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# Science Education in Bangladesh: A Qualitative Review of Progress, Challenges, and Policy Prospects

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## Abstract

*This study examines the situation of science education in Bangladesh, analyzing the effects of government changes and concentrating on the educational system's difficulties. The study sheds light on curriculum, teacher preparation, and resource availability to enhance science education in both urban and rural settings. Semi-structured interviews, policy analysis, and a review of the literature were all part of the qualitative research methodology. In addition to interviews with elementary and secondary science teachers throughout Bangladesh, information was obtained from pertinent educational policies, scholarly publications, and reports. Teachers' opinions on the difficulties of teaching science, the availability of resources, and the efficacy of governmental reforms were all examined in the interviews. Recurring themes and patterns were found using thematic analysis. Results show that access to science education has increased, while there are still issues, especially in rural areas. Inadequate teacher preparation, a lack of resources, and an antiquated curriculum that impedes inquiry-based learning are major problems. Regional inequities and gaps in teacher skills persist despite government initiatives to promote digital education and infrastructure. To raise the standard of science education, the report emphasizes the necessity of ongoing investments in infrastructure upgrades, curricular reforms, and teacher development. A small sample size that might not accurately represent all regional contexts and possible bias in self-reported data are among the limitations. With its useful suggestions for resolving the issues and enhancing science instruction in Bangladesh, this study provides insightful information for researchers, educators, and policymakers.*

**Keywords**: *Science education; Bangladesh Teacher Training; Curriculum reforms; educational disparities.*

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## Introduction

An important factor in determining a nation's economic growth and technical advancement is science education. Science education has emerged as a crucial area of attention in Bangladesh since the country's rapidly growing population and changing global needs necessitate a highly qualified workforce. The Bangladeshi government has implemented many reforms over the years to raise the standard of science education, such as curriculum revisions, digital learning projects, and more teacher preparation [1],[2],[3].

However, despite these developments, there are still large gaps in the efficient application of these regulations, especially in rural areas where infrastructure issues and resource limitations continue to lower the quality of education. The possibility for this study to offer a thorough grasp of the condition of science education in Bangladesh now is what makes it significant [4],[5].

This study intends to add to current conversations regarding educational reforms by highlighting both the achievements and the difficulties encountered. It also provides insightful information that can direct future policymaking. Notwithstanding initiatives to enhance science instruction, major obstacles such as restricted access to learning materials, insufficient training for teachers, and out-of-date curricula continue to exist in many Bangladeshi schools, impeding students' ability to develop critical thinking and scientific inquiry abilities [6],[7],[8],[9].

The disparity in the quality of science education is made worse by the infrastructure and educational access gaps between urban and rural communities. Although several studies have examined Bangladesh's educational system as a whole, less attention has been paid to the particular difficulties in teaching science, especially in rural areas. Moreover, there hasn't been a thorough assessment of the success of current government programs in science education [10],[11],[12],[13].

By examining the effects of governmental reforms and identifying significant obstacles to the efficient delivery of science education in both urban and rural settings, this study seeks to close this gap. This study's main goals are to examine the situation of science education in Bangladesh today, analyze the difficulties teachers and students encounter, and assess the results of government programs meant to enhance science instruction.

By combining urban and rural viewpoints on science education in Bangladesh, this study offers a fresh viewpoint on a topic that has received little attention in previous studies. It offers a distinct perspective on the intricacies of science education in a developing nation by concentrating on the relationship

between curriculum revisions, teacher professional development, and resource availability. The study also offers practical suggestions for enhancing scientific instruction, with an emphasis on bridging the gap in resources and reducing the urban-rural divide.

## Method

This study employed a qualitative research methodology to investigate the current state of science education in Bangladesh, identify existing problems, and evaluate the effectiveness of government programs and reforms aimed at improving the field. The research methodology encompasses a literature review, interviews with educators, and an analysis of relevant educational policies. The literature review involved a thorough examination of previous studies, reports, and scholarly articles on science education in Bangladesh to identify historical trends, significant policy shifts, and challenges within the educational system [14],[15].

Semi-structured interviews were conducted with science educators from urban and rural schools across various educational levels to gather insights into the challenges they face, the availability and quality of resources, the impact of teacher training, their perceptions of the national curriculum, and the role of government initiatives. The analysis of educational policies and reforms involved reviewing documents such as the Science and Technology Policy, the Education Policy of 2010, and curriculum modifications by the National Curriculum and Textbook Board to assess their effectiveness in addressing key issues [16],[17]. Data collected from interviews and the literature review was analyzed using thematic analysis, involving data organization, coding, theme development, and interpretation to understand the challenges and potential solutions for improving science education in Bangladesh.

Ethical considerations, including informed consent and ensuring confidentiality, were paramount throughout the research process. While this study aims to provide a comprehensive analysis, it acknowledges limitations such as the potential for bias in self-reported data and the generalizability of findings due to its qualitative nature.

## Result and Discussion

## Historical Development of Science Education

Bangladesh's educational system has its roots in the British colonial era, when elites, mostly in urban areas, were the only ones allowed to receive an education. Bangladesh inherited an education system that was inadequate to meet the demands of a newly independent country after gaining independence in 1971. At first, the main priorities were increasing access to education in rural areas, raising literacy rates, and repairing the educational infrastructure [18],[19], [20],[21].

Bangladesh experienced a serious dearth of resources and qualified teachers throughout the 1970s and 1980s. Nonetheless, several national measures were implemented to enhance the educational system in the years after independence. Among the first measures taken to address these educational issues were the creation of science-focused schools, the introduction of the national curriculum, and the recognition of basic education as a fundamental right [22],[23],[24],[25],[26].

## The Growth of Science Education

Since gaining independence, science education in Bangladesh has undergone multiple stages of development. The government started concentrating on adding science courses to the primary and secondary curricula in the 1980s and 1990s. With a focus on topics like physics, chemistry, biology, and subsequently computer science, efforts were undertaken to increase the accessibility of science texts and resources [27],[28],[29],[30],[31].

A new national curriculum was introduced in the 1990s to promote a more thorough grasp of science and technology. The introduction of the Secondary School Certificate (SSC) and Higher Secondary Certificate (HSC) exams, in which science courses were crucial, was a noteworthy accomplishment. Students were encouraged to seek professions in science, technology, engineering, and mathematics (STEM) industries as a result of the curriculum's extension to incorporate a wider range of science courses [32],[33],[34],[35].

## Current State of Science Education

Over 16 million pupils are currently enrolled in elementary schools in Bangladesh, and enrollment rates have significantly improved, particularly for girls. But there are still issues, especially with science education. Science is a required topic in elementary and secondary education, and students are expected to study a variety of scientific subjects [36],[37],[38].

The National Curriculum and Textbook Board (NCTB) creates Bangladesh's science curriculum and modifies it frequently to reflect international developments. Depending on the educational level, there are various tracks within the science curriculum. Depending on their interests and intended professional path, junior secondary and senior secondary school students can select science courses such as biology, chemistry, physics, and math's. Nevertheless, a shortage of qualified scientific teachers, out-of-date textbooks, and inadequate lab space make it difficult for many schools to successfully apply this curriculum despite these efforts [39],[40].

Table 1. Overview of the Bangladeshi Education System

| Age | School Year | Formal Educational Level | Types of Education |
|---|---|---|---|
| **5–6** | 1–2 (2 years) | Kindergarten | General schools (Kindergarten), Islamic schools (Raudatul Athfal) |
| **7–12** | 3–8 (6 years) | Elementary school | General schools (Primary Schools), Islamic schools (Madrasah Ibtidaiyah) |
| **13–15** | 9–11 (3 years) | Junior secondary school | General schools (Junior Secondary Schools), Islamic schools (Madrasah Tsanawiyah) |
| **16–18** | 12–14 (3 years) | Senior Secondary School | General schools (Senior Secondary Schools), Vocational Schools (Vocational Secondary Schools), Islamic schools (Madrasah Aliyah) |

Table 2. Overview of the Bangladeshi Tertiary Education System

| Age | School Year | Formal Educational Level | Types of Education |
|---|---|---|---|
| **19–22** | 4 years | Undergraduate | Academic education program (Bachelor's degree), Vocational education program (Diploma degree) |
| **22–23** | 2 years | Graduate | Academic education program (Master's degree), Professional education program, Specialist education program, Applied master's program (from vocational education) |
| **24–26** | 3 years | Post-graduate | Academic education program (Doctoral degree), Applied doctoral program (from applied master program) |

## Challenges in Science Education

Several challenges impede the growth of science education in Bangladesh. These include:

- **Resource Limitations:** Textbooks, digital resources, and necessary lab equipment are scarce in many schools, particularly in rural areas. This dearth of resources has a major impact on students' capacity to participate in real-world, experiential science learning [41],[42].
- **Teacher Training:** The credentials and training of educators have a direct impact on the caliber of science instruction. Many teachers may find it difficult to stay up with scientific and technological breakthroughs because they lack sufficient subject-specific training [43].
- **Inequality in Access:** The standard of science education in urban and rural areas differs noticeably. Lower academic achievement in science courses is a result of rural schools' frequent underfunding and shortage of trained teachers [43],[44].
- **Outdated Curriculum and Teaching Methods:** Although the curriculum is updated frequently, it frequently stays unduly theoretical, and many instructors still use antiquated teaching techniques. Inquiry-based learning, which is essential for developing students' critical thinking and problem-solving abilities, is not given enough attention [45],[46].

## Government Initiatives and Reforms

In response to these challenges, the Bangladesh government has introduced several key reforms aimed at improving science education. Some notable initiatives include:

- The Education Policy of 2010: The foundation for Bangladesh's extensive educational reforms was laid by this initiative. It sought to improve the standard of science instruction at all levels and underlined the significance of STEM education. The proposal recommends increasing funding for science education and enhancing programs for preparing teachers [47].
- Digital Education: The government has concentrated on advancing digital education in tandem with the growth of information and communication technology (ICT). Students now have greater access to resources and possibilities for learning science thanks to the advent of online courses, digital content, and e-learning platforms [48],[49].
- Science and Technology Policy: To transform Bangladesh into a knowledge economy based on science, the government put into effect a Science and Technology Policy in 2011. This strategy aims to enhance research and development, develop a workforce with the necessary skills to meet the demands of a contemporary economy and support science and technology education at all levels [50],[51].
- Public-Private Partnerships: To enhance science education, the government has collaborated with some non-governmental organizations, international organizations, and private establishments. These partnerships have resulted in the creation of science clubs, model schools, and educational initiatives that expose children to the real-world applications of science [52],[53].

## Future Prospects

The future of science education in Bangladesh hinges on several factors, including:

- Teacher Training Improvement: To raise the standard of science education, teacher education programs must be improved to place a greater emphasis on science pedagogy and practical teaching methods.
- Infrastructure Investment: The government must make investments in modernizing lab facilities and guaranteeing that schools, especially those in rural regions, have access to cutting-edge scientific equipment to promote practical science instruction.

- Encouraging Inquiry-Based Learning: Students' critical thinking and problem-solving skills will be enhanced in science classrooms by a shift away from rote memorization and toward inquiry-based, experiential learning.
- Equity in Access: Closing the educational attainment gap between urban and rural areas requires that all children, irrespective of their location or socioeconomic background, have access to high-quality science instruction.

## Conclusion

Science education in Bangladesh has made significant progress over the years, with increased access to education and government reforms aimed at improving the quality of science instruction. However, problems still exist, especially in rural places where access to contemporary educational infrastructure is restricted, teacher preparation is insufficient, and resources are scarce. To encourage inquiry-based learning and critical thinking, the government has made progress in developing curricula and implementing digital learning, but more reforms in curriculum delivery, improved access to laboratory resources, and ongoing investment in teacher professional development are still required.

These major issues must be resolved if science education in Bangladesh is to continue to advance. To better meet international educational standards, the government must prioritize modernizing the science curriculum, guaranteeing fair access to resources, and bolstering teacher preparation programs. Furthermore, encouraging cooperation between the public and private sectors can aid in enhancing the infrastructure of education, particularly in places that get insufficient funding. Future research should concentrate on assessing how curriculum changes and teacher preparation programs affect student outcomes over the long run. Furthermore, studies contrasting scientific instruction in urban and rural areas may shed light on how to resolve differences in educational quality and access.

## Author Contributions

**Elias Ahmed**: Conceptualization, Methodology, Writing – review & editing, Supervision, Project administration. **Mahmudulhassan**: Methodology, Writing – review & editing, Investigation. **Saif Uddin Ahmed Khondoker**: Conceptualization, Methodology, Writing – review & editing, Investigation.

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## Conflict of Interest

The authors declare no conflicts of interest.

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