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Study on Planning Aspect of Science Education and Supply, Development and Retention of High Quality Science Teachers

Parul Priya[1]* Dr. Mihir Pratap[2]

[1,2] Assistant Professor, Department of Education, C. N. College, Sahebganj, Muzaffarpur (Constituent Unit of B.R.A.B.U, Muzaffarpur)

Abstract – Science education, in today's global education system, encompasses much more than fact-based knowledge. If learners are unable to connect science education to their lives, it becomes meaningless and incomprehensible. Thus, Pakistan, like many other countries worldwide, should adopt a Science Technology Society (STS) approach to science education delivery. The STS approach is aimed at developing scientifically literate citizens capable of making informed choices about socio-scientific issues affecting their lives. The difficulties in adopting this approach in Pakistan stem from four areas that will need to be completely redesigned in accordance with the STS approach. The examination system; science textbooks; science teacher education programmes; and available resources and school facilities are just a few of these areas. A nation's wealth and prosperity are contingent upon the efficient use of its human and natural resources via industrialisation. Industrialisation requires scientific education and training in technical skills. Science education is critical because it has enormous value in both the student's personal life and his social life. Students must develop a scientific outlook so that it becomes ingrained in their way of life and culture. The new generation must be equipped with scientific knowledge, a scientific temperament, and a scientific attitude in order to mature and function effectively as citizens in the modern world. All civilised countries promote the study of science and its applications to various fields of activity, believing that the more it accomplishes, the stronger the nation becomes. And this may be why modern education has a strong bias toward science.

Keywords – Supply, Development, Retention, High Quality, Science Teachers, Planning

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INTRODUCTION

Higher education has the potential to significantly improve a country's socioeconomic situation. A country can make tremendous strides forward by providing a beneficial education to its citizens and developing science and technology. A skilled human resource base is an asset that has the potential to transform even the most backward economy into a developed one..

Educational scenario of Bihar

Bihar is one of the country's most populous states. The population density is highest in the country's major states. Bihar's literacy rate was 61.8 percent in 2011, with male literacy at 71.2 percent and female literacy at 51.5 percent. Higher education encompasses both college and university education, as well as training in both general and technical fields. Less than 1% of the population is enrolled in post-secondary education. In Bihar, the gross enrolment rate in higher education for the 18-23 age group is approximately 14.9 percent, compared to the national average of 25.2 percent in 2016-17.

The supply, development and retention of high quality science teachers

The teacher is the single most significant factor affecting the learning quality. Thus, it is critical to ensure the supply, development, and retention of qualified science teachers. The majority of research on teacher supply has focused on how to attract prospective teachers, and thus on their intentions and judgments. Undergraduates have been the primary target, possibly due to the difficulty of reaching mature entrants. According to studies, the proportion of undergraduates willing to seriously consider teaching has decreased significantly over the last decade. Despite this decline, prospective teachers' perceptions of the job's nature remain relatively stable. Students are frequently at the heart of the appeal of becoming a teacher.

The prospect of'making a difference,' of inspiring students, and of working with people rather than money or things are all significant motivations to teach. Undergraduates frequently speak of their own teachers' influence on them as students. This demonstrates that there is a sizable reservoir of goodwill available. However, prospective teachers frequently express concerns about their ability to control classes and their lack of support in doing so. In the sciences, teacher training targets have been consistently missed, but because figures are not differentiated by discipline and published figures on job openings are somewhat misleading, the impact is difficult to trace.

The supply storey varies significantly across schools, regions, and disciplines. Schools operating under adversity frequently face greater difficulty recruiting and retaining specialist teachers. This differentiation is likely to have a detrimental effect on the quality of instruction. Polarisation is most obvious in physics, the primary'shortage' subject, but it extends further. While 44% of specialists in science departments hold degrees in biology and 25% hold degrees in chemistry, only 19% hold degrees in physics, leaving the remainder as generalists. It is clear that non-specialists are increasingly teaching physics throughout the system. Additionally, after pupil characteristics, the teacher's level of specialist qualification was found to be the second most effective predictor of pupil performance in physics. This scarcity is self-sustaining. A small undergraduate physics population results in fewer and less qualified teachers, which results in lower-achieving students and decreased recruitment to higher education. Across science, the degree class obtained by PGCE students is slightly skewed toward the lower end, although the educational impact of this effect is unknown.

Teacher quality encompasses more than academic credentials, and Ofsted data paints a favourable picture of trainees. Science teachers typically begin their careers with a strong foundation in one or more areas of the school science curriculum. Professional development begins by assisting trainee teachers in translating this knowledge into effective 'pedagogical content knowledge' (PCK) – the most effective methods for teaching specific science content and concepts to specific groups of students...

Numerous research studies have demonstrated that students perform better in science when taught using inquiry-based methodologies (Roccard, Csermely, Jorde, Lenzen, Walberg-Henriksson & Hemmo, 2017). This inquiry-based learning model, which allows students to investigate and explore independently, necessitates the provision of appropriate space and physical resources for this exploration to occur. The majority of participants perceived a lack of such resources as a barrier impeding their ability to deliver effective lessons. 55 (78.6 percent) of respondents indicated that they lack the physical space, materials, and equipment necessary to teach science, while only 15 (21.4 percent) indicated that they have adequate resources to do so.

Curriculum content and structure

At any level, the science curriculum is a statement about the aspects of science that we choose to teach from a much larger set of possibilities. These choices, such as the purpose of education, what is most valuable to individuals and society, and how to balance intrinsic and instrumental motivations for learning, all encapsulate values. While empirical evidence can help inform these choices, it cannot make them. Scholarship and analysis have provided critical insights, for example, into the nature of scientific knowledge and its implications for learning. Curriculum research should include more of this type of work. Science educators have recognised the importance of major trends in twentieth-century scholarship on science, particularly the work of Popper and Kuhn, for science education. However, much science education appears to have missed this lesson. Certain writings on science education have acknowledged a tension between indoctrinating students into a structure of agreed-upon and largely impersonal knowledge and the personal and social values associated with education and schooling. However, this insight has been sporadic and has had little impact on teaching.

OBJECTIVES OF THE STUDY

1. To study on Curriculum content and structure
2. To study on Educational scenario of Bihar

RESEARCH METHODOLOGY

Population and the Sample

The study's universe included the entire upper secondary level in north Bihar. Thirty schools (25%) were chosen from 12 higher secondary schools in north Bihar after weighing the location and type of school. The sample for the study was drawn in a systematic manner and consisted of 70 students and 80 teachers drawn at random from the above 30 schools. The student sample was chosen after weighing factors such as gender, ethnic origin, school type, and location; and in the case of teachers, sex, location, and school type were considered. Out of the 30 schools chosen for the study, two were government high schools, sixteen were deficit schools, and twelve were private schools (details of the schools chosen for the study are provided in Table ll). Twelve students were chosen at random from each of these schools' class xii..

Table 2 Detail is of students sample selected

Type of school \ locale	Boys		Girls		Total	
	Non-tribal	Tribal	Non-tribal	Tribal	Non-tribal	Tribal
Government urban schools	1	4	7	3	7	22
Deficit schools Rural	10	18	3	7	10	38
Urban	12	5	6	3	1	27
Private schools Rural	2	8	10	5	3	28
Urban	5	9	1	2	6	23
Total					27	138

Tools and Techniques

The following tools and techniques were used to collect data from the study's select sample:

(i) Questionnaire for teachers to ascertain the constraints and issues associated with science instruction.

(ii) Science attitude scale - For students, a five-point Likert type scale.

(iii) In-depth interviews with Headmasters/Headmistresses of select schools, as well as SCERT/government officials responsible for science education..

Areas of Science Education

The students' attitudes toward science were categorised using a systematic approach into four categories: planning, organising, leading, and controlling..

(1) Planning of Science Education

It is regarded as a critical step in the management of the teaching-learning process. At this point, the teacher assumes the role of manager and is responsible for developing the objectives. He deconstructs the content into logically sequenced elements. He prepares the instruction for teaching and plans the activities using his imagination and creativity. Planning activities include the following: (1) system analysis; (2) task analysis; (3) entry behaviour of the learner; (4) specification of students' knowledge, skills, and attitudes; and (5) identification of student needs. (6) Development of learning objectives, (7) planning for the criterion test, and (8) criterion test construction. The respondents' agreement or disagreement with statements about the aforementioned activities was used to determine their positive or negative attitude toward science education planning.

DATA ANALYSIS

General Information about Science Teachers

Details of the Teacher Sample

The sample of thirty high school science teachers included 32 males and 48 females. The qualifications and training of science teachers at the secondary level were examined. Separately, the percentages of qualified teachers in rural and urban schools were determined. Table 1 contains additional information.

Table 1 Qualification and training of teachers by locale of schools

Qualifications	Urban	Rural	Total
B.Sc.	6 (12.5%)	6 (18.75%)	12 (15.00%)
B.Sc., B.Ed.	36 (75.0%)	19 (59.37%)	55 (68.75%)
M.Sc.	6 (12.5%)	2 (6.25%)	8 (10.00%)
Undergraduate	0	5 (15.62%)	5 (6.25%)
Total	48	32	80

As shown in Table 1, the sample of 80 teachers consisted entirely of teachers who held a Bachelor's degree in addition to a teacher training degree, i.e., a Bachelor of Education. The majority of trained teachers worked in urban schools. The vast majority of science teachers in rural schools lacked formal education. There were a handful of science teachers who held a master's degree in the subject. It is significant to note that undergraduate teachers taught in high school classes, particularly in rural schools. The analysis reveals a shortage of both trained and qualified science teachers in secondary schools, particularly in rural areas. Close examination of the data revealed that only 70% of teachers in high schools were properly qualified to teach science..

Service Conditions of Teachers

Due to a shortage of qualified teachers, it is customary to hire teachers on an ad hoc and part-time basis. With this in mind, the service conditions of teachers were analysed in relation to their appointment type. Permanent, ad hoc, and part-time teachers were hired. Separate studies were conducted on teachers from rural and urban schools. Table 2 contains additional information.

Table 2 Mode of appointment of teachers by locale of schools

Appointment	Urban	Rural	Total
Permanent	30 (62.50%)	12 (37.5%)	42 (52.5%)
Ad-hoc	14 (29.16%)	12 (37.5%)	26 (32.5%)
Part-time	4 (8.33%)	8 (25.0%)	12 (15.0%)
Total	48	32	80

According to Table 2, 42 science teachers out of 80 held permanent positions, 26 were appointed on an ad hoc basis, and 12 were assigned on a part-time basis. Rural schools had a higher proportion of part-time and ad-hoc teachers. This is a significant disadvantage, as teachers hired on an ad-hoc or part-time basis are not eligible for service benefits and lack job security, which can have a negative effect on their morale and commitment to the job..

Planning Aspect of Science Education

The most critical step is planning, as it is required to create an effective teaching and learning environment. This, in turn, necessitates a sufficient number of qualified and trained teachers who are familiar with the objectives of science education. With this in mind, we analysed science teachers' perspectives on various aspects of science education planning..

Teacher’s opinion about the adequacy of science teachers

In general, this region's schools lack sufficient qualified and trained science teachers.

Table 3: Opinion of the urban and rural teachers were sought regarding the adequacy of science teachers and the data have been provided

Adequacy of Teachers	Urban	Rural	Total
Adequate	32 (66.67%)	14 (43.75%)	46 (57.5%)
Inadequate	16 (33.33%)	18 (56.25%)	34 (42.5%)
Total	48	32	80

According to Table 3, 66.67 percent of urban teachers and 56.25 percent of rural teachers expressed concern about the lack of qualified graduate science teachers in high schools. This is a significant finding because the majority of high schools, particularly those located in rural areas, have struggled to hire an adequate number of trained and qualified science teachers.

CONCLUSION

Whether developing or developed, eastern or western, capitalist or socialist, democratic or dictatorial, traditional or modern, science and its application have an impact on all societies. Genuine scientific knowledge j is the most powerful technological tool available in the modern world. A nation's wealth and prosperity are contingent upon the efficient use of its human and natural resources via industrialisation. The use of human material for industrialisation necessitates a science education and training in technical skills. Science education is critical because it has immense value in both the students' individual and social lives. Students must develop a scientific outlook so that it becomes ingrained in their way of life and culture. The new generation must be equipped with scientific knowledge, a scientific temperament, and a scientific attitude in order to mature and function effectively as citizens in the modern world. All civilised countries promote the study of science and its applications to various fields of activity, believing that the more it accomplishes, the stronger the nation becomes. And this may be why modern education has a strong bias toward science..

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Corresponding Author

Parul Priya*

Assistant Professor, Department of Education, C. N. College, Sahebganj, Muzaffarpur (Constituent Unit of B.R.A.B.U, Muzaffarpur)

priya.parul28@gmail.com