was found to be significant at 0.05 level. Hence the statement "Modern teaching methods are used to teach the science subjects" is accepted.

Statement 2 (table 9) indicates that the obtained value of χ^2 was found to be significant at 0.05 level. Hence the statement "Audio/visual aids are used in the school to teach the science subjects" is accepted.

Statement 3 (table 9) indicates that the obtained value of χ^2 was found to be significant at 0.05 level. Hence the statement "Teacher training in science subjects is arranged according to modern needs" is accepted.

Statement 4 (table 9) indicates that the obtained value of χ^2 was found to be significant at 0.05 level. Hence the statement "Refresher courses for teaching science are conducted regularly" is accepted.

Discussion

Regarding up-gradation of science education's relevance and quality, majority of experts viewed that quality of education was not up to the mark. While majority of heads of institutions, science teachers and students opined that quality of science education was up to mark. This idea was disapproved by (ADB 1996) which reported that SEP I had not yet achieve its primary objective of improving of quality and relevance of science education. Research in science education is helpful to increase the quality and relevance. Both experts and heads of the institutions viewed that education department took interest in conducting research in science education.

Most of the heads of institutions viewed that science teachers were professionally as well as academically qualified. Heads of institutions also opined that teacher training in science subject was arranged according to modern needs. This idea is also supported by Government of Pakistan (2005), that principals/headmasters of elementary and secondary level were provided in-service training on various aspects of science, mathematics and computer education. Majority of heads of institutions expressed that there was acute shortage of science teachers in the schools. The experts expressed that motivation was lacking in teachers.

According to Government of Pakistan (2005) to motivate and overcome the shortage of female science and mathematics teachers, particularly in rural schools, the project provided 264 scholarships for F.Sc pass female students to complete three years B.S.Ed. degree. These scholarships were awarded on merit to the female students belonging to rural areas. Later on, in view of limited number of available seats of B.S.Ed. course, ADB consented to a proposal to allow one year B.Ed course as well. Third option was also agreed with, to award scholarship for two years BSc course followed by one year B.Ed course.

Conclusions

In the light of analysis of data and findings of the study, following conclusions were drawn;

1. Majority of heads of the institutions, teachers and students opined that science teachers for the subject of Physics, Chemistry, Biology and Mathematics were available. Most of the heads of the institutions viewed that science teachers were professionally as well as academically qualified.
2. Majority of heads of the institutions and teachers viewed that science teachers for the subject of computer science were not available. The reason for such shortage might be due to absence of computer courses in teacher education programs.
3. Majority of heads of institutions and science teachers expressed their views that quality of science education was up to mark.
4. Majority of students viewed that Audio/Visual aids were not used to teach the science subjects.
5. Majority of teachers viewed that in-service teacher training as well as refresher courses in science subjects were arranged in Regional Training Centers under SEP-II. Both teachers and students expressed that activity-oriented and other modern methods were used to teach the science subjects.
6. Majority of heads of the institutions were found dissatisfied with regular release of funds for science education. The heads of institutions pointed out that funds provided for the implementation of science education project were insufficient. Majority of the experts, heads of institutions and science teachers viewed that local government did not provide funds for science education projects in Pakistan.

Recommendations

In the light of the study results, the following major recommendations were made:

1. The study results revealed that computer teachers were not available. It is recommended that computer science teacher's posts be sanctioned for each secondary school. Computer courses may also be introduced in teacher education programs so that computer teachers be made available for appointment in schools.
2. It was found that science teachers were not using A/V aids and activity-oriented methods of teaching in the classes. It is recommended that A/V aids be used during teaching of science subjects. Proper monitoring o the training be given to use A/V aids like overhead projectors, slide projectors, biology slides and charts, computer aided instructions (software), science/mathematics kit as well as modern methods of teaching be ensured. It is suggested that science teachers be provided in-service training in the development of low cost A/V aids and be motivated to use of available equipments and aids. Activity oriented teaching be encouraged. Practicals be given due importance. Science teachers should use science teaching kit for

demonstration before the students and likewise students be used science teaching kit to perform the activity assigned by the teacher. There is need of peer coaching and supervision of the teachers. Teacher training needs to be assessed weekly or monthly. With the help of peer coaching teachers in the same school can observe each other and help each other to employ active teaching and learning strategies.

3. The study findings revealed that motivation was lacking in teachers. It is suggested that communication, interaction and coordination among heads, science teachers and project personnel be encouraged. Also, incentives in the form of extra increment, certificate of recognition or bonus salary be given to science teachers in order to promote motivation among them. Donor agencies be approached for the arrangement of extra funds.

4. The study revealed that funds provided for science education were insufficient and these were not properly utilized and regularly released. It is therefore, recommended that availability of sufficient funds be ensured. Loans from foreign agencies be taken for completing the science education projects in the country. The funds be released regularly and utilized properly. The results of the present study revealed that the local government did not provide funds for science education projects in Pakistan and the funds provided by other agencies were not available in time. There should be involvement of local government to provide funds for science education projects in Pakistan. The government should ensure availability of funds well in time.

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References

Shami, P.A. and K. H. Sabir. (2005) Professional requirement of Education Managers under Devolution Plan. Academy of Educational Planning and Management, Ministry of Education, Islamabad Pakistan. P.20.

Asian Development Bank (1995) Project Completion Report of Science Education for Secondary Sector Project in the Islamic Republic Of Pakistan.

Government of Pakistan (2005) Report Physical Facilities Provided under Second Science Education Project (200-2005). Ministry of Education, Project Wing, Islamabad.

Meyer, G.R (1983) Strategies for the social effectiveness of Biological Education at Secondary Level. University of the Philppines, Institute for Science and Mathematical Education Development. Occasional Paper.

Chand, T(1990). Educational Technology. Anmol Publications. New Dehli.India

Sampath, K. (1990) Introduction to Educational Technology. Sterling Publishers Private

Limited.India.

Edline, K. (1989). New ACT test to stress higher order thinking skills. Journal of Research in Science Teaching; 23(6):533-542

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