Analysis of the Profile of Science Teachers and Challenges in Conducting Science Practical in Secondary Schools of Mizoram

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Abstract

The study aimed to analyse the profile of science teachers in secondary schools of Mizoram, focusing on their educational and professional qualifications, nature of appointment, and teaching experience across different school management types—Government, Deficit, Samagra, and purely Private. The study also examined the challenges faced by science teachers in conducting science practicals, such as syllabus load, practical timetable constraints, availability of laboratory equipment, financial issues, and subject expertise. The findings highlight significant disparities in qualifications, job security, and resources, particularly affecting Samagra and Private Schools. The study provides insights into the need for policy interventions to improve quality of science education in Mizoram.

Keywords: *Profile, Challenge, Science teachers and Secondary schools*

Background of the study

Science education encompasses the teaching and learning of science for individuals across various age groups, including children, college students, and the general public. As a core subject in schools, science integrates knowledge from disciplines such as Biology, Chemistry, Physics, and Earth Sciences, as well as Mathematics, Computational Sciences, and, where applicable, Social Science and Vocational Education.

The National Curriculum Framework (NCF, 2005) emphasizes that the objectives of secondary-level science education should include engaging students in learning science as a unified discipline, equipping them with hands-on skills to design

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advanced technological modules, and encouraging them to analyze issues related to the environment and health. These objectives highlight the need for a robust science education system that not only imparts theoretical knowledge but also fosters critical thinking, problem-solving, and innovation.

Secondary school science teachers' qualifications, employment status, and the challenges faced by them in conducting practical experiments are critical factors that influence the quality of science education. In Mizoram there are different school management types viz. Government, Deficit, Samagra, and Private Schools, each with distinct standards in terms of teacher recruitment, training, and infrastructure.

The effectiveness of science teaching in Mizoram is frequently hindered by inadequate resources, financial constraints, and shortage of qualified teachers. These challenges are particularly pronounced in rural and remote areas, where schools often lack well-equipped laboratories and up-to-date teaching-learning materials. Furthermore, the disparity in teacher training status across different school management types make the issue more prominent and may lead to uneven educational outcomes. An in-depth analysis of these factors is essential to identify gaps and propose intervention that can enhance the quality of science education in the state.

Review of related literature

Braund and Driver (2005) investigated students' perceptions of practical science in primary and secondary schools, focusing on progression and continuity in learning. The study highlighted the difficulties students faced during the transition from primary to secondary education, particularly in science. Findings revealed that a significant proportion of both primary and secondary students believed practical work positively contributed to their general learning in science.

Mijung Kim and Aik-Ling Tan (2011) explored the difficulties faced by elementary pre-service teachers in teaching inquiry-based practical work. The study examined teachers' decision-making processes and internal conflicts regarding their abilities and beliefs about science teaching. The study identified multiple challenges influencing pre-service teachers' practical work. These included time constraints, inadequate materials, curriculum demands, and pedagogical assumptions. The study emphasized the importance of understanding teachers' internal negotiations regarding the role of science education and practical work in classrooms and society.

Paywand Jalal (2019) investigated challenges faced by science teachers in implementing practical work. The study assessed the availability of laboratory facilities and science materials in basic schools while also evaluating the capability of

laboratory tools. Conducted in Kurdistan Region Government (KRG) basic schools, the study involved 250 science teachers who participated through a structured questionnaire. The study indicated that most schools lacked laboratory tools, and over half of the teachers faced difficulties due to inadequate access to laboratory aids and materials, absence of science training courses, and various governmental and practical constraints. Despite these challenges, teachers expressed a strong desire to integrate practical work into their teaching process. The study highlighted differences in teachers' opinions based on years of experience and underscored the need for improvements in laboratory facilities and training.

Sevinç Nihal Yeşiloğlu and Fitnat Köseoğlu (2020) examined epistemological problems underlying pre-service chemistry teachers' aims in using practical work in school science. The findings categorized participants' aims into six themes: providing learning through discovery, verifying scientific theory, making scientific theories concrete, developing students' scientific process skills, fostering an understanding of the nature of science, and enhancing curiosity and motivation toward science. The study discussed epistemological problems associated with these aims and recommended explicit integration of epistemology into science teaching approaches and practical work methodologies.

Arnejo et al. (2021) examined students' perceptions of science laboratory functionality in Zamboanga del Sur National High School. The study sought to determine whether students viewed functional science laboratories as advantageous or disadvantageous. Results indicated that students recognized the importance of functional laboratories, though they faced difficulties in physics, biology, and chemistry experiments. STEM students seldom used laboratories for experiments but acknowledged the benefits of functional labs, especially for those pursuing medical courses in college. The study concluded that STEM students found it challenging to learn specialized subjects without laboratory facilities.

Rationale of the study

A comprehensive understanding of the profile of science teachers and the obstacles they encounter in conducting practical activities is vital for enhancing the quality of science education in Mizoram. However, the efficacy of science education is frequently undermined by inequities in teacher qualifications, insufficient infrastructure, and financial limitations. This study aims to address these challenges by investigating disparities in the academic and professional qualifications of science teachers across various school management types. The study further seeks to explore employment status and the teaching experience of science teachers as these factors play a pivotal role in delivering quality instruction. The study also aims to explore the challenges faced by science teachers in conducting practical experiments.

Zohmingliani (2011), in her doctoral research, highlighted the absence of a clear policy for science education in Mizoram, as well as the lack of a robust monitoring mechanism, particularly for evaluating science practical work. She noted that the disproportionate emphasis on theory over practical work from high school to college levels is highly detrimental. In light of these issues, the researcher is interested to investigate the status of science teachers and the challenges they face in conducting science practicals. Consequently, the present study, titled "Analysis of the Profile of Science Teachers and Challenges in conducting Science Practical in Secondary Schools of Mizoram," was undertaken.

Statement of the problem

The statement of the problem is titled as "Analysis of the Profile of Science Teachers and Challenges in conducting Science Practical in Secondary Schools of Mizoram."

Operational terms used in the study

Science Teacher Profile: Science Teacher profile in the present study refers to the educational qualifications, professional training, nature of employment, and teaching experience.

Science Practicals: Hands-on experimental activities conducted in laboratories to enhance conceptual understanding. In the present study, science practical refers to the practicals conducted at secondary stage of education

Challenges : In the present study, challenges means problems and issues faced by science teachers in conducting science experiment.

Objectives of the study

1. To analyse the profile of teachers teaching science subject in the secondary schools of Mizoram.
2. To identify the challenges faced by science teachers in conducting science practical in Mizoram

Method of the study

The present study was carried out with the intention of analysing the profiles of secondary school science teachers in Mizoram\, as well as the challenges faced by them in conducting science practicals. Hence, the researcher has employed descriptive survey for the study.

Population and sample of the study

The population of the study consisted of all Secondary Schools and Science Teachers in Mizoram. Stratified random sampling technique was employed in the present study. A total of 100 Secondary schools were selected keeping in mind the type of management. All science teachers from the selected 100 schools formed the sample of the study.

Tools used for data collection: A questionnaire was developed to study the major challenges faced by science teachers was used to collect data.

Mode of data collection and data analysis: The investigator personally visited 100 schools and took permission from the concerned authorities to collect data. After getting approval, questionnaire was administered to the science teacher after which interviews were conducted.

Analysis and interpretation

Objective No. 1: *To analyse the profile of teachers teaching science subject in the secondary schools of Mizoram*

The Profile of teachers by types of school management is presented in table no. 1.

Table No. 1 : Profile of Science Teachers

		Type of School Management								Total (N=102)	
		Government (N=47) Total		Deficit (N=8)		Samagra (N=15)		Private (N=32)			
Educational qualification	M.Sc.	18	(38.3%)	7	(87.5%)	9	(60%)	13	(40.6%)	47	(46.1%)
	B.Sc.	29	(61.7%)	1	(12.5%)	6	(40%)	15	(46.9%)	51	(50.0%)
	B.E	0	(0.0%)	0	(0.0%)	0	(0.0%)	3	(9.4%)	3	(2.9%)
	Others	0	(0.0%)	0	(0.0%)	0	(0.0%)	1	(3.1%)	1	(1.0%)
Professional Qualification	M.Ed.	1	(2.1%)	0	(0.0%)	1	(6.7%)	0	(0.0%)	2	(2.0%)
	B.Ed.	46	(97.9%)	7	(87.5%)	14	(93.3%)	11	(34.4%)	78	(76.5%)
	D.El.Ed.	0	(0.0%)	1	(12.5%)	0	(0.0%)	1	(3.1%)	2	(2.0%)
	None	0	(0.0%)	0	(0.0%)	0	(0.0%)	20	(62.5%)	20	(19.6%)

Nature of appointment	Regular	45	(95.7%)	8	(100%)	0	(0.0%)	0	(0.0%)	53	(52%)
	Con-tract	2	(4.3%)	0	(0.0%)	0	(0.0%)	0	(0.0%)	2	(2%)
	CSS	0	(0.0%)	0	(0.0%)	15	(100%)	0	(0.0%)	15	(14.7%)
	Private	0	(0.0%)	0	(0.0%)	0	(0.0%)	32	(100%)	32	(31.4%)
Teaching experience	10 yrs and below	19	(40.4%)	4	(50%)	12	(80%)	28	(87.5%)	63	(61.8%)
	11 to 20 yrs	18	(38.3%)	3	(37.5%)	3	(20%)	4	(12.5%)	28	(27.5%)
	21 yrs and above	10	(21.3%)	1	(12.5%)	0	(0.0%)	0	(0.0%)	11	(10.8%)

As shown in Table No. 4.5, the majority of science teachers hold either an M.Sc. (46.1%) or B.Sc. (50%) degree. Government schools have a larger proportion of B.Sc. degree holders (61.7%), while Deficit Schools have a higher percentage of M.Sc. holders (87.5%). In Samagra Schools, 60% of science teachers have an M.Sc. degree, while 40% hold a B.Sc. degree. Private Schools showed a more balanced distribution, with 40.6% holding an M.Sc. and 46.9% holding a B.Sc. Additionally, a small percentage of science teachers in Private Schools (9.4%) hold a B.E. (Bachelor of Engineering) degree, which is absent in other school categories. Only 1% of science teachers belong to the "Others" category i.e. Bachelor in Arts, found only in Private Schools.

A B.Ed. (Bachelor of Education) qualification is the most common professional qualification, held by 76.5% of science teachers as per norms provided by NCTE Regulation 2014. Government (97.9%), Deficit (87.5%), and Samagra Schools (93.3%) have a high proportion of science teachers with a B.Ed., whereas in Private Schools, only 34.4% have B.Ed. degree, indicating a significant gap in professional training. Only 2% of science teachers hold an M.Ed. (Master of Education), suggesting a very low rate of higher professional qualifications among science teachers. A small percentage (2%) have D.El.Ed., found only in Deficit and Private Schools. Notably, 19.6% of science teachers in Private Schools have no professional teaching qualification. This suggests that Private Schools employ a higher number of unqualified science teachers compared to other types of management.

Majority of science teachers (52%) hold regular positions, mainly in Government (95.7%) and Deficit Schools (100%). However, in Samagra Schools, no science teachers have regular appointments, with 100% under CSS (Centrally Sponsored

Scheme) they are employed with co-terminus with the scheme. In Private Schools, all science teachers (100%) fall under private appointments. Only 2% of science teachers are on a contract basis, found exclusively in Government Aided schools.

Most science teachers have 10 years or less experience (61.8%), particularly in Private Schools (87.5%) and Samagra Schools (80%), suggesting a younger teaching workforce in these schools. Government Schools have a relatively balanced distribution, with 40.4% having less than 10 years of experience, 38.3% between 11-20 years, and 21.3% above 21 years. Deficit Schools show a similar trend, with a moderate number of science teachers (50%) in the early career stage. The number of highly experienced science teachers (21+ years) is quite low (10.8%) overall, with the highest percentage in Government Schools (21.3%). Private Schools have no science teachers with more than 21 years of experience, indicating high teacher turnover.

Objective No. 2: *Challenges faced by science teachers in execution of science practicals in Mizoram*

Table No. 2 : Problems of Science Teachers

Problems	Yes/ No	Govt. School (N=47)	Deficit School (N=8)	Samagra School (N=15)	Private School (N=32)	TOTAL (N=102)
Issues related to syllabus load	YES	8 (17%)	1 (12.5%)	3 (20%)	3 (9.4%)	15 (14.7%)
	NO	39 (83%)	7 (87.5%)	12 (80%)	29 (90.6%)	87 (85.3%)
Practical time allotment in the Time table	YES	34 (72.3%)	5 (62.5%)	12 (80%)	19 (59.4%)	70 (68.6%)
	NO	13 (27.7%)	3 (37.5%)	3 (20%)	13 (40.6%)	32 (31.4%)
Problems related to practical equipment	YES	35 (74.5%)	3 (37.5%)	15 (100%)	25 (78.1%)	78 (76.5)
	NO	12 (25.5%)	5 (62.5%)	0 (0%)	7 (21.9%)	24 (23.5%)
Issues related to practical examination	YES	7 (14.9%)	1 (12.5%)	3 (20%)	8 (25%)	19 (18.6%)
	NO	40 (85.1%)	7 (87.5%)	12 (80%)	24 (75%)	83 (81.4%)

Issues related to subject expertise	YES	3 (6.4%)	0 (0%)	0 (0%)	8 (25%)	11 (10.8%)
	NO	44 (93.6%)	8 (100%)	15 (100%)	24 (75%)	91 (89.2%)
Issues related to finance	YES	34 (72.3%)	4 (50%)	13 (86.7%)	15 (46.9%)	66 (64.7%)
	NO	13 (27.7%)	4 (50%)	2 (13.3%)	17 (53.1%)	36 (35.3%)
Problems related to laboratory	YES	18 (38.3%)	3 (37.5%)	11 (73.3%)	20 (62.5%)	52 (51%)
	NO	29 (61.7%)	5 (62.5%)	4 (26.7%)	12 (37.5%)	50 (49%)

The above table no. 2 presents the challenges faced by science teachers in issues related to syllabus load, time table, availability of equipment, examinations, subject expertise, financial problems, and laboratory across the different school types.

One of the least significant problems reported by science teachers is syllabus load. Only 14.7% of science teachers across all school types found it challenging. Among them, Samagra School science teachers reported the highest difficulty (20%), followed by Government Schools (17%), Deficit Schools (12.5%), and Private Schools (9.4%). This suggests that the syllabus is generally manageable for most science teachers.

Issues concerning allotment of time for practical in the time table are widespread, with 68.6% of science teachers facing difficulties in scheduling?. The problem is most prevalent in Samagra Schools (80%), Government Schools (72.3%), Deficit Schools (62.5%), and Private Schools (59.4%).

The availability of practical equipment is another significant challenge, with 76.5% of science teachers reporting issues. Samagra Schools are the most affected, with all science teachers (100%) from Samagra school appealed a lack of adequate equipment. Private Schools (78.1%) and Government Schools (74.5%) also face serious shortages, while Deficit Schools experience relatively fewer problems (37.5%).

The issues regarding practical examinations are reported by only 18.6% of science teachers. The issue is most prominent in Private Schools (25%), followed by Samagra Schools (20%), Government Schools (14.9%), and Deficit Schools (12.5%). The majority of science teachers do not find practical examinations particularly problematic.

Concerns related to subject expertise are the least reported, with only 10.8% of science teachers facing issues. Private Schools have the highest complaints in connection with subject expertise (25%), while no science teachers from Deficit or Samagra Schools expressed concerns. This suggests that, overall, science teachers in most schools are adequately qualified to handle practical subjects.

Issues related to financial problems are significant concerns, affecting 64.7% of science teachers. The highest percentage of financial difficulties is reported in Samagra Schools (86.7%), followed by Government Schools (72.3%), Deficit Schools (50%), and Private Schools (46.9%). The data indicates that financial constraints are a major barrier, particularly for purchasing required practical equipment in Government and Non-government schools

Lastly, laboratory problems are reported by 51% of science teachers, with Samagra Schools experiencing the highest percentage (73.3%), followed by Private Schools (62.5%), Government Schools (38.3%), and Deficit Schools (37.5%). This suggests that many schools lack proper laboratory infrastructure and resources, which can hinder students' learning experiences in science subject.

Findings and discussions

Findings in relation to Secondary Schools Science Teacher's Profile in Mizoram

Educational Qualification: Most science teachers in government and deficit schools hold B.Sc. or M.Sc. degrees. Private schools, however, have a more diverse teaching workforce, including a small percentage of B.E. and other degree holders.

Professional Qualification: Government and deficit schools employed a high percentage of B.Ed.-qualified teachers, while private schools have a significant proportion of unqualified science teachers (19.6%).

Nature of Appointment: Regular appointments are predominant in government and deficit schools, whereas Samagra schools fully rely on CSS funded employees, and private schools operate solely with privately appointed teachers.

Teaching Experience: Government schools have a balanced mix of experienced and early-career science teachers. In contrast, private and Samagra schools primarily employ young teachers with high turnover rates.

Discussions

The study highlighted significant disparities in the qualifications and experience of science teachers across Mizoram's school types. Government and deficit schools employ teachers with higher professional qualifications, such as B.Ed. degrees, while

private schools often rely on unqualified teachers. This raises concerns about the quality of science education in private institutions, echoing findings by Childs and McNicholl (2007), who noted that teachers lacking pedagogical knowledge struggle to deliver effective lessons. Additionally, government and deficit schools offer more stable teaching positions, whereas Samagra and private schools depend on contractual or temporary staff, leading to high turnover rates. Research by Salvan and Hambre (2020) suggests that teacher stability is crucial for consistent student outcomes, emphasizing the need for addressing these disparities.

Findings in relation to Challenges faced by Science Teachers in Mizoram

Science teachers across all school types faced challenges, including a lack of practical equipment and financial constraints. Issues related to laboratory facilities and scheduling practical classes are particularly prevalent in government and Samagra schools. However, concerns regarding subject expertise and syllabus load were relatively minor. The findings emphasized the need for better resource allocation, improved scheduling, and increased financial support to enhance the quality of science practical education.

Discussions

A key challenge is the lack of practical equipment and financial constraints, particularly in government and Samagra schools. Inadequate laboratory resources and difficulties in scheduling practical classes hinder hands-on learning, aligning with Braund and Driver (2005), who emphasized the importance of practical work in enhancing students' understanding of scientific concepts. Financial constraints, limited materials, and large class sizes further intensify these issues, as noted by Malathi and Rohini (2017) and Jalal (2019). While Mizoram's teachers revealed sufficient subject knowledge, infrastructure deficiencies limit their ability to conduct effective practical sessions. The study emphasizes the need for improved resource allocation, better scheduling, and increased financial support for practical science education. Arnejo et al. (2021) highlighted the benefits of well-equipped laboratories, reinforcing the necessity for functional labs in Mizoram's schools. Policymakers should prioritize investments in laboratory infrastructure, provide professional development for teachers, and ensure equitable resource distribution across school types.

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