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Editorial

A New Chapter in NAEM's Research Journey

The National Academy for Educational Management (NAEM) is delighted to present the much-anticipated volumes 34, 35, 36, and 37 of its Research Journal.

This current volume (Volume-36) encapsulates groundbreaking research on pivotal issues in education. Notable contributions explore the use of Artificial Intelligence (AI) tools to enhance Formative Assessment in Secondary and Higher Secondary Education and Teacher Training. The articles also delve into the usefulness of Entrepreneurship Education, forging vital links between learning and real-world applications. Additionally, this issue also covers some more important articles related to education and classroom teaching like climate change, outcome-based education, formative assessment etc.

We are immensely grateful to the researchers and editorial teams whose efforts have enriched these volumes. Our heartfelt thanks also go to the Director General of NAEM and to the Ministry of Education for their generous funding and continued support, enabling us to contribute to Educational Development in Bangladesh.

Moving forward, NAEM reaffirms its commitment to promoting research excellence and ensuring regular journal publications.

Prof. Dr. Ummay Asma
Director, Research & Documentation Division
Editor, NAEM Journal

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Use of Artificial Intelligence (AI) Tools to Facilitate Formative Assessment in Secondary, Higher Secondary Education and Teachers' Training Colleges in Bangladesh

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Abstract

The use of Artificial intelligence (AI) is the ability of a computer or a robot controlled by a computer to do tasks that are usually done by humans because they require human intelligence and discernment. Through the present study, researchers assesses the applicability of AI tools for the purpose of assessment in the secondary and higher secondary level in Bangladesh. The method of the study is survey based descriptive approach. The objectives of the study are as: to assess the needs and initiatives for AI-Driven Skill for Formative Assessment Evaluation Process; to explore the preparedness for inclusion AI for Formative Assessment in Secondary and Higher Secondary Education and Teacher's Training Curriculum; and to Identify the needs to enhancing Capacity Building of the Teachers at the Teacher's Training Curriculum. The data collection instruments are used as questionnaires, observation schedule and Focus Group Discussion (FDG). The sample size of the study is 100 where teacher's trainer 20, Teachers of secondary and higher secondary level 40 and the students of secondary and higher secondary level 40. The major findings are as: Most of the teachers (90%) have the available idea about Artificial Intelligence (AI) for the student's assessment and given the importance to include the AI mechanism in the curriculum; the teachers express that the AI tools should be included in the curriculum to face the future generation. Without the inclusion of AI tools in the curriculum the teachers are not properly familiar with those tools; and all teacher trainers believe that if they introduce the AI tools then the students skillfully apply it for their learning purpose. The recommendations of the study are as: Artificial Intelligence (AI) should include for the students continuous assessment for given the importance to include the AI mechanism in the present curriculum. Artificial intelligence is developed as human activities through the setup program of human. The tools are able to design as assignment writing makes quiz, short question, paraphrase etc. AI takes solve the problem within short time and plays the importance rules for students teaching learning activities. This study helps the planner to plan regarding 4iR period and making smart Bangladesh within 2041

Key Word: AI= Artificial intelligence; CA= Continuous Assessment, BI= Behavioral Indicators PI= Performance Indicators

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Introduction:

Artificial Intelligence (AI) is the ability of a computer or a robot controlled by a computer to do tasks that are usually done by humans because they require human intelligence and discernment. Although there are no AIs that can perform the wide variety of tasks an ordinary human can do, some AIs can match humans in specific tasks. Researcher able to focus on Al as an intel ligent components such as learning, reasoning, problem solving, perception, and using language.

(AI and Formative Assessment – CIRCLS_ 25.09.2023) The write up explore how can AI tools is well-sited for formative assessment. AI tools able to explain the Formative assessment for the secondary level teachers and students such as (i) AI can offer individualized feedback on specific content;(ii) AI can offer individualized feedback that helps students learn how to learn; (iii) AI can provide meaningful formative assessment outside of school; and (iv) AI might be able to assess complex and messy knowledge domains.

The primary purpose of formative assessment is to improve learning, not merely to grade or to audit it. It is assessment for learning rather than assessment of learning. Formative assessment is both an "instructional tool" that teachers and students "use while learning is occurring" and "an accountability tool to determine if learning has occurred". In other words, to be "formative," assessments must inform the decisions that teachers and students make minute by minute in the classroom. The basic indicators of formative assessment mention as are: (i) Shared learning targets and criteria for success; (ii) Feedback that feeds learning forward; (iii) Student self-assessment and peer assessment; (iv) Student goal setting; (v) Strategic teacher questioning; and (vi) Student engagement in asking effective questions.

Statement of the problem

AI tools can help teacher and teacher educators by answering every common question, resolving the different issues, and providing a seamless experience for stakeholders. This not only helps improve stakeholder's satisfaction but can also free up time for their service team to focus on more complex problems for evaluation.

The AI tools that the researchers used in the present study with the purpose of formative assessment in the secondary and higher secondary level

Rational of the Study

The assessment and evaluation system of secondary school and teacher training education is so correlated to assess the effectiveness of national aims and objectives of Bangladesh. (Islam F. and Mahmud R. 2006) The prescribe study try to explain the present status of secondary level teacher training/education in Bangladesh. Effective teacher education is a key factor in ensuring quality school education and teachers-training activities. The objectives of the teacher education program are to produce trained teachers-effective teaching-learning process for the existing secondary level educational institutions of the country. The research study discloses existing teacher education situation in Bangladesh for secondary level schools (Schaffner, J., Glewwe, P. and Sharma, U., 2021). The chart-01 is used for the evaluation of

teaching and training process according to the objectives of the respective program. Within the three windows (Examples, Capabilities and Limitations) and sub-windows of them as (i) Examples: Explain quantum computing in simple terms, Got any creative ideas for a 15 year old's birthday, How do I make an HTTO request in Javascript? (ii) Capabilities: Recall what kind of user said earlier in the conversation and allows the user to provide follow-up corrections and trained to decline inappropriate requests; (iii) Limitations: May occasionally generate incorrect information, may occasionally produce harmful instructions or biased content, limited knowledge of world and events after 2021. The proposed of the article is to assess the relation between the teacher-students activities of secondary school and teacher-training evaluation existing evaluation system with the help of the model. The study also assess the relationship among the improvement of teacher education, teachers administration and management, natures of students, admission mechanism, curriculum and syllabus, assessment system, in-service and pre-service training, quality of teacher education, problems and solutions of secondary teacher education in Bangladesh. The study "Use of Artificial Intelligence (AI) Tools to Facilitate Formative Assessment in Secondary and Higher Secondary Level in Bangladesh" is so relevant to assess the present assessment scenario about teacher training process and the secondary level school of Bangladesh.

Objectives:

The objectives of the study are: a) To assess the needs and initiatives for AI-Driven Skill for Formative Assessment Evaluation Process; b) To explore the preparedness for inclusion AI for Formative Assessment in Secondary and Higher Secondary Education and Teacher's Training Curriculum ; c) Identify the needs to enhancing Capacity Building of the Teachers at the Teacher's Training Curriculum; and d)To recommend an institution and legal framework to create enabling environment in order to support AI for Formative Assessment in Secondary Higher Secondary level Education and Teacher's Training

Scope of the study

The scope of Artificial Intelligence (AI) in the secondary level education is essential to ensure the quality education and as well as to build the Smart Bangladesh. The existing teaching-learning assessment system faces to threat for proper judgment of students, teacher and examination activities. According to the World Bank report, Bangladesh has made remarkable achievements over the past few decade by ensuring access to education at all levels and especially for girls. The country's net enrollment rate at the primary school level increased from eight percentages in 2000 to hundred percentage in 2015. Bangladesh has the great achievement about gender parity in access to primary and secondary level. The overall adult literacy rate is 72.3% up to the year 2016. 2.3 billion free books are distributed since 2011. There are approximate 37 million total students in Bangladesh whereas 17 million students received scholarship and stipends. There are 32,000 educational institutes with the multimedia classroom. Bangladesh, like many other countries, is investing greatly in the education system considering as one of the core strategies to alleviate poverty and facilitate development including raise the ICT skills of Bangladeshis and move towards the information

society. There are some problems regarding the skill and education sector. AI-driven future skill development, capacity building of teachers, the establishment of AI lab, implementation of predictive intelligence system, the formation of AI-supported legal can solve the problem.

Background

Teachers Training Colleges (TTC) of Bangladesh provide the training of the secondary level teacher who works overall the area of the Country. Government teacher training colleges follow the syllabus and curriculum to fulfill the demand of the teachers of secondary level educational institutions. According to the objectives of teachers training colleges of Bangladesh, TTC would apply the assessment procedures during their training period. The TTC can built the trainees (secondary level teachers) for satisfaction of secondary level schools or institutions. It is the target of trained teacher that after completion of the training program, trained teachers would apply the prescribe assessment and evaluation method for the betterment of the students. With the help of the AI mechanism the monitoring and evaluation of teacher training colleges and the secondary level school able to obey the mechanism for the betterment of students and teachers. Some of the AI technique may able to assess the model such as (i) translation; (ii) write articles; (iii) answer the questions as direction; (iv) can write the code of any program, such as C++; and (v) Debug. The AI model is able to fine-tuned for the desire activities or domains and allow it to perform wide range of applications. One potential downside of the model is that, like other machine learning models, it is good machine when preserved the data according to program related. If the training input data contains biases or inaccuracies, the model may produce the outcome in the biases approaches. The requirement of the formative assessment are explained as (i) the approaches allow to adapt instructional based results, making modifications and improvements of the evaluation process that will produce immediate benefits for our students' learning. (ii) Formative assessments give our students evidence of their current progress to actively manage and adjust their own learning. This also provides our students the ability to track their educational goals. (iii) Formative assessments give us the ability to provide constant feedback to our students. **(https://www.naiku.net/blog/importance-of-formative-assessment/_08.10.2023)**

Literature Review:

The literature review is the important activities of the research work in any related work. Literature review help the researcher to find-out the research gap of the prescribe study. The following literature can help the find-out the gap of the above mention topic. **(Emmanuel Chinonso Opera, 2023)** In the field of education artificial intelligence is treated as the use of information and communication tools for improving the teaching learning mechanism. Machine intelligence and communication technology help the learners for achieving the learning domain and change the attitude of assessment & evaluating psychology. Students will be able to evaluate themselves of their learning capacity face to face through AI.

(Schaffner, J, Glewwe, P and Sharma, U, 2021) The assessment of secondary level school and teacher training college in Nepal examined the impacts of the School Sector

Development Program (SSDP) training for the subject of Math and science teachers. The aim of the study was to measure the internal positive and negative activities of the program's structure and execution. **(European Commission, 2022)** The Europe AI system is used for improving the classroom situation and it is used for different ways to support teaching, learning and assessment/evaluation activities. AI is given the greater opportunities for the school teachers, administrator to improve the existing situation of teaching-learning activities. The evidenced based research about AI has some limitation. Machine teaching-learning based artificial intelligence is more powerful. The technique can actually learn and become better over time, consequence as they involve with large, multi-dimensional datasets. In these mechanisms of education, machine teaching-learning based artificial intelligence tools can be utilized for a variety of tasks as: (i) monitoring students' activities (ii) creating models that accurately explain student outcomes.

Adiguzel, T., et al (2023). AI introduces new techniques to the educational environment with the potential to transform conventional teaching and learning processes. This study paper offers a comprehensive overview of AI technologies, their potential applications in education, and the difficulties involved. Chatbots and related algorithms that can simulate human interactions and generate human-like text based on input from natural language are discussed. ***Trust,T. et al (2023),*** This paper recommended the following issues with AI integration practices for teacher educators as (i) provide pre-service and in-service teachers with opportunities to critically interrogate and interact with AI technologies in ways that allow them to make informed decisions about their use in education;(ii) Provide opportunities for pre-service and in-service teachers to reflect upon and rethink their practices in the era of AI technologies; (iii) Role model how to critically evaluate the teaching materials and information generated by AI writing tools, such as ChatGPT; (iv) Encourage pre-service and in-service teachers to embed AI education into their practices; and (v) Increase transparency in teaching and learning. **Zhai, X, Chu 1X et al (2021)** Artificial Intelligence (AI) has applied to the education sector and explore the potential research trends and challenges of AI in education. This study explain 100 papers including 63 empirical papers (74 studies) and 37 analytic papers were selected from the education and educational research category of Social Sciences Citation Index database from 2010 to 2020. The content of the study analysis showed that the research questions could be classified into development layer (classification, matching, recommendation, and deep learning), application layer (feedback, reasoning, and adaptive learning), and integration layer (affection computing, role-playing, immersive learning, and gamification). **Tira Nur Fitria (2021),** Artificial Intelligence (AI) helps process daily activities including teaching and learning in the field of education. The objective of the study is to investigate Artificial Intelligence (AI) in education, especially in the teaching and learning process. The study result shows that AI has been widely applied to various educational technology platforms such as 1) Virtual Mentor, 2) Voice Assistant, such as Google Assistant (Google), Siri (Apple), and Cortana (Microsoft). 3) Smart Content, 4) Presentation Translator. 5) Global Courses, for example, MOOCs, Udemy, Google AI, Alison, Khan Academy, edX, Udacity, Coursera, etc. 6) Automatic Assessment, 7) Personalized Learning for examples Ruangguru, etc. 7) Educational games, 8) Intelligent Tutoring System (ITS) or Intelligent ComputerAided Instruction (ICAI).

Artificial Intelligence (AI) is the producers of modeling human thinking and designing a machine so it can behave as humans. **(Kengam**, J, 2020) Artificial Intelligence can be used and is being used in Educational sector. During the 21th International Conference on Artificial Intelligence in Education held in 2020, The impact of AI in education and its pros and cons are presented here. AI also describes a specific way to develop AI enabled platform for education and finally the after effects of AI in education.

(Education Technology, 2023)To include AI approaches in the education, healthcare, ethical, equitable policies should adopted with the consideration of the following issues:

(i) Leverage automation to advance learning outcomes while protecting human decision making and judgment;(ii) interrogate the underlying data quality in AI models to ensure fair and unbiased pattern recognition and decision making in educational applications, based on accurate information appropriate to the pedagogical situation; (iii) enable examination of how particular AI technologies, as part of larger edtech or educational systems, may increase or undermine equity for students; and (iv) take steps to safeguard and advance equity, including providing for human checks and balances and limiting any AI systems and tools that undermine equity.

Methodology:

This study is basically qualitative and descriptive approaches to assess the readiness of the secondary level teachers **(Class X to XII)**, students and evaluation process of government teachers training colleges. The procedures of data collection from (i)Teacher's Trainers,(20) (ii) Teachers of secondary and higher secondary level (40) and (iii) Students of secondary (Class IX and X) and higher secondary (Class XI and XII) level (40).

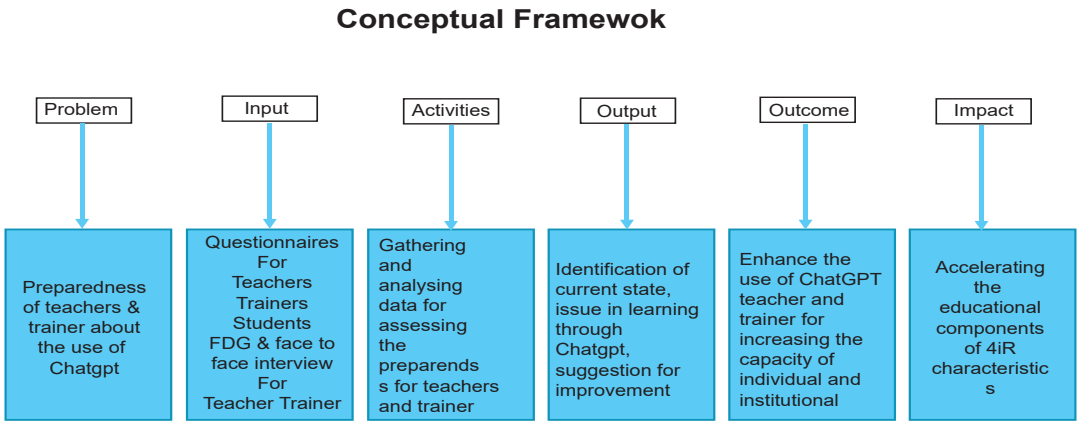
Population

The three types of population are considering in the following study: (a)The total secondary levels of students who have the knowledge about AI; (b) The total number of secondary level teachers who have the AI knowledge; and (c) Total number of trainers of Govt. Teachers Training College teachers who able to apply the AI knowledge/tools. The data were collected from primary and secondary sources. The data were also presented in the four approaches such as: (i) Descriptive approaches; (ii) Tabular approaches; (iii) Graphical approaches and (iv) Statistical presentation approaches.

Conceptual Framework of the study

With the following Conceptual Framework the secondary education and teacher training college's assessment mechanism correlated one to another.

Chart-01: Conceptual Framework



Data Analysis and Interpretation:

Artificial Intelligence (AI) in higher education presents both significant obstacles and transformative prospects. Although AI-powered solutions offer faster administrative procedures and individualized learning experiences, there may be issues with algorithmic bias, data privacy, and other issues. The present study assess the situation of Artificial Intelligence about secondary and higher secondary level teachers, students and teachers trainers of teachers training colleges preparedness for upcoming future. To achieve the global educational requirement for the year 2030 and 2041, teacher, students and teachers adopt the digital or technological support. Data are collected for the study by using questionnaires of teachers, students and teachers trainers of teacher's training colleges. Again some the qualitative data collection through FDG (Foucs broup Dpeussion) and interview schedule with the consideration of set objectives. The four specific objectives are setting for the study of "Use of Artificial Intelligence (AI) tools to Facilitate learners for continuous Assessment in Secondary , Higher Secondary and Teachers' Training Colleges in Bangladesh". The data are presenting the following three sub-chapters as:

AI driven tools for Continuous Assessment Evaluation

The three types of stakeholders given the information through the survey based questionnaire and FDG & observation schools. The stakeholders are secondary and higher secondary students, teachers of secondary and higher secondary level and the teachers' trainer of teachers' training colleges of Bangladesh.

Most of the students (Bing=25%, Grammarly 50%, Question Well= 37.5%, ChatGPT= 62.5% and Prepared MCQ question= 37.5%) given the opinion for the use of AI tools about Transcript evaluation are possible.

All the students of secondary and higher secondary expressed that AI tools should include in the present curriculum for build-up the Smart Bangladesh.

Table-01: Teacher Knowledge about AI

Knowledge about AI	No of respondents	Percentage
Yes	36	90%
No	04	10%
Total	40	100%

The table indicates that most of the teachers (90%) have the available idea about Artificial Intelligence (AI) for the student's assessment and given the importance to include the AI mechanism in the curriculum.

Teacher's comments on Students assessment

The teacher's comments about the AI tools for student's continuous assessment through the FGD techniques as:

Artificial intelligence is the tool that acts as human activities through the setup program of human. The tools able to as the human assessment related activities such as assignment writing make quiz, short question, paraphrase etc. AI takes decision in different types of critical issues within short time. It is remarkable contribution regarding research work for the future generation. It also plays the importance rules for students teaching learning activities.

Teacher's idea about continuous assessment

Teachers adopt the different strategies changes for developing program for continuous assessment techniques such as assignment, quiz, short questions development for student's assessment. Otherwise, continuous assessment is the continuous and short term or even periodic assessment to keep students actor throughout the period. The teachers also said that it is the assessment strategies that indicate the student's gradual achievement in respective classes or grade. Some the teachers' said that continuous said that continuous assesses indicate the class test, homework, assignment, group work, class test etc.

The teachers' trainer's comments on AI

AI is the Artificial Intelligences that man use their intelligence through the computer or software for their respective purpose; Artificial intelligence is the technology work as human nature and solve the different types of answer with the AI tools; It is the tools that human instructed as natural activities. It gives information automatically getting an instruction and proceeds toward the 4iR period with the help of AI activities.

Model 02: Regression Model for the students to properly use AI tools in their teaching-learning activities

Model	Unstandardized Coefficients		t	Sig.
	B	Std. Error		
(Constant)	.359	.411	.873	.388
X_1= ICT teachers able to give idea about AI tools in in the classroom	.282	.126	2.237	.032*
X_2 =students utilized IT for the associate for teaching learning activities.	.031	.151	.202	.841
X_3= AI is able to assesses the continuous assessment to satisfy the indicators of curriculum	.283	.165	1.709	.096*

*p value < 05% or 0.05 level significant

Dependent variable(Y): In the present situation, educational institutions able to apply AI tools for continuous /formative assessment.

$$\mathbf{Y= a+ b1X_1+b2X_2+ b3X_3}$$

$$\mathbf{Y= 0.\ 359 +\ \ 0.282\ X_1\ + 0.031\ X_1 + 0.283X_3}$$

The Model o1 indicate that X_1 and X_3 variables are given the significant result to execute the application of AI tools for continuous/formative assessment in the sechondary and higher secondary levels teachers students and teachers trainers.

Table 02: The overall comment of the regression model as

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.431[a]	.186	.118	.47318	.186	2.739	3	36	.058

AI tools include the present curriculum

Table 03: AI tools are necessary for formative assessment in present curriculum

AI tools are applicable for curriculum	No. Of students	Percentage
Fully possible	15	38%
Sometimes	17	43%
Not possible	05	13%
No comments	03	06%
Total	40	100%

The table express that 38% students agreed about the include AI tools for continuous assessment, 43% students sometimes agreed , 13% express it is not possible and only 6% do not comments on it.

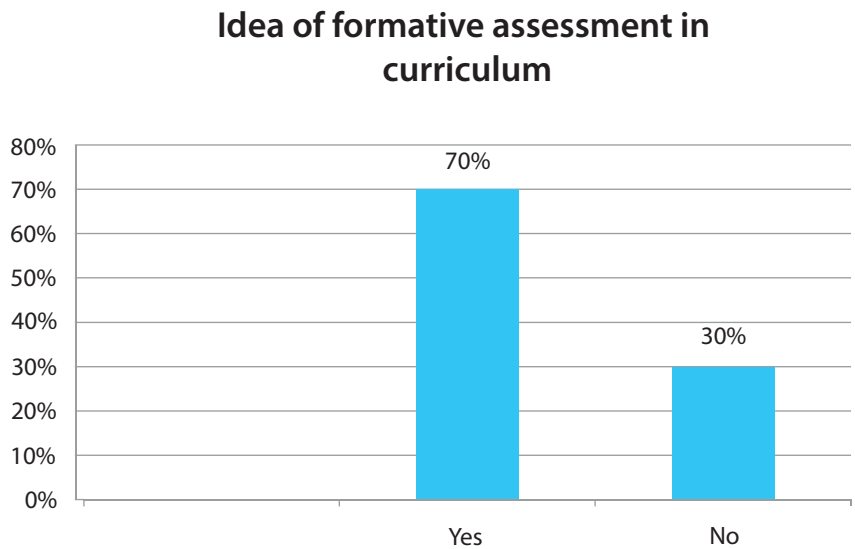
Teachers mention the evaluation methods for student's continuous assessment

Teacher mention the continuous assessment evaluation through the written exam, are evaluated with formative assessment, continuous assessment, formal system examinations, Class test & presentation, formative & summative assessment, class test, homework & group work, individual work, half yearly & annual exam, practical test, creative activities & new curriculum-2022

Teacher's comments through FDG activities

The teachers express that the AI tools should be included in the curriculum to face the future generation.Without the inclusion of AI tools in the curriculum the teachers are not properly familiar with that tools.

Chart 03: Teachers' trainers have the available idea of formative assessment that is included in the curriculum

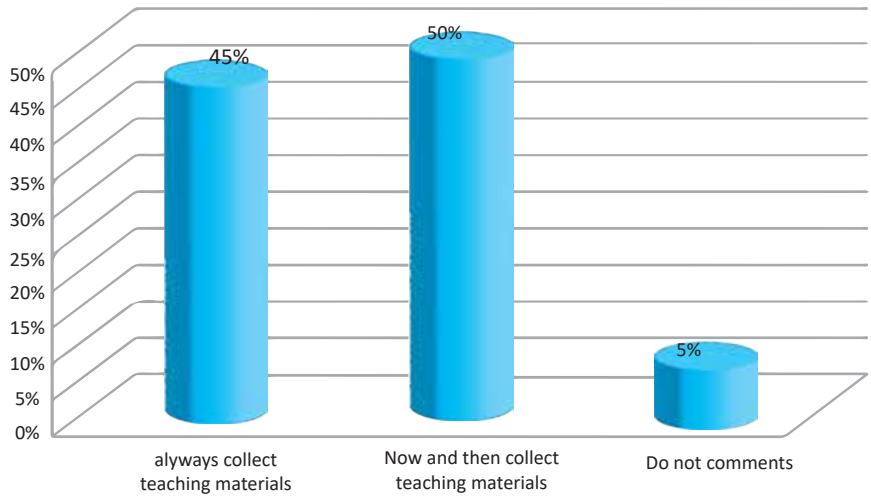


The graph-01 indicates that most of the teachers' trainers (70%) express that they agreed to include AI in the curriculum for student's continuous assessment and 30% of the respondents does not agree about it.

Preparedness of AI tools for continuous assessment

The teachers' trainer's given the importance of preparedness AI tools for continuous assessment in such way: teachers and students able to prepared assignment, they create different types of question on a specific topic, they able to collect different types of data, students use of ChatGPT prepared multiple types of evaluation related activities. AI tools help the teachers and students for their teaching and learning purpose.

Graph-04 Teachers trainers use the internet/ website materials



The graph indicate that 45% of the teachers' trainer's always collect the teaching materials from internet/website to conduct the training session effectively, 50% of the teachers' trainer's now and then collect the teaching materials from internet/website to conduct the training session effectively and only 5% of them are not comments regarding it.

Major findings and conclusion of the Study

The major findings are distributed in the three categories as

Students perspectives

- Most of the students (Bing=25%, Grammarly 50%, Question Well= 37.5%, ChatGPT= 62.5% and Prepared MCQ question= 37.5%) given the opinion for the use of AI tools about Transcript evaluation are possible.
- All the students of secondary and higher secondary expressed that AI tools should include in the present curriculum for build-up the Smart Bangladesh.
- Most of the teachers (90%) have the available idea about Artificial Intelligence (AI) for the student's assessment and given the importance to include the AI mechanism in the curriculum.
- The secondary and higher secondary level of students able to use AI tools for Preparing assignment, Quiz, question-answer etc. with the following, such as ChatGPT, Education Copilot, Quillbot, Formative AI, Grammarly, Micro-soft Bing, Bard AI (Google),Question Well, Google Bird, Answer well as well as.

- All the students said that their others friend were expert for introducing AI tools.

Teachers perspectives findings

- Teachers want to adopt the different strategies changes for developing program for continuous assessment techniques such as assignment, quiz, short questions development for student's assessment.
- The teachers said that AI tools are the assessment strategies that indicate the student's gradual achievement in respective classes or grade and continuous assesses indicate the class test, homework, assignment, group work, class test etc., AI tools are helpful for the increase of teaching learning activities.
- The teachers realized that they want be a training activities about the AI and their tools which are related to assess the formative or continuous assessment. They also want to know the clear idea about PI and BI regarding present curriculum through training activities.

Teachers' trainers' perspectives

- Most of teachers' trainer's (85.0%) idea about AI tools in their respective teachers training activities and others other teaching-learning activities.
- AI is the Artificial Intelligences that man use their intelligence through the computer or software for their respective purpose;
- AI had done different types of activities through the machine for the certain purpose and they define it as Human knowledge/intelligence artificially transfers with the computer and others devices. IT is also use for instant query and solution that act human intelligences.
- Teachers' trainer's given the emphasis in the following area as Students evaluation, Transcript evaluation, Programming purpose, Robotics, Productivity activities and cheating for different educational purposes.
- All teacher trainers believe that if they introduce the AI tools then the students skillfully apply it for their learning purpose.
- Teacher trainer express that AI tools helps them to evaluate the training program in different format such make the questions, prepared & evaluate the assignment, conduct the short question-answer session, make the quiz questions, make lesson plan etc. Smart Bangladesh, vision 2030, vision 2041, fulfill the requirement of 4iR the teachers trainer capacity building should increase through AI tools.

Recommendations

The following recommendations are proposed of the papers that are set up with the help of findings:

- Artificial Intelligence (AI) should include for the students continuous assessment for given the importance to include the AI mechanism in the present curriculum. Artificial intelligence is developed as human activities through the setup program of human. The tools are able to design as assignment writing makes quiz, short question, paraphrase etc. AI takes solve the problem within short time and plays the importance rules for students teaching learning activities.

- Integrate the educational related AI tools to assess present curriculum indicators such as the PI (Performance indicators) and BI (Behavioral Indicators) and arrange training for teachers and teachers' trainers.

- AI tools should directly use for the purpose of students evaluation, Transcript evaluation, design programming, familiar with robotics, include productivity activities and cheating .

- The institutions should provide some paid version AI tools site to the use of teachers and students for the collection of teaching learning materials with the purpose of continuous assessment (CA).

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Usefulness of Entrepreneurship Education in Bangladesh: A Link Between Education and Practice

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Abstract

Entrepreneurship education has gained significant attention in recent years as a response to increasing youth unemployment rates and corporate crises. However, there are several challenges and shortcomings in entrepreneurship and innovation education, particularly in the context of Bangladesh. This study aims to explore the usefulness and linkage of entrepreneurship education and practice in establishing entrepreneurship in Bangladesh. The objectives include investigating the effectiveness of entrepreneurship education, examining the teaching methods employed, identifying institutional shortcomings, and exploring the connection between entrepreneurship education and entrepreneurial outcomes. The study utilizes a mixed methods approach, including surveys, focus group discussions, interviews, and data analysis using various software tools. This study has collected data from some specific private universities like North South University, Independent University Bangladesh, East West University, BRAC University, University of Liberal Arts, Daffodil International University, and ASA University Bangladesh. The key findings highlight the positive impact of entrepreneurship education on developing an entrepreneurial mindset, generating innovative ideas, and creating new business models. Additionally, the study reveals diverse entrepreneurship opportunities and teaching methods across universities. However, challenges such as limited resources, lack of awareness, and regulatory barriers hinder the delivery and development of entrepreneurship education. Recommendations to overcome these challenges include reducing regulatory barriers, providing access to capital, fostering an entrepreneurial culture, and supporting innovation. The study also demonstrates a positive correlation between entrepreneurship education and entrepreneurial opportunities. Moreover, empirical evidence suggests that entrepreneurship education contributes to higher profits compared to individuals without such education. The study concludes that entrepreneurship education, incubation, and training play a vital role in successful entrepreneurship development.

Keywords: Usefulness, Challenges, Entrepreneurship Education, Entrepreneurial Opportunities, Bangladesh

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1. INTRODUCTION (Background and Statement of the Problem)

Entrepreneurship education has risen to the top of the conversation as a replacement due to the rising rates of youth unemployment and the corporate world crises (Dhar & Farzana, 2018). Education may offer a continuous impetus for a country's advancement as the foundation of national prosperity and development (Pei, 2019). As we are marching towards prosperity to be a developed country by 2041, then the education system with an innovative and entrepreneurial approach can make this path easy to obtain Smart Bangladesh (a2i, 2022).

Entrepreneurship education has different perspectives such as entrepreneurship environment, entrepreneurship curriculum, and entrepreneurship tasks which helps a student to develop his startup or own business. So far, entrepreneurship programs are usually found in the business section of an institution. It can be said that Finance, Marketing, Management, and Accounting are all topics where the principles are closely related (Imm, 2020). Despite the fact that they are all specialized sectors of business, entrepreneurship education covers the fundamentals in all of them.

In addition, the traditional course teaching innovation and entrepreneurship in colleges and universities comprises helping college students clarify their professional development direction, directing their employment, and explaining the basic understanding of entrepreneurship (Pei, 2019). Although the overall impact of innovation and entrepreneurship courses can still be improved, students' enthusiasm for participation in these types, of course, teaching activities needs to be stimulated.

Still, in line with experts (Pei, 2019) several problems lay in entrepreneurship and innovation education, these are a) it is necessary to enhance and expand the university administration's expertise in innovation and entrepreneurship education and teaching; b) some universities' innovation and entrepreneurship teaching courses are not scientific, and the teaching structure is not fully developed; c) in colleges and universities, the techniques of teaching entrepreneurship education is not uniform; d) there aren't enough expert tutors at universities to encourage students to learn about innovation and entrepreneurship; and e) there are no specialized institutions to manage entrepreneurship education in colleges and universities (Maritz, et al., 2014).

Above all these facts and contracts, there are no prospective statistics or history of status regarding the contribution of entrepreneurship education on students' entrepreneurship development from the perspective of Bangladesh. Institutional shortcomings, teaching techniques, structures and curricula are not symmetric in all entrepreneurships educational institutions. Even the existing literature and studies are not sufficient in this field from the perspective of Bangladesh. As a result, it has become very inevitable to research to find out the usefulness and linkage of entrepreneurship education and practice to establish entrepreneurship in Bangladesh.

The Rationale of the Study

Studies disclose that entrepreneurship education creates a variety of programs to assist students in "connecting the dots" in the most effective way possible (Modenov, Vlasov,

& Markushevskaya, 2018). It emphasizes a variety of methods for reaching objectives and it focuses on how to run existing hierarchies to the best of one's capacity. Therefore, entrepreneurship education aims to equip students with the knowledge, skills, and drive necessary to succeed as entrepreneurs in a range of situations.

Studies found that Lacatus & Staiculescu (2016) argued entrepreneurship from the ground of an economic model; Pei (2019) explained entrepreneurship education from the perspective of the entrepreneurial needs of students and society; Linan (2007) discussed differently has a significant role in building entrepreneurial skills; Shah *et al*. (2020) looked at the impact of entrepreneurship education on the predictive value of attitude, subjective norms, and self-efficacy; and Aziz and Akbar (2010) discussed program inputs for entrepreneurship education.

Despite several studies and findings on entrepreneurship education and innovation, little is known about the usefulness of entrepreneurship education in Bangladeshi to build up a new entrepreneur. There is no concrete status of the contribution of entrepreneurship education to students' entrepreneurship after graduation through entrepreneurship education. Even, the linkage between entrepreneurship education and entrepreneurship is unknown from the perspective of Bangladesh.

Therefore, this study has investigated the usefulness of entrepreneurship education to establish entrepreneurship in Bangladesh. The findings will contribute to establishing a developed country by 2041. Thus, it has become inevitable to do research on the usefulness of entrepreneurship education to education to establish entrepreneurship in Bangladesh.

Objectives of the Study

The objectives of this study are:

a) to find out the usefulness of entrepreneurship education to establish entrepreneurship;
b) to find out the linkage between entrepreneurship education and practice;
c) to explore teaching methods of entrepreneurship education; and
d) to find out the institutional shortcomings in delivering entrepreneurship education.

Scope and limitation of the study

The study has a huge scope to investigate different perspectives of entrepreneurship education and entrepreneurship development in business schools, private universities, business faculties of public universities, vocational and technical educational institutions, and engineering universities. But, due to the time and budget constraints, this study has engaged only a few private universities. Sampling and sample size might be another limitation of this research as it is intended to confine within the periphery of business schools of private universities. But this limitation has established a new dimension of future research in this field.

LITERATURE REVIEW

Entrepreneurship education can be defined as a process of imparting knowledge, skills, and attitudes necessary for the creation and management of new ventures (Kuratko, 2005). Entrepreneurship education is essential for fostering entrepreneurial attitudes and skills, which are necessary for the growth and development of entrepreneurship (Ismail & Sawang, 2020). According to Alam *et al*. (2017), entrepreneurship education in Bangladesh is relatively new, but it has gained momentum in recent years.

Several studies have been conducted on the relationship between entrepreneurship education and entrepreneurship development in Bangladesh. For instance, Akhtar and Islam (2019) conducted a study to examine the impact of entrepreneurship education on entrepreneurial intentions among Bangladeshi students (Akhtar & Islam, 2019). The study found that entrepreneurship education positively influences entrepreneurial intentions among Bangladeshi students. The authors concluded that entrepreneurship education can play a significant role in promoting entrepreneurship in Bangladesh.

Another study conducted by Ali *et al*. (2020) investigated the role of entrepreneurship education in promoting entrepreneurial intentions and venture creation in Bangladesh (Ali, Bhuiyan, & Islam, 2020). The study found that entrepreneurship education significantly influences entrepreneurial intentions and venture creation in Bangladesh. The authors suggested that entrepreneurship education should be integrated into the curriculum of educational institutions in Bangladesh to promote entrepreneurship and contribute to the country's economic development.

A number of academics have examined entrepreneurship as a strategy for economic growth, with innovation as the primary driver of business growth (Modenov, Vlasov, & Markushevskaya, 2018). According to Modenov *et al*., (2018), there are several issues concerning innovative features of developing a knowledge society for entrepreneurship education. Digital technologies, E-learning, and IT are some of the features of novel concepts for entrepreneurial education that they have highlighted. They have, however, left room for determining the scope of student creativity in entrepreneurship education.

Linan (2007) discussed that the entrepreneurial process has three primary elements such as a) entrepreneur, b) environment and c) opportunity (Liñán, 2007). The process can be seen at a glance in the following figure 1:

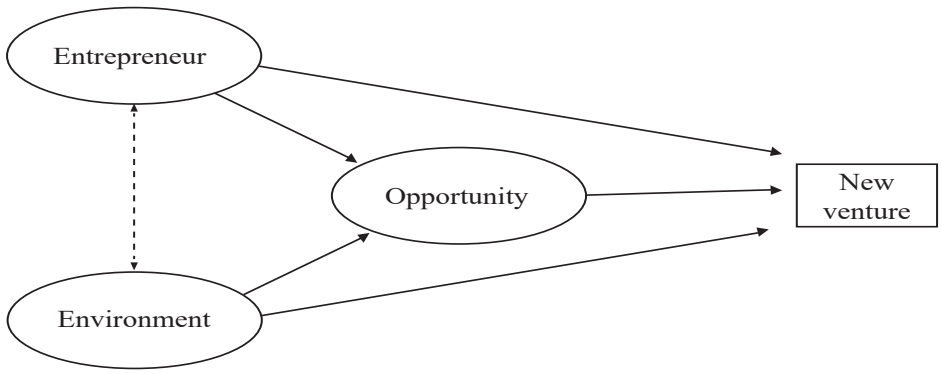


Figure 1: The entrepreneurial process (Linan, 2007)

Tripathi (2021) has discussed that entrepreneurship education plays a significant role in building entrepreneurial skills in human beings (Tripathi, 2021). These skills help people to take risks and decisions, to manage the situation, and to attain knowledge. However, this study did not engage in any critical discussion on the linkage between entrepreneurship education and entrepreneurs development.

Shah *et al*. (2020) looked at the impact of entrepreneurship education on the predictive value of attitude, subjective norms, and self-efficacy in predicting entrepreneurial inclinations (Shah, Amjed, & Jaboob, 2020). Entrepreneurship education, on the other hand, moderates this link by enhancing the path coefficients of entrepreneurship mindset and self-efficacy.

Liu at al. (2021) discussed that in Kirkpatrick's paradigm, there are four levels of evaluation: reflection, learning, behavior, and results (Kirkpatrick, 1959). The first stage, reflection, is concerned with the participants' perceptions of and satisfaction with the educational process and its various components, such as the timing of the entrepreneurial curriculum, the effectiveness of the teachers, and the subjects covered in the lessons. The second level is learning, which assesses how participants in entrepreneurship education have changed in terms of their aptitude, expertise, and attitudes. The third level, conduct, primarily evaluates how well participants' actions that they learn in entrepreneurship education are applied in their personal and professional lives. The number of new firms the participants started is the finest illustration. The relationship between changes in participant behavior and activities, performance, or output is evaluated at the fourth level, known as the result. To gauge the effectiveness of entrepreneurship education, participants' business ventures were also evaluated for success (Liu, Kulturel-Konak, & Konak, 2021).

Conceptual Framework

It is believed that research without a conceptual framework makes it difficult for readers to understand the researcher's scholastic point and the underlying features of his or her thesis. A conceptual framework is a set of rules that the researcher feels can explain the event's natural course (Camp, 2001).

As a result, the following conceptual framework has been developed.

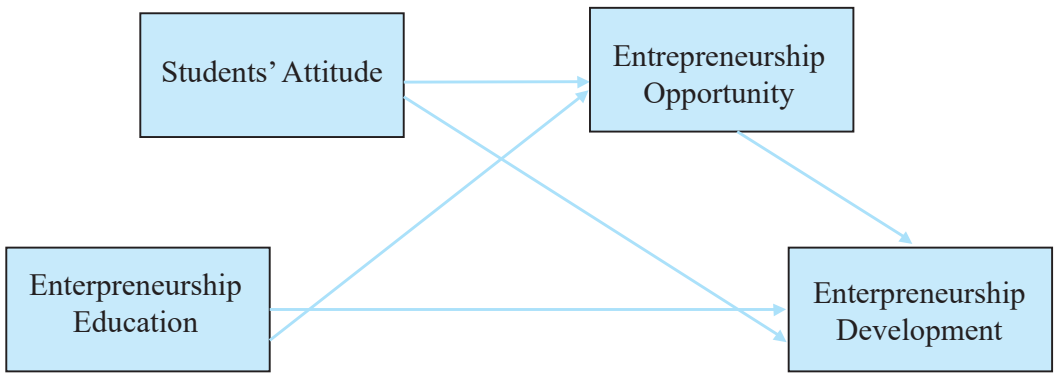


Figure 2: Conceptual Framework

Entrepreneurial opportunity recognition, skills, and attitudes together constitute entrepreneurial abilities. Enhancing skills allows entrepreneurs to discover and exploit opportunities that enable them to be more innovative towards entrepreneurship. Entrepreneurship education is integrated into social learning networks through collaboration and sharing, and iterative learning processes are used to complete the acquisition of new knowledge and skills. This improves student entrepreneurs' capacity to adjust to changes in the entrepreneurial environment. Entrepreneurs' capacity for entrepreneurship development is regarded as a tool for fostering creativity and the capacity to spot possibilities.

METHODOLOGY

Study Areas and Period of Time

The study is conducted on Dhaka district and the study is conducted from July 2022 to April 2023.

Nature of the Study

This study is based on mixed methods. The quantitative method and statistical, mathematical, or computational techniques (Given, 2008) have been used to reach the objectives and analyze the data. Whereas the qualitative method has been used to obtain in-depth understanding and knowledge. These two methods have provided a vast range of understanding regarding the current research through statistical and in-depth reasoning. Therefore, this study has cautiously chosen mixed methods.

Procedures of Sampling

This study has engaged purposive and random sampling procedures. The sample size has been determined by using Yamane's (1967) formula. Taro Yamane's (1967) formula: n= $\frac{N}{1+Ne^2}$ and n=384.

Data Collection Methods

The business schools of all the private universities are the source of data. But this study has collected data from some specific private universities like North South University, Independent University Bangladesh, East West University, BRAC University, University of Liberal Arts, Daffodil International University, and ASA University Bangladesh. However, Daffodil International University was the primary focus of this study as this university offers a bachelor program on entrepreneurship. Some successful entrepreneurs have been interviewed for this study also.

For attaining quantitative data, a survey method has been administered to investigate research objectives. In addition, Focus Group Discussions (FGD) and interviews have been used for collecting qualitative data. However, existing literature and statistics have been reviewed and evaluated to gather information related to the study and verify the collected data.

Table 1: Data collection Matrix

Data Collection Techniques	Respondents	Sapling technique	Sample Size	To achieve objectives
Key Informant Interview (KII)	NSU, IUB, EWU, BRAC University, ULAB, DIU, and ASA UB	Purposively	10	2, 1, 3
	Different established entrepreneurs	Simple random	7	1, 2, 3, 4
FGD	Students from the selected universities (business schools)	Simple random	4	2, 1, 3
Case studies	Established entrepreneurs	Purposively	3	1, 2
Survey	Students (NSU, IUB, EWU, BRAC University, ULAB, DIU, and ASA UB)	Simple random	390	1, 2, 3, 4
	Experimental Group (EG) and Control Group (CG)	Purposively	20	1, 2, 3
Total Respondents			431	

The study is based on the inductive approach. Key Informant Interviews (KII) and Focus Group Discussions (FGD) are used for obtaining in-depth thoughts and information from the

experts, students and relevant professionals. However, this study has engaged case studies techniques and this study has scrutinized different cases aligning to the research problems. In addition, a survey questionnaire has also been administered to have a statistical overview of the research problems.

Drafting and reviewing the survey instruments: A draft interview questionnaire has been developed after a rigorous review of the available research documents.

Supervision during data collection: The principal investigator has directly supervised the RAs in the fields. He has visited the survey areas as and when necessary to ensure the quality of work.

Technical approaches to 'Quality Control': The quality of the data has been maintained through checking and cross-checking by the core researchers. The quality controllers have been checked 'Back Check' 5-10% of data through spot visits and mobile phones to ensure the authenticity and quality of the data.

Data Analysis Techniques

After checking and cross-checking the collected data, all the interviews have been transcribed, coded and entered into the NVivo, Python, SPSS and SMART PLS3. Data has been presented in graphs and charts after analysis. In addition, FGD and Interview transcripts have been analysed by administering Word Clouding, Sentiment Analysis, Word Clustering, and Multiple Response Analysis. Structure Equation Modelling has been done to find the linkage and correlation between entrepreneurship education and entrepreneurship development.

Ethical Considerations

Inform consent has been taken before the interview and ethical clearance has been obtained from the relevant authority. The consent of interview recording, data presentation, and information sharing has been taken appropriately. The study has given value to the respondent during the whole interview, and they are unidentified.

FINDINGS AND DISCUSSION

In this section of this study, different types of data have been analysed. Key Informant Interview has been administered for the faculties of different entrepreneurship institutions and business schools. Besides, some interviews have been taken with established entrepreneurs and government institutions. However, this study has engaged some FGD with the students of entrepreneurship programs.

Key Informant Interviews with Faculty Members and Entrepreneurs

This study has engaged teachers in in-depth interviews for obtaining different perspectives on entrepreneurship education in Bangladesh.

Teaching Method of Entrepreneurship Education

The study found from the interview of teachers that different teaching techniques such as lecture method, industrial trips, workshops or innovative projects, case studies, videos, seminar-based assignments, presentations, and simulations.

Table 2: Teaching Method of Entrepreneurship Education

N		Responses		Percent of Cases
		Percent		
Teaching Method[a]	PowerPoint Presentations	6	22.2%	100.0%
	Assessment	3	11.1%	50.0%
	Guest speakers	3	11.1%	50.0%
	Industrial trips	3	11.1%	50.0%
	Case Studies	3	11.1%	50.0%
	Simulations	3	11.1%	50.0%
	Videos	4	14.8%	66.7%
	Seminar-based assignment	2	7.4%	33.3%
Total		27	100.0%	450.0%

a. Dichotomy group tabulated at value 1.

b. Percentage more than 100 due to multiple answers

Table 2 shows that all respondents said that instructors use power point presentations, 67 percent of respondents said that instructors use videos, 50 percent of respondents said that instructors use guest speakers, 50 percent of respondents said that instructors use case studies, 50 percent of respondents said that instructors use industrial trips and only 33 percent respondents said that instructors use seminar-based assignments.

The Usefulness of Entrepreneurship Education

Teachers said that students will learn to prepare a feasibility study, marketing, and financial plans, learn legal aspects, and funding opportunities, and create an entrepreneurial mindset from the entrepreneurship education programs.

Table 3: Usefulness of Entrepreneurship Education

N		Responses		Percent of Cases
		Percent		
Usefulness of EE[a]	Students will learn to prepare a feasibility study	5	29.4%	83.3%
	Students will prepare marketing and financial plans	4	23.5%	66.7%
	Students heard about funding opportunities	4	23.5%	66.7%
	Students will create an entrepreneurial mindset	4	23.5%	66.7%
Total		17	100.0%	283.3%

a. Dichotomy group tabulated at value 1.

b. Percentage more than 100 due to multiple answers

Table 3 shows that 83 percent of respondents said that students will learn to prepare a feasibility study, 67 percent of respondents said that students will prepare marketing, and financial plans, 67 percent of respondents said that students heard about funding opportunities and 67 percent of respondents said that students will create an entrepreneurial mindset.

Challenges in delivering Entrepreneurship Education

The found that teachers and educators faced different challenges in delivering entrepreneurship education.

Table 4: Challenges in delivering Entrepreneurship Education

N		Responses		Percent of Cases
		Percent		
Barriers2[a]	Limited Resources	3	11.5%	50.0%
	Lack of Trained Faculty	3	11.5%	50.0%
	Lack of Awareness	4	15.4%	66.7%
	Regulatory Barriers	3	11.5%	50.0%
	Limited Access to Markets	4	15.4%	66.7%
	Negative Attitude Towards Entrepreneurship	3	11.5%	50.0%
	Less supportive counseling	2	7.7%	33.3%
	Inadequate managerial and financial support	2	7.7%	33.3%
	Lack of proper educational planning.	2	7.7%	33.3%
Total		26	100.0%	433.3%

a. Dichotomy group tabulated at value 1.

b. Percentage more than 100 due to multiple answers

Table 4 shows that 67 percent of respondents said that lack of awareness, 67 percent of respondents said that limited access to markets, 50 percent of respondents said that limited resources, 50 percent of respondents said that lack of trained faculty, 50 percent of respondents said that regulatory barriers, 50 percent respondents said that negative attitude towards entrepreneurship, 33 percent respondents said that less supportive counselling, 33 percent respondents said that inadequate managerial and financial support, and 33 percent respondents said that lack of proper educational planning.

Institutional Shortcomings in delivering Entrepreneurship Education

The found following institutional shortcomings from the teacher's interviews.

Table 5: Institutional Shortcomings in delivering Entrepreneurship Education

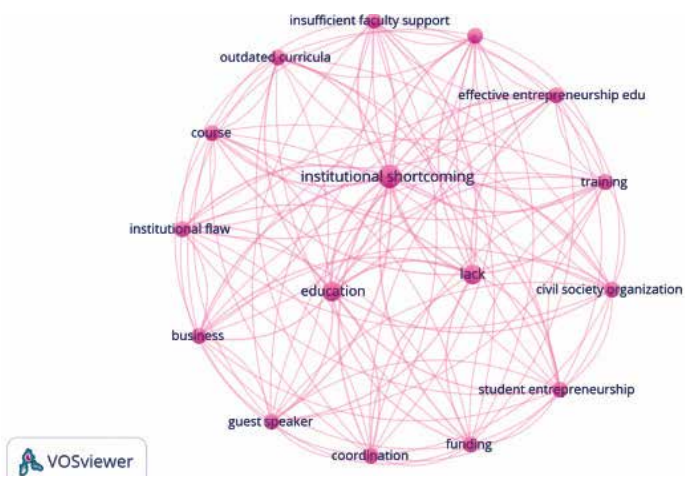
N		Responses		Percent of Cases
		Percent		
Institutional Shortcomings[a]	Lack of Coordination	4	28.6%	66.7%
	Outdated Curricula	3	21.4%	50.0%
	Limited Industry Engagement	2	14.3%	33.3%
	Limited Access to Funding	3	21.4%	50.0%
	Insufficient Faculty Support	2	14.3%	33.3%
Total		14	100.0%	233.3%

a. Dichotomy group tabulated at value 1.

a. Percentage more than 100 due to multiple answers

Table 5 shows that 67 percent of respondents said that lack of coordination, 50 percent of respondents said that outdated curricula, 50 percent of respondents said that limited access to funding, 33 percent respondents said that limited industry engagement and 33 percent of respondents said that insufficient faculty support.

Figure 3: Network Term Frequency Mapping



Problems in Entrepreneurship Development in Bangladesh

Entrepreneurs said that there are some challenges in entrepreneurship development in Bangladesh.

Table 6: Problems in Entrepreneurship Development in Bangladesh

N		Responses		Percent of Cases
		Percent		
Problems[a]	Collateral and credit history are required to obtain loans from conventional banks	4	21.1%	100.0%
	Lack of access to funding	2	10.5%	50.0%
	Inadequate infrastructure	3	15.8%	75.0%
	Limited access to technology	3	15.8%	75.0%
	Shortage of skilled workers	3	15.8%	75.0%
	Bureaucratic red tape and corruption	4	21.1%	100.0%
Total		19	100.0%	475.0%

a. Dichotomy group tabulated at value 1.

b. Percentage more than 100 due to multiple answers

Table 6 shows that all respondents said collateral and credit history were required to obtain loans from conventional banks, all respondents said bureaucratic red tape and corruption, 75 percent of respondents said inadequate infrastructure, 75 percent of respondents said limited access to technology, 75 percent respondents said shortage of skilled workers and 50 percent respondents said lack of access to funding.

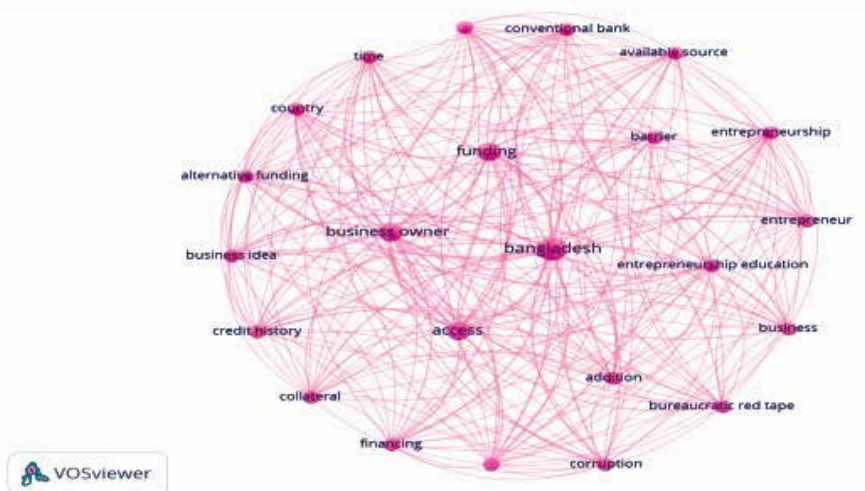


Figure 4: Network Diagram of Term Frequency

Recommendations to Overcome the Barriers to Establish Entrepreneurship

The found from the teacher's interview that several initiatives need to be taken for overcoming barriers to establishing entrepreneurship.

Table 7: Recommendations to Overcome the Barriers to Establish Entrepreneurship

N		Responses		Percent of Cases
		Percent		
Recommendations[a]	Reduce Regulatory Barriers	5	22.7%	83.3%
	Provide Access to Capital	4	18.2%	66.7%
	Encourage Collaboration	2	9.1%	33.3%
	Support Innovation	3	13.6%	50.0%
	Foster an Entrepreneurial Culture	4	18.2%	66.7%
	Ease the procedures of taking different permissions, licenses, and legal steps	2	9.1%	33.3%
	Know how sharing	2	9.1%	33.3%
Total		22	100.0%	366.7%

a. Dichotomy group tabulated at value 1.

b. Percentage more than 100 due to multiple answers

Table 7 shows that 83 percent of respondents said that reduce regulatory barriers, 67 percent of respondents said that provide access to capital, 67 percent of respondents said that foster an entrepreneurial culture, 50 percent of respondents said that support innovation, 33 percent of respondents said that ease the procedures of taking different permissions, license, and legal steps, 33 percent respondents said that encourage collaboration, and 33 percent respondents said that know-how sharing.

Survey finding from Student's perception

The survey questionnaire has been administered in different private universities to get ideas on teaching methods, facilities, students' attitudes, and motivation regarding entrepreneurship. however, the study has identified the correlation between students' attitudes towards entrepreneurship and entrepreneurial opportunity.

Name of the Universities

Table 8: Name of the University

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	North South University	131	33.6	33.6	33.6
	Independent University Bangladesh	53	13.6	13.6	47.2
	East West University	54	13.8	13.8	61.0
	BRAC University	25	6.4	6.4	67.4
	University of Liberal Arts	28	7.2	7.2	74.6
	Daffodil International University	55	14.1	14.1	88.7
	ASA University Bangladesh	44	11.3	11.3	100.0
	Total	390	100.0	100.0	

Table 8 shows that around 34 percent of students belong to North South University, 14 percent of students belong to Independent University Bangladesh, 14 percent of students belong to East West University, 14 percent of students belong to Daffodil International University, 11 percent of students belong to ASA University Bangladesh, 7 percent of students belong to University of Liberal Arts and 6 percent of students belong to BRAC University.

Structure Equation Modelling

Confirmatory Factor Analysis (CFA)

Table 9: Loading Value of Different Independent Variables

	EE	EI	EO	SAE
EE1	0.951			
EE2	0.829			
EE3	0.91			
EE4	0.685			
EE6	0.603			
EI4		0.887		
EI5		0.898		
EI6		0.911		
EO2			0.861	
EO3			0.821	
EO4			0.886	
EO5			0.818	
SAE10				0.861

SAE11				0.821
SAE12				0.886
SAE13				0.818

[EE= Entrepreneurship Education; EI= Enterprise Innovativeness; EO= Entrepreneurial Opportunities; SAE=Student's Attitude Toward Entrepreneurs]

One crucial factor is the size of the component loading. High loadings on a factor would suggest that they converge on the latent construct in the case of high convergent validity. All factor loadings should, at the very least, be statistically significant. Standardized loading estimates should be.5 or higher, and ideally.7 or higher, as a statistically significant loading could still be quite weak in strength, especially with large samples. Most of the time, since standardized parameter estimates can only fall between -1.0 and +1.0, researchers should interpret them (Hair, 2019). Individual items are reliable because most of the standardized loadings are greater than 0.7 (Table 9). Most of the factor loadings of entrepreneurship education are more than 0.8 except EE4 and EE6. Most of the factor loadings of enterprise innovativeness are more than 0.8. Most of the factor loadings of entrepreneurial opportunity are more than 0.8. Most of the factor loadings of students' attitudes towards entrepreneurship are more than 0.8.

Reliability and Validity

Table 10: Reliability and Validity

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
EE	0.877	1.045	0.901	0.651
EI	0.882	0.899	0.926	0.807
EO	0.868	0.87	0.91	0.717
SAE	0.868	0.87	0.91	0.717

Table 10 shows that the AVE values exceeded the recommended value of 0.5 (Fornell and Larcker, 1981), demonstrating adequate convergent validity. Composite reliability values indicated that all constructs were well above the recommended value of 0.7 (Hair *et al*, 2010). Cronbach's alpha values for most of the constructs also met the minimum threshold of 0.60, suggesting that the constructs were acceptable.

Discriminant Validity (FL)

Table 11: Discriminant Validity (FL)

	EE	EI	EO	SAE
EE	0.807			
EI	0.226	0.898		
EO	0.171	0.328	0.847	
SAE	0.171	0.328	1	0.847

The degree to which one Latent Variable (LV) differs from other model constructs is known as discriminant validity (Chin, 2010; Hair *et al*., 2017). Table 11 shows that the discriminant validity exists when all the values of the ratio are less than 0.85. All the values (ranging from 0.807 to 0.847) were below the acceptable range of 0.85, indicating the discriminant validity except EI.

Variance Inflating Factor

Table 12: Variance Inflating Factor

	VIF
EE1	4.056
EE2	2.333
EE3	3.756
EE4	1.944
EE6	1.464
EI4	2.587
EI5	2.346
EI6	2.482
EO2	2.334
EO3	1.94
EO4	2.656
EO5	1.995
SAE10	2.334
SAE11	1.94
SAE12	2.656
SAE13	1.995

VIF is a statistic used to assess the degree of collinearity between the constructs in a structural model or between the indicators in a formative measurement model. The VIF and the tolerance value are intimately connected (Hair, 2019). Before analyzing the structural model, in addition to reliability and validity, the variance inflation factor (VIF) must be assessed to compute multicollinearity. Hair at al. (2017) recommended a cut-off value of 5.0 for multicollinearity. Table 12 shows that all items VIF value less than 5 and it indicates that there are no multicollinearity problems among independent variables.

Measurement Model

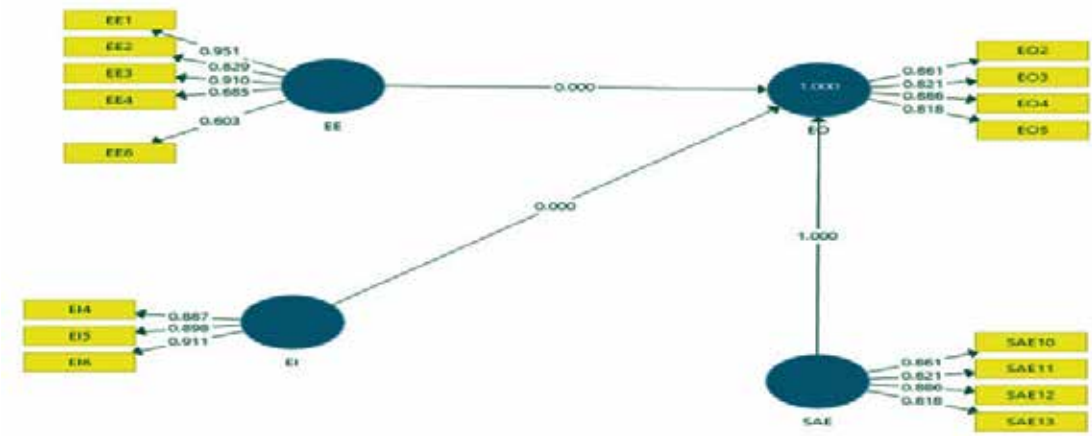


Figure 5: Measurement Model

Figure 5 depicts the factor loadings of most of the items greater than 0.7 except EE4 and EE6. There is a positive correlation between students' attitudes towards entrepreneurship and entrepreneurial opportunity.

Linkage Between Entrepreneurship Education and Practice

This study has compared two groups of people who have taken education in entrepreneurship education and who did not take entrepreneurship education. Such as a) the Experimental Group (10 members) has received formal training on entrepreneurship, and b) the Control Group (10 members) has not received any training program.

Table 13: Benefits of Training Program

N		Responses		Percent of Cases
		Percent		
$Benefits[a]	Knowledge	7	15.2%	70.0%
	Connectivity	9	19.6%	90.0%
	Media Coverage	5	10.9%	50.0%
	Export	8	17.4%	80.0%
	Costing	9	19.6%	90.0%
	Use Outlet	8	17.4%	80.0%
Total		46	100.0%	460.0%
a. Dichotomy group tabulated at value 1.				

Table 13 depicts that around 40 percent of respondents received training due to connectivity and costing related issues. Only 11 percent of respondents received training due to media coverage.

Table 14: Obstacles due Lack of Entrepreneurship Education

N		Responses		Percent of Cases
		Percent		
$Access[a]	C-V-P (Cost-Volume-Profit) Analysis	9	36.0%	90.0%
	Lack of Self Confidence	4	16.0%	40.0%
	Access to Loan	8	32.0%	80.0%
	Market Knowledge	4	16.0%	40.0%
Total		25	100.0%	250.0%
a. Dichotomy group tabulated at value 1.				

Table 14 depicts that 90 percent of entrepreneurs were facing costing-related issues due to a lack of entrepreneurship education. Eighty percent said they were unable to access loan facilities.

Table 15: Correlations Matrix

Correlations					
		Training	Age	Income	Family Support
Training	Pearson Correlation	1	.095	.837**	.734**
	Sig. (2-tailed)		.689	.000	.000
	N	20	20	20	20
Age	Pearson Correlation	.095	1	.012	.244
	Sig. (2-tailed)	.689		.960	.299
	N	20	20	20	20
Income	Pearson Correlation	.837**	.012	1	.752**
	Sig. (2-tailed)	.000	.960		.000
	N	20	20	20	20
Family Support	Pearson Correlation	.734**	.244	.752**	1
	Sig. (2-tailed)	.000	.299	.000	
	N	20	20	20	20
**. Correlation is significant at the 0.01 level (2-tailed).					

Table 15 shows that there is a positive correlation between training, income and family support.

Comparison between Experimental Group-1 and Control Group-1

Table 16: Comparison-01

Variable	Experimental Group (EG) 1	Control Group (CG)1
Type of Business	Pickle, Ghee, Mustard Oil	Pickle, Ghee, Mustard Oil
Getting Entrepreneurship Education	Yes	No
Initial Investment	10,000 Tk	10,000Tk
Revenue (Monthly)	8000Tk	7000Tk
Operating Cost	6400Tk	6,200Tk.
Profit	1600Tk (20 Percent)	800Tk (11.4 Percent)

From above table 16, it is evident that though both groups invest the same amount, EG earns more profit than the control group. In both cases, the initial investment is 10,000 Taka. The monthly revenue of EG is more than 1000 Taka compared to CG.

Comparison between Experimental Group-2 and Control Group-2

Table 17: Comparison-02

Variable	Experimental Group (EG) 2	Control Group (CG)2
Type of Business	Handicraft	Handicraft
Getting Entrepreneurship Education	Yes	No
Initial Investment	10,00,000 Tk	10,00,000Tk
Revenue (Monthly)	200,000Tk	150,000Tk
Operating Cost	1,70,000TK	Tk.1,35,000Tk.
Profit	30,000Tk (15 Percent)	15,000Tk (10 Percent)

Based on the information provided in Table 17, it is clear that despite investing equal amounts, the experimental group (EG) generates higher profits compared to the control group (CG). In both cases, the initial investment is 1,000,000 Taka. The monthly revenue of the EG exceeds 50,000 Taka in comparison to the CG.

It is found that only a limited number of educational institutes offer entrepreneurship education. Among the different private universities, the following three institutions of three reputed universities have enrolled the following numbers of students in FY 2022-23 (table 35). Among them, certain numbers of entrepreneurs established their businesses.

Table 18: No. of Students Enroll Entrepreneurship Program in 2022-23

University	Batch	Enroll	Entrepreneur
North South University (Start-Up)	1st Batch 2023	09	09(4 Start Up)
	2nd Batch 2023	11	11(4 Start Up)
East West University (PGD in Entrepreneurship)	1st Batch 2023	11	01
Daffodil International University (DIU) Bachelor in Entrepreneurship	Semester I 2023	25	03
	Semester II 2022	22	02

However, there is a huge opportunity in Bangladesh to develop entrepreneurship, but it requires proper training, education, and guidance. Without proper finance, entrepreneurship education will not be fruitful to establish businesses. However, time-to-time training can also improve business ideas. Financial and banking sectors under the proper guidance of the government may come forward to invest in the entrepreneurial sector, boost up the new entrepreneurs, and make excellent marketing mechanisms.

CONCLUSION

Entrepreneurship education has been identified as a key driver of economic growth and development in Bangladesh. This is because entrepreneurship can create jobs, generate wealth, and increase economic competitiveness. However, the link between entrepreneurship education and practice in Bangladesh was underexplored. This study has examined the state of entrepreneurship education in Bangladesh and how it can be linked to practice. The study reveals that several challenges need to be addressed if entrepreneurship education is to be an effective tool for promoting entrepreneurship in Bangladesh. Nevertheless, several opportunities can be leveraged to improve the quality of entrepreneurship education and its link to practice.

Challenges in linking entrepreneurship education to practice are lack of coordination, outdated curricula, limited access to funding, limited industry engagement, and insufficient faculty support. While the government has launched several initiatives to promote entrepreneurship, there is still a need for a more coordinated and strategic approach to entrepreneurship education. This includes developing a clear vision for entrepreneurship education, defining its objectives, identifying the key stakeholders, and establishing a governance structure to oversee its implementation.

In addition, there are several challenging factors to delivering entrepreneurship education limited access to markets, limited resources, lack of trained faculty, negative attitude towards entrepreneurship, less supportive counselling, inadequate managerial and financial support, and lack of proper educational planning.

Despite these challenges, several opportunities can be leveraged to improve the link between entrepreneurship education and practice in Bangladesh. One such opportunity is the growing interest in social entrepreneurship in the country. Social entrepreneurship has the potential to address some of the pressing social and environmental challenges that Bangladesh faces while also creating economic opportunities.

Furthermore, another opportunity is the growing interest in technology entrepreneurship in Bangladesh. The country has a large pool of talented software engineers, and several successful technology startups have emerged in recent years. Therefore, there is a need to develop technology entrepreneurship education programs that cater to the specific needs of this sector.

Policy Recommendation

- There is a need to create a more supportive ecosystem for entrepreneurship in Bangladesh which will include providing access to finance, technology, and networks to aspiring entrepreneurs.
- The government needs to reduce regulatory barriers including permissions, licenses, and legal steps to start a business.
- Entrepreneurial Culture needs to be established to encourage collaboration, support innovation, and foster an entrepreneurial enterprise.
- Social and technology entrepreneurship need to be developed to improve the link between entrepreneurship education and practice.
- The government, the private sector, and other stakeholders to work together to address these challenges and seize these opportunities to promote entrepreneurship and economic growth in Bangladesh.

Future Research Direction

This study has covered some private universities. This research left the scope to engage both public and private universities to have ideas on entrepreneurship education and entrepreneurship development. Again, some factors can be analysed to identify entrepreneurship development and women entrepreneurship. Therefore, future research might be taken to investigate these types of problems.

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A Study on Secondary School Students' Perception of Climate Change

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Abstract

Bangladesh is an extremely vulnerable country to climate change and Bangladeshi children's wellbeing are susceptible to climate change due to their direct exposure to environmental changes.The study explores secondary school students' perception of climate change and how such perception is socially and educationally influenced. Currently, there is no specific policy document on environmental education in Bangladesh. Indigenous knowledge is also not integrated in the existing curriculum. There is a dearth of research focused on environmental education; and little research has focused on adolescents' environmental education in Bangladesh. In this qualitative study, a child-framed research methodology was employed as the central mode of inquiry. The study was conducted with 40 participants including 20 male and 20 female students from 15 to 16 years old from four different government and private secondary schools in Bangladesh. The child-framed methodology required qualitative and quantitative data presentation and analysis including five sections, they are adolescents' climate change perception, climate change knowledge, climate change sensitivity, climate change agency; and social and educational influence on their climate change perception. The majority of participants' perception of climate change was clear, and their level of climate change knowledge was higher. Many participants showed ecocentric views and intentional agency of climate change. Participants' major sources of information about climate change were the textbook, family, the Internet, everyday life and indigenous knowledge. The research revealed significant gaps in climate change education research related to adolescents' climate change perception, knowledge and agency. The study has the potential to inform environmental education policy formulation and curriculum development in Bangladesh.

Keywords: Climate Change, Agency, Environmental Education, Adolescents, Sustainability.

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Introduction

Bangladesh is one of the most vulnerable countries to the impacts of climate change due to lowland (Kabir & Hossen, 2019). Sea level rise, extreme temperature, saltwater intrusion, increased rainfall and severe cyclones are the major impacts of climate change in Bangladesh (Hayward & Ayeb-Karlsson, 2021).

In Bangladesh, the effect of climate change is extreme and Bangladeshi young people are on the front position of climate change (Khatun & Logan, 2023). Loss and damage of climate change creates rural children's post-traumatic stress disorder; and rural people's migration to urban areas impacts urban children and young people's nutrition and health (Hayward & Ayeb-Karlsson, 2021). Many rural children face problems going to school during floods (Islam, 2014).

Therefore, climate change impacts Bangladeshi children and young people's mental health, physical health and education. However, local knowledge is important to address environmental problems in developing countries (Khatun & Logan, 2023). This paper employed a child-framed methodology to explore adolescents' perception of climate change in Bangladesh.

Statement of the Problem

Climate change is one of the key global environmental issues of the 21st century (Ofori et al., 2023), whereas environmental education is an important field because of 'policy, curriculum and learning' (Gough, 2013, p.1). Environmental education research can change people's behavior towards the environment. School is an important place to implement the policy of environmental education, where students learn how to interact in a harmonious way with the environment (Paredes-Chi, 2015). However, we have to explore secondary school students' perception of climate change; and information about climate change in the existing curriculum. Further research is required on environmental education policy and practice.

Rationale of the Study

Although the government of Bangladesh has framed a number of environmental policies to support environmental studies, at present there is no specific policy document on environmental education for school education. Environmental education research focuses on climate change education and research (Reid, 2019).

Young people are the future generations to deal with the negative impacts of climate change. Research about young people's climate crisis engagement is in a very young phase (Skovdal & Benwell, 2021). Although some studies have taken young people's views of climate change, there is very little research effectively engaging individuals (Corner et al., 2015). As Rickinson (2001, p. 224) recognized, "the voice of the learner is a severely neglected one in environmental education research and curriculum development". The current research has the potential to develop environmental education policy and curriculum in Bangladesh.

However, secondary school students' climate change agency is infrequent in Bangladesh. There has been a little quantitative research on young people's experience and perception of

climate change and education in Bangladesh (UNICEF, 2021). Furthermore, there is a lack of qualitative research on secondary school students' perception on climate change. Therefore, it is crucial to explore Bangladeshi adolescents' perception of climate change, which is socially and educationally influenced.

Objectives

The study aims to explore secondary school students' perception of climate change; and how do society and education influence students' perception to face climate change. The key research questions behind the study are:

1. How do Bangladeshi secondary school students perceive climate change?
2. How do secondary school students live their lives at present?
3. What are the thoughts of students' to live their lives in the future?
4. How do social and educational structures influence students' agency of climate change?

Limitations

The research study was limited to four different secondary urban and rural government and private schools in Bangladesh. Although findings of the study may not provide an ample picture, this study revealed rich data in a qualitative paradigm. Quantitative data were also gathered to support the study.

Literature Review

Environment and Education in Bangladesh

Secondary education creates the link for confirming the continuity of further education and it also plays an important role to make students as human capital through quality education (Rahman et al., 2018). However, the National Education Policy 2010 mentioned that secondary level science, social science, business studies, information technology and computer science as being closely related with the development of technology and economic activities (MoE, 2010). Although this policy focuses on economic development through secondary education, it did not emphasize environmental issues.

Perception of Climate Change

A quantitative study was conducted in 2010 with grades 8 to 11 students (from 12-18 years old) in Greek to examine their beliefs about the greenhouse effect and climate change. Although students had clear ideas about the impacts of climate change, they were not clear about the causes and solutions of it. Television was the key source of students' climate change knowledge. In this study, environmental education programmes positively impacted students' ideas about climate change (Liarakou et al., 2010).

The study was conducted with 73 students of science background from two government secondary schools in Malaysia. The study examined students' misconceptions of climate

change. The study revealed the majority of students' level of perception about climate change was clear, only a minority of them demonstrated misconceptions about global warming, greenhouse effects, acid rain and ozone layer depletion (Karpedewan et al., 2015).

Climate change perception may play a significant role in influencing the attitudes of the school students and empower them to fight for the adverse effect on the local area and the country (Rahman et el., 2014). In Bangladesh, the study was piloted with 270 secondary school students (from 14-16 years old & 6-10 grades) to examine their understanding of climate change. The study revealed secondary school students' perception of climate change. Female students were well informed about climate change issues. Type of school, grade and merit position, gender, mother's education and occupation, religion and family income influenced students' awareness of climate change (Rahman et al., 2014).

Sensitivity of Climate Change

Sensitivity is an empathetic view towards the environment (Chawla, 1998). A study was conducted with 300 high school students in Istanbul, Turkey to assess their knowledge and awareness or sensitivity of climate change. The study revealed the majority of students' had sufficient basic knowledge about the cause and effects of climate change but their level of awareness was low (Tuna et al., 2011).

In India, the study was conducted with100 students from grade 8 to 10 (aged 15 & above) to investigate their awareness of climate change. Young people believed in climate change from year to year. Newspapers were the major source of knowledge among young people. They thought humans are causing climate change and they can solve it by using renewable energy, growing organic fruits and vegetables and buying more local products. Some students showed interest in expenses to mitigate the impacts of climate change (Lal, 2017).

Climate change awareness is an element of environmental consciousness. A qualitative descriptive study was carried out with 611 high school students in Sumatra, Indonesia. The study investigated students' awareness and attitude of climate change. The majority (98.4%) of participants' were aware of climate change and knew the impacts of climate change are drought, flood, water pollution, vector-borne illness. They showed positive attitudes towards mitigation. Participants' learned about climate change from social media (Deshiana et al, 2022).

Knowledge of Climate Change

In 2012, an online survey was conducted in Australia with 5000 students (11-18 aged).The study revealed, Australian young people's knowledge of climate change is good but they believe climate is changing, which is human induced (Baldwin et al., 2022).Young people were considering recycling as a more effective action and adopting plant based food as a less effective action to mitigate greenhouse gas emission. They showed a lack of beliefs and agency of climate change. Television news was the source of information about the issue (Baldwin et al., 2022).

In a study in Nepal, 110 secondary school students expressed their understanding of climate change as change of weather over decades (Gautam et al., 2021, p. 24). Students demonstrated an inadequate level of awareness about the impacts of climate change on human health. The key important source of information about climate change among young people was television. The study suggested project work activities to increase students' knowledge (Gautam et al., 2021).

The study was conducted in South Africa with 68 students of grade 11of two public schools in 2015. South African young people demonstrated misconceptions of climate change. They combined climate change and greenhouse effect. For example, learners thought ozone layer depletion, cigarette smoking and air pollution make climate change worse and petrol contribute to global warming. Young people's perception of climate change was influenced by their peers and parents (Lakegu & Davis, 2017).

Source of Knowledge

In Ankara and Neveshir of Turkey, a study was carried out with 15 to 16 year old students to examine their ideas about global warming. The study revealed students' misconceptions about the causes and consequences of global warming. Their source of knowledge about global warming was television, radio, newspapers and the Internet (Kilinc et al., 2008).

In 2023, a study of Ghana revealed that undergraduate students believe climate change is factual and it is human induced. Students showed their concern and misconceptions about the causes and consequences of climate change. Students' level of education, mothers' occupation, ethnicity and religion influenced their perception, knowledge and attitude of climate change. Students' source of knowledge about climate change was school (Ofori et al., 2023).

Agency of Climate Change

As Khatun (2019, p. 68) mentioned that 'agency is at the heart of environmental education' where young people are inspired to take action towards the environment. In 2021, a descriptive quantitative study was conducted with 332 students of grade 12 in Zamboanga City, Philippines. The study revealed students' sustainable disposal of solid wastes. Students used eco-friendly bags and washable food containers. Television, radio, parents and social media were the sources of information about students' environmental awareness (Molina & Catan, 2021).

Factors Influencing Adolescents' Climate Change Perception

Payne carried out a research with young people (aged eight to 16), adults (aged 45 to 53) and thirteen green families in Melbourne, Australia to examine the influence of green families on young people's ecoliteracy and found family is a place for environmental education and individuals' development (Payne, 2020).

A mixed method approach (quantitative and qualitative research) was conducted with 700 secondary school students in Turkey to examine their perceptions of recycling wastes. The study revealed students' higher level of positive attitude towards recycling by people, trees,

garbage and factories in their drawings. Students' perception included recycling components. Grade level and father's education influenced their recycling attitude (Demir & Oteles, 2023).

A quantitative study was piloted with grade 10 students in Indonesia to examine their climate change perception. The study revealed students' positive beliefs in climate change. They thought climate change occurs due to humans' activities rather than natural phenomena. Although students' level of understanding about climate change was higher, they were not willing to take action on the issue (Kundariati et al., 2024).

Conceptual Framework

The research study revealed secondary school students' perception, sensitivity, knowledge and agency of climate change; and their perception was influenced by social and educational factors. The current study impacts students' education, mental health and emotional well-being.

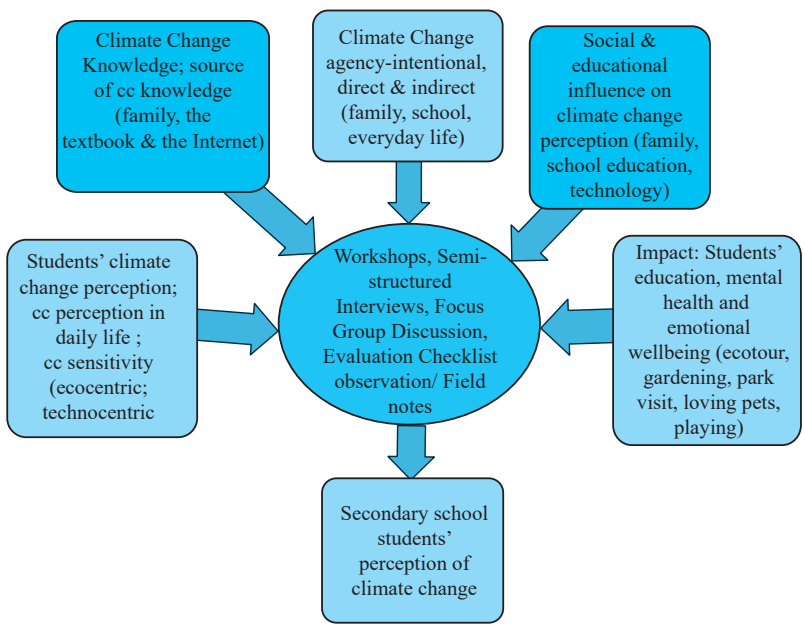

Figure 1: Conceptual Framework of the Study.

Methodology

Child-framed Methodology

A child-framed ethnographic methodology was employed to investigate secondary school students' perception of climate change in Bangladesh. The qualitative and quantitative data were collected through workshops, semi-structured interviews, Focus Group Discussion, intarview checklist and observation as field notes. Participants were advised to speak in native language (Bengali).

Study Area

The study was conducted in the Dhaka City and Shyamnagar upazila of Satkhira district. Dhaka is an urban area, whereas Shyamnagar is a rural area. Urban people are less affected by the natural disasters except for the extreme heat. Shyamnagar upazila is known as a vulnerable area due to its geographical location. Cyclone and river bank erosion are the most common disasters in this area. Local people in Shyamnagar know the ways of adaptation to the impacts of climate change.

Nature of the Study

The study is empirical in nature, therefore the data presentation is based on primary and secondary data. It incorporated qualitative approach to explore the study concern areas grounded on all data and analysis.

Participants Selection

Forty students including 20 male and 20 female students (from15 to 16 years old) of grade 10 from four different government and private secondary schools participated in the current research study. Ten students were selected from each school. Students were chosen based on their interest in the research topic. We communicated with school principals for their consent to carry out the research by providing a letter.

Schools Selection

Four government and private secondary schools were selected for research inquiry to understand their perception of climate change. Two schools from urban and two from rural areas. Four schools are: Lalmatia girls' high school and National Bangla high school in Dhaka city; and Nakipur pilot girls' high school and Nakipur Government Haricharan pilot high school in Shyamnagar upazila of Satkhira district.

However, urban students are less affected by natural disasters and they mostly learn about climate change issues from textbooks and the Internet. In contrast, rural students are more vulnerable to climate change impacts and are affected and they learn about climate change issues from their everyday life and local knowledge.

Sources of Data and Methods of Data Collection

Primary data were collected from the schools and houses whereas the source of secondary data was journals, books and reports. Research approach was adopted for the study with semi-structured interviews, Focus Group Discussions, evaluation checklist and observation. We used two months for data collection.

Tools of Data Collection

Four workshops were organized in four different secondary schools with the participants for ice breaking and to discuss the research topic and the research process. Two hours were used for each workshop. Semi structured interviews (in-depth) were organized in four different secondary schools with 40 participants. Twenty students from urban and twenty from rural areas. Each interview was conducted with one participant for 20 minutes following the interview questionnaire. Focus Group Discussions were formed in four schools. Five students participated in each Focus Group Discussion for two hours following the FGDs questionnaire. Two FGDs in each school, therefore, eight focus group discussions were organized in four schools. Forty students from four different schools participated in the checklist session. Ten students participated from each school. Students' non-verbal expressions during the workshops; and Focus Group Discussions were observed at schools; and their daily lives' activities were also observed at homes as field notes.

Data Analysis and Presentation

The study's child-framed research methodology requires a representation of data, both qualitative and quantitative data analysis. Qualitative thematic analysis technique was followed for semi-structured interviews and Focus Group Discussions data. Data were organized and categorized into different themes based on literature review. Themes have been developed through 'coding' and 'memoing' (Loafland et al., 2006, p. 200). In contrast, quantitative data were analyzed with frequency tables and percentages with the help of Excel and also using descriptive statistics.

Ethical Considerations

Individual details of informants were not disclosed and all participants were treated equally. Pseudonyms were used for the principal researcher and participants to maintain privacy of the research.

Findings and Discussions

Perception of Climate Change

Nova was 15 years old, and was from an urban Girl's school. She is passionate about the environment.

> Climate change is a natural process. It is the change in the pattern of average weather in a particular area for 30 to 40 years. Due to climate change, the temperature of air increases and the rainfall pattern changes, so we get a little or heavy rain during the rainy season. Frequent floods, drought and seasonal changes also happen due to climate change. There is an adverse impact of climate change on our health, education, food, safe drinking water and energy production. The negative activities of humans' drives climate change. Public overuse of personal vehicles, which produce

> black smoke and contribute to the effects of climate change (Lily-Nova, Principal Researcher's Interview, 2024).

Nova was well informed about the issues of climate change because of her environmental awareness. This echoes Rahman et al. (2014). She also stated climate change is a natural process and humans drive climate change. In contrast, in this anthropogenic era, humans can also solve environmental problems in innovative ways. Nova mentioned the impacts of climate change on humans' health but she didn't discuss its impacts on mental health and emotional wellbeing of humans (Lawrence et al., 2021).

John was 16 years old, and was from a rural high school. He is environmentally aware:

> Changing the pattern of average weather in a specific area for 30 to 40 years is known as climate change. Increased temperature, heavy rainfall are the impacts of climate change. Regular floods, cyclones and droughts occur due to climate change. Humans' negative activities such as cutting down trees and overuse of air condition, haphazard waste management practices drive climate change. The impact of climate change on our food, pure drinking water, energy production and humans' health is massive (Lily-John, Principal Researcher's Focus Group Discussion, 2024).

John described how climate change negatively impacts the environment and his daily life. He mentioned haphazard waste management practices of humans driving climate change, which indicates his good understanding about the issue. Solid waste directly contributes to climate change by emitting methane gas (Gupta & Verma, 2021). John memorized the words about climate change and its impacts rather than understanding, which was influenced by the school curriculum. This statement echoes Karpudewan et al. (2015). The participant revealed anthropocentric practices of humans. The majority (95%) of participants appeared to hold a clear perception of climate change and its issues in the study, whereas a minority (5%) of them showed a misconception of it.

Sensitivity of Climate Change

Pradeep was 16 years old, and was from a rural high school. He lives in a riverside village:

> The climate is changing because of the negative activities of humans' like dumping waste in the rivers and cutting down trees, using too many plastic bags, making bricks through factories, using air conditioning and personal vehicles randomly. These activities impact food, health, education, people's movement and energy production. It is possible to reduce air temperature by planting trees as green trees absorb carbon dioxide from the air. I plant trees in our home garden, and care for the plants with rain water and organic manure. I make manure with kitchen waste products, using the fruits and vegetables scraps (Lily-Pradeep, Principal Researcher's Interview, 2024).

Pradeep demonstrated his ecocentric views through education and awareness. Although Pradeep mentioned humans are responsible for environmental damage, he inspired others to plant trees.This statement mirrored Cutter- Mackenzie and Hoepper (2014). In contrast, although Pradeep stated his anthropocentric views, he showed his empathy for the environment. This is consistent with Sykes et al (2000, p.92) because they believed 'nature should exist for its own existence'. Many participants showed ecocentric views of climate change and some participants displayed both ecocentric and anthropocentric views.

Lucky was 16 years old, and was from an urban high school. He expressed his concern of climate change:

> I think the climate is changing. People's lifestyle and their daily activities are the main causes of the impacts of climate change. People use air conditioning, private cars and motorbikes, cutting down trees to make furniture and other purposes, these activities are accelerating climate change. Sea level rise, river bank erosion, and the loss of biological diversity are the impacts of climate change. We can reduce the air temperature by planting trees (Lily-Lucky, Principal Researcher's Interview, 2024).

Lucky thought the environment is important for humans' well-being and existence. This idea indicates his techno-centric view of the environment, where humans are central to environmental conservation (Cutter Mackenzie & Hoepper, 2014). In contrast, the participant's willingness to plant trees displayed his ecocentric views. Some participants revealed both ecocentric and anthropocentric views of the environment. This statement echoes Sykes et al. (2000) and Yencken (2000) as they believed nature is something for humans' use. In this study, many (85%) of participants plant trees monthly and some (10%) of them plant yearly; and only a few (5%) of participants do not plant trees at all.

Knowledge of Climate Change

Shimul was 16 years old, and was from an urban high school. He described global warming and its impacts:

> The components of greenhouse gases are: methane, carbon dioxide, nitrous oxide, and water vapour. Greenhouse gas traps the heat of the sun, which emits from the earth surface and can't escape. Air conditioning, aerosol spray, refrigerator, black smoke from vehicles and brick factories produce greenhouse gases. People cut down trees, extremely use air conditioning, and refrigerators. They use and burn plastic (polythene) bags. These activities warm the earth, consequently drought, cyclone, flood, river bank erosion, water logging conditions occur. If this situation remains, the sea level will rise and coastal people's adequate food, pure drinking water and homes will be affected. Planting more trees, using solar energy and using eco-friendly bags

> may help to reduce the impacts. I know about climate change issues from my family, the textbook and the Internet (Lily-Shimul, Principal Researcher's Interview, 2024).

Shimul assumed air pollution directly contributes to greenhouse gas emissions; and showed insufficient knowledge of climate change by combining the greenhouse effect and global warming. This statement echoes Lakegu and Davis (2017). The participant also described the anthropogenic causes and consequences of global warming, which is consistent with Kilinc (2008). According to (Beresford-Kroeger, 2010, p.133), 'the atmospheric carbon-dioxide bounces the infrared energy which increases the greenhouse effect' as a result the atmosphere is warming up.

Beli was 15 years old, and was from a rural Girl's school. She lives in a riverside village:

> Carbon dioxide, methane, chlorofluorocarbon, nitrous oxide, sulfur-dioxide and water vapour are the elements of greenhouse gases. Greenhouse gases absorb the sun's heat which emits from the earth surface and trap it in the atmosphere, as a result the temperature in air increases. Black smokes of brick factories and motor vehicles, aerosol spray, refrigerators and kitchen chimneys are the sources of greenhouse gases. Cutting down trees, overuse of personal vehicles, use of air conditioning, using and burning of plastics are also the reasons for greenhouse gas emissions. Planting trees, walking, sustainable waste management practices, and using jute or cotton bags for shopping groceries can help to reduce the concentration of greenhouse gases. In the rainy season, water logging occurs in my area due to heavy rainfall, so I cannot go to school and feel unwell.Thus, extreme temperature impacts my mental health and education. If this condition continues, the glacier melting will occur due to extreme temperature, as a result coastal areas will be inundated and the Sundarban area's biological diversity will become extinct in the near future. In 2009, cyclone *Aila* affected the two river dams and many people lost their houses in our locality. However, I know about climate change issues from the textbook, family, local newspapers and the Internet (Lily-Beli, Principal Researcher's Focus Group Discussion, 2024).

Beli described climate change as a global issue and it impacts the local environment. This is mirrored by Huq et al. (1995), who indicated, in Bangladesh the biological diversity of the Sundarbans will be affected by the sea level rise due to the low-lying geography. Beli mentioned climate change impacts her mental health and education, which echoes Hayward and Ayeb-Karlsson (2021) and Islam (2014). Participants revealed climate change as a global issue and it impacts the local environment. The majority (92.5%) of participants demonstrated a higher level of knowledge about climate change. Only a few (7.5%) of them displayed inadequate knowledge by combining the greenhouse effect and global warming.

Source of Knowledge

Nayan was 16 years old, and was from a rural high school. He is passionate about environmental learning:

> My family buys fruits from the market and our vegetables come from our village farm. My father uses cotton bags for shopping for vegetables and fruits. We have a vegetable garden on the house rooftop. I collect kitchen waste water after washing vegetables and fruits. I reuse this unpolluted water for watering plants. My parents taught me these eco-friendly practices at home (Lily-Nayan, Principal Researcher's Interview, 2024).

The participant learned environmentally practices from his parents. Payne found "green parents' social ethics, politics and numerous practices were influenced by their own parents" (Payne, 2005, p.88). These results showed the importance of indigenous ways of environmental learning; and demonstrated the need of integrating environmental education in the school curriculum. Participants of this current research study learned eco-friendly practices from their own parents.

Ena was 15 years old, and was from a rural Girl's school. She was well informed about climate change:

> I learned about climate change issues from the textbook and daily life. Drought, cyclones and floods occur due to climate change. People lose their homes and agricultural land for river bank erosion during floods (Lily-Ena, Principal Researcher's Interview, 2024).

Ena learned about climate change issues from the textbook and daily life.

> This statement is mirrored by Sykes et al. (2000) as Indian students' source of environmental learning was school. In this study, the majority (100%) of participants' source of knowledge about climate change was their family, the textbook and the Internet. Participants were also educated about the issues from their everyday life experiences.

Agency of Climate Change

Topu was 16 years old, and was from a rural high school. He described the importance of planting trees:

> I plant trees in our garden in June and July months. This time is best for planting trees because soil is wet. Trees supply us with oxygen to live. Green trees reduce air temperature. We use two waste bins for household wastes. I dispose of waste properly. I use a fan in summer. I make compost using kitchen organic wastes such as fruits and

> vegetables scraps. I apply it to our garden plants. I switch off the light and fan before leaving my room (Lily-Topu, Principal Researcher's Focus Group Discussion, 2024).

Topu said green trees reduce air temperature. This is mirrored by Osman et al. (2023) as planting trees positively impacts global warming, if we manage it effectively. He also mentioned domestic waste disposal. Many (90%) participants used two bins for domestic solid waste disposal; and a few (10%) of them used one bin. They learned this eco-friendly practice from their own parents.

Toma was 15 years old, and was from a rural Girl's school. She is passionate about gardening:

> We have a vegetable garden. My family uses pond water and cow dung as green manure in the garden. I use kitchen waste water for watering plants that come after washing rice. I also make compost using vegetables and fruit peels. I apply this manure in the vegetable and flower gardens (Lily-Toma, Principal Researcher's Focus Group Discussion, 2024).

Toma used kitchen waste water for watering plants that come through washing rice, which is consistent with Quinton and Khatun (2019). The author found in their research study, reuse of kitchen waste water reduces pressure on fresh water as an alternative source during a crisis.

Blue was 16 years old, and was from a rural high school. He is passionate about the environment.

> I enjoy growing vegetables in our garden. I take care of the garden regularly. We can improve the environment through sustainability practices such as using solar energy, jute bags, harvesting rainwater, recycling solid wastes and re-using kitchen waste water. We collect rainwater for drinking. We use both solar and electric energy. The source of solar energy is the sun. Planting trees, celebrating World Environment Day, making rally, cleaning the playground and organizing theater through eco-club may raise environmental awareness of other adolescents (Lily-Blue, Principal Researcher's Focus Group Discussion, 2024).

Blue and his family drink rainwater. This echoes Islam et al. (2014) as rainwater is accepted as safe for drinking in the Southern part of Bangladesh. Many rural participants' families use rainwater for drinking after filtering. A few urban participants' families collect rainwater for watering plants. However, participants gathered environmental knowledge from schools or homes directly; and indirectly through observation of the environment. Family, school education, everyday life and indigenous knowledge influenced participants' environmental learning.

Factors Influencing Climate Change Perception

Danish was 16 years old, and was from an urban high school. He is aware of the environment:

> We can improve the environment by sustainable waste management practices by recycling and reuse of household solid wastes such as paper and plastic bottles and reuse of clean kitchen waste water (Lily-Danish, Principal Researcher's Focus Group Discussion, 2024).

The participant mentioned recycling domestic solid wastes. This is consistent with Demir and Oteles (2023) as the author found, secondary school students showed a higher level of positive attitude towards recycling wastes. In Bangladesh, secondary science curriculum discusses the reuse of plastics (Iqbal & Kaikobad, 2022). Recycle and reuse of solid waste should be integrated in the secondary science curriculum. The participant thought technological progress may improve the current state of the environment.

Shama was 15 years old, and was from a rural Girls' school. She is passionate about the environment:

> We have a vegetable garden in the ground. I take care of the garden on the weekend. I use kitchen waste water for watering plants. I collect this water after washing rice and vegetables. I also apply organic manure in the garden. I make this compost using organic wastes such as fruits and vegetables scraps. I like eating vegetables (Lily-Shama, Principal Researcher's Interview, 2024).

Shama takes care of her garden by applying organic manure. This statement echoes Cutter -Mackenzie (2009) as gardening played a significant role in adolescents' everyday lives. It is an ecological practice in direct and indirect ways. Gardening impacts adolescents' physical health, mental health and emotional wellbeing. Jones et al. (2005) stated, vegetable gardens build up individual's knowledge and improve nutritional practices. Participants learn the food value of vegetables from the garden. Though some participants showed anthropocentric views of the environment, they love the country and its natural resources. Participants have ecological sustainability practices. The majority (50%) of participants grow vegetables on the rooftop, some (37.5%) of them produce on the ground and a minority (12.5%) of them grow vegetables on the balcony.

Runa was 15 years old, and was from a rural Girl's school. She shared her real life experiences:

> In our area, increasing salt water intrusion decreases soil infertility as a result the number of freshwater fish are decreasing. Due to climate change, cyclones, drought, and floods happen that impacts our agriculture. I know about the climate change issue from my family and daily life. I live in a village, so I have experience on climate change issues (Lily-Runa, Principal Researcher's Focus Group Discussion, 2024).

Runa cited cyclone and drought impacts rural agriculture. Global warming resulting in climate change will create a food crisis in the future by reducing production of crops (Chowdhury et al., 2015). Participants of this study were well informed about climate change issues through observation of their community environment. Participants' climate change perception was influenced by their family, school education and daily life.

Conclusion

The current research study identified significant gaps in research related to secondary school students' climate change perception, knowledge and agency. This study revealed secondary school students' perception, sensitivity, knowledge and agency of climate change in Bangladesh. The majority of students' gathered information about climate change from the textbook, family, friends, the Internet, everyday life experiences and indigenous knowledge. Students showed their empathy for the environment. Students' climate change agency was influenced by society and education.

However, this intervention raises secondary school students' awareness of environmentally friendly practices and motivates them to make more environmentally friendly choices. Child-framed methodology presented empowerment and agency of adolescents in Bangladesh.

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Recommendation

The study recommends further research with secondary school students to explore their climate change perception, sensitivity, knowledge and agency extensively.

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The Readiness of Outcome-Based Education (OBE) at Tertiary Level in Bangladesh: A Comparative Study of One Private and One Public University

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Abstract

This comparative study explores Outcome-Based Education (OBE) implementation readiness at the tertiary level in Bangladesh, focusing on one private and one public university. The research aims to provide valuable insights into the existing landscape of OBE in higher education institutions, shedding light on the challenges and successes these institutions face in adopting this educational paradigm. The study employs quantitative data collection methods to understand OBE readiness in private and public university settings comprehensively. Preliminary findings suggest varying degrees of preparedness for OBE implementation in private and public universities. While both institutions demonstrate a commitment to aligning their educational practices with OBE principles, differences in resources, infrastructure, and institutional culture influence the pace and effectiveness of the transition. Challenges such as resistance to change, inadequate faculty training, and the need for continuous assessment mechanisms emerge as common themes. The comparative analysis of the two university cases provides a nuanced understanding of the contextual factors shaping OBE readiness in Bangladesh. The findings contribute to the academic discourse on OBE implementation, offering practical recommendations for policymakers, administrators, and faculty members seeking to enhance the preparedness of tertiary institutions for outcome-based education. This study illuminates OBE readiness in Bangladeshi tertiary education, emphasising the importance of context-specific strategies for successful implementation. The research outcomes contribute to the ongoing dialogue on educational reform, providing valuable insights for institutions grappling with the complexities of transitioning to Outcome-Based Education.

Keywords: OBE, quality, infrastructure, institutional culture, training, tertiary education

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Introduction

One of the unspoken norms for the contemporary educational system is outcome-based education or OBE. An outcome is the final presentation of knowledge that students should be able to perform after a course and during their degree programme. Consequently, OBE is an educational method where curricular choices are based on the exit learning outcomes that students are expected to meet in their professional lives. To promote students' holistic development, the curriculum explicitly and unambiguously defines all learning outcomes in addition to the topics, teaching/learning techniques, assessment methodologies, and academic quality control procedure (Syeed *et al*., 2022). Having knowledgeable, imaginative, creative, and valuable human capital that can propel the economy and nation is essential in the current economic climate. Knowledge is seen to have the transformational capacity that could advance a country. Therefore, it is critical to make investments in the nation's educational system (Sun & Lee, 2020). The OBE is currently a significant issue of discussion in the academic arena. In recent years, the demand for and the number of higher education institutions in Bangladesh have grown dramatically. Access to higher education is essential to meet the local and global labour market's changing needs. To complete this process, higher education needs to be improved. Enhancements to the curriculum, staff, material resources, academic facilities, and research opportunities are all necessary to improve the standard of higher education. The higher education curriculum merits being guided by the objective of bridging the gap between the demand for talent in the job market and the supply of such graduates graduating from universities. To that end, colleges should adopt and implement the outcome-based education approach (UGC, 2020).

The OBE curriculum is primarily concerned with setting up an educational system that ensures students have access to what they need to complete their studies and meet the predetermined learning objectives (Spady, 1994). OBE learning is one of the most effective teaching strategies because it allows instructors to establish an exceptional learning environment where students can actively engage in class activities. This strategy is then connected to its theoretical underpinnings with other excellent modern strategies like student-centred learning, active learning, lifelong learning, and disability learning, and it guarantees that educational institutions meet their predetermined goals and objectives with all teaching-learning techniques explicitly stated in the curriculum (Harden *et al*., 1999; Midraj, 2018; Baguio, 2019). The transition from a traditional teacher-centric paradigm to a modern student-centric one has been the driving force behind the recent global trend in postsecondary education (Tam, 2014). The Fourth Industrial Revolution drove a significant shift in the 21st-century labour market by establishing a threshold for hard talents and modern, job-oriented soft skills. Therefore, one essential quality that graduates must possess to improve their employability is the capacity to adapt to technological and global problems (Chowdhury & Das, 2022).

In its OBE template previously given to universities, the commission said that Bangladesh has seen an increase in demand for advanced education and the institutions that supply it. Access to higher education must be expanded to meet local and global labour market needs. Enhancing the quality of higher education necessitates enhancements to the curriculum, faculty, finances, academic facilities, and research opportunities. The higher education curriculum

should be centred on results motivated by attaining objectives that bridge the gap between job market demand and the supply of skilled graduates (Jasim, 2021). As a result, it is recognised that 50% of institutions have already begun to construct and modify the OBE Curriculum, one of the most essential requirements for quality control.

Nonetheless, universities that choose not to participate could impede the nation's overall progress in developing and implementing the OBE curriculum (Chowdhury & Das, 2022). The current study summarises the main features of outcomes-based education and illustrates how it is used in public and private university contexts. The approach is based on basic educational concepts and offers students a solid foundation to develop the required practice fitness.

Research Objectives

a) To assess the readiness and realities of outcome-based education (OBE) at the tertiary level in Bangladesh.

b) To identify the challenges of implementing OBE.

c) To suggest some recommendations for creating a culture of OBE.

Conceptual Clarification

Outcome-Based Education (OBE)

Outcome-based education (OBE) has been available (Spady, 1986). Enhancing students' educational experiences by accomplishing learning objectives through curriculum design is "outcome-based education." The results of the OBE process are crucial in ensuring that academic institutions can efficiently and objectively assess students' performance and assure pertinent stakeholders about the calibre and capability of graduates. The OBE procedure is crucial for advancing the calibre of programs, institutions, instruction, and pupils' employability (Sun & Lee, 2022). Perpetrator defines the process in OBE; conversely, curriculum formulation and organisation, course topic selection, teaching strategies, and the evaluation process should be driven by students' pragmatic learning or skill set growth (OBE outcomes) (Harden, 1999; Harden, 2002). Thus, exit learning outcomes—which students should demonstrate after each course and during graduation—drive curricular decisions in the Open and Distance Education (OBE) approach to education. (Harden, 1999; Ben-David, 1999). Developing engineering graduates with the knowledge, creativity, high skill, flexibility, innovation, critical thinking, problem-solving, and entrepreneurial spirit to meet the challenges of the fourth industrial revolution depends on this OBE process (Hassan, 2020).

Development of OBE

A performance-based approach to creating innovative tertiary level curricula, outcome-based education, or OBE, is quickly becoming the de-facto standard for many established and developing educational systems, including those in Europe, the United States, Australia, Malaysia, India, Pakistan, Indonesia, and Bangladesh. This approach focuses more on developing practical skill sets than on the eloquence of the educational process. This is

because OBE emphasises developing a person's ability to function efficiently in their future employment and education. Nonetheless, many objectives are affective, focusing more on attitudes, values, feelings, and emotions than academic success. The masters of OBE have taken over the educational system almost everywhere in the country, and they have set uniform laws, schedules, plans for implementation, and learning objectives across the board. Simply put, the objectives of the OBE technique should be clearly defined for pupils, as well as the steps needed to prioritise each outcome (Zain *et al*., 2016).

Perpetrator defines the process in OBE; conversely, curriculum formulation and organisation, course topic selection, teaching strategies, and the evaluation process should be driven by students' pragmatic learning or skill set growth (OBE outcomes). (Harden, 2002). The creation of OBE was substantially contributed by the pioneering work of Spady in 1988 in schools in the United States of America. The original goal was to implement reforms by boosting accountability and supporting greater school flexibility or autonomy. (Harden, 1999; Mcneir, 1993; Pliska & McQuaide, 1994). Later, it also progressively extended to medical education (Harden, 2007; Smith, 1999).

However, many academic stakeholders also criticised this shift towards OBE. One viewpoint is that learning should be unrestricted by results and should instead be open-ended (Harden, 1999), while some criticised the claimed results for improperly emphasising attitudes and values (Harden, 2002). Along these lines, McNeir (1993) and McKernan (1993) critique OBE, stressing that education should be valued independently of results. They contend that the fantastic, erratic journeys of teaching and learning through inquiry and discovery are frequently constrained when education is defined as a collection of results. But this liberal idea of education might work for the humanities, arts, or other related fields (Glatthorn, 1993) but not for fields like engineering or medical science, where we can't afford to ignore graduates who gain a particular set of skills through curriculum-defined learning outcomes (Harden, 1999). Realising the benefits of OBE in Europe, the OBE process and practice training have obtained significant recognition in universities in recent decades (Drew, 2007; Harden *et al*., 1997).

Methodology of Study

The research employed a qualitative approach to achieve its goals and obtain the desired outcomes. This study's main objective is to explore the effectiveness of implementing Outcome-Based Education (OBE) in both public and private universities, specifically in ensuring educational quality. Consequently, utilising a hybrid research methodology in this study offers the advantage of a deeper understanding of the findings (Newman, 2013). Moreover, unexpected findings from the qualitative inquiry allow for further investigation and clarification, enhancing the overall research process (Maxwell & Loomis, 2003). The research technique is an approach to making an objective, systematic choice on what to study. Research methodology evaluation may be seen as a branch of science. The proposed research is an example of exploratory social science because it seeks to learn more about three distinct topics: the effectiveness and readiness of public universities' efforts to improve higher education, the difficulties that have arisen recently in applying OBE to this end, and the strategies that have been developed to address these issues.

Respondents were drawn from those who have some connection to the IQAC of the chosen institution, whether directly or indirectly. This allowed the researchers to collect first-hand accounts from various stakeholders who have used IQAC's services. From sample data, researchers may extrapolate to the whole population (Creswell, 2014). In purposive sampling, the researcher makes an informed decision about which units to sample. The researcher's primary concern here should be selecting participants in a way that is representative of the whole. However, this method primarily relied on a tiny yet representative sample (Aminuzzaman, 2011).

Table 1: Criteria and Number of Respondents

Method of Data Collection	Criteria	Number of Respondents	Total
In depth Interview	Students	40 from each Institution	80
Key Informant Interview (KII)	Teachers	10 from each Institution	20
Grand Total			100
Additionally, 2 FGDs were conducted from these universities (participants will be teachers)			

Researchers at one public and one private university will seek to interview a manageable sample of students and faculty for this research. Finally, Focused Group Discussion (FGD) was a fantastic method for collecting qualitative information. One FGD were conducted at each institution under study, yielding a wealth of information that may be used to corroborate the In-depth interview conclusions. For FGD, it will anticipate between seven and twelve participants. Last but not least, the research can benefit much from firsthand observation and the observations of the stakeholders. Qualitative results helped immensely in achieving the study's goals and painting a picture of the perceived level in the "Mapping the Readiness of Outcome-Based Education (OBE) at Tertiary Level in Bangladesh: A Comparative Study of One Private and One Public University".

Results and Discussion

An integrated strategy is required for postsecondary education. For this purpose, the existing policy framework and institutional arrangement should first be applied and re-examined. Declaring that this framework will be quality-oriented is crucial. The aims of higher education can only be attained if we pay attention to the basic rules and ethos that universities, by and large, strive to achieve worldwide (Rabbani & Chowdhury, 2014). This section presents broad findings and discusses the field study data.

(a) **Governance and Effective Management**

Public University:

Supportive Governance Structure: (N=19) Participants highlighted that the decision-making process and structure of the university's governance system support the implementation of Outcome-Based Education (OBE). The governance system prioritises clear objectives and measurable outcomes, facilitating the effective implementation of OBE. The Institutional Quality Assurance Cell (IQAC) ensures curriculum alignment with OBE principles.

Mixed Feelings and Areas for Improvement: While some aspects support OBE, areas for improvement include transparency in decision-making and better communication between departments and IQAC. Lack of clarity in conveying OBE objectives to students and room for enhancement in governance structure alignment with OBE goals.

Role of Vice-Chancellor: The Vice-Chancellor supports OBE initiatives, emphasises education and research, and provides financial support for OBE curriculum development.

Private University:

Supportive Governance Structure: (N=23) Participants noted that the decision-making process and structure of the university's governance system support OBE implementation. The university has a well-defined vision and mission for its Program of Education (PoE), effectively communicated to stakeholders. Robust mechanisms for receiving complaints and addressing issues, including sexual harassment, are in place.

Areas for Improvement: (N=17) Participants suggested improving the definition of the PoE's vision and mission to align better with OBE principles and enhance strategic plan communication. They also suggested improving the management of the academic calendar and evaluating the class size policy for better learning outcomes.

Moderate Support for OBE: (N=10) participants expressed moderate support, citing the university's governance structure as instrumental in supporting efficient management and OBE implementation. Recognised efforts in maintaining a defined vision and mission, strategic planning, and mechanisms for complaints handling and academic calendar management.

(b) **Leadership, Responsibility, and Autonomy**

Public University

Leadership's Role in Organizational Structure and Responsibilities: Most respondents (N=26) emphasise the significant role of university leadership in defining and maintaining a clear organisational structure with well-defined responsibilities. While efforts have been made to ensure transparency, there are areas where clarity in roles and responsibilities could be improved, hindering the effective implementation of OBE. Autonomy, coupled with adequate

financial support, is deemed essential for the successful execution of OBE initiatives, but bureaucratic hurdles and budget constraints have sometimes limited this autonomy.

Diverse Perspectives on Leadership's Promotion of Responsibility and Autonomy: The nine participants(N=9) acknowledged the efforts of the university leadership in promoting a culture of responsibility and autonomy by recruiting qualified teachers for the initiative of Outcome Based Education, providing training above and beyond the BE curriculum and providing overall support for its implementation. Fifteen participants (N=15) felt a need for more freedom of leadership and improved responsibility distribution systems, citing top-down instruction and limited student participation in the decision-making process. Nevertheless, most participants acknowledged the university leadership's efforts in setting clear goals, monitoring performance and motivating relevant stakeholders to innovate in the Outcome Based Education curriculum context.

IQAC's Perspective on Leadership's Promotion of Responsibility and Autonomy: According to the Internal Quality Assurance Cell (IQAC), university leadership promotes responsibility and autonomy by entrusting and enabling stakeholders to lead and facilitate OBE initiatives. The leadership provides sufficient authority to develop and implement OBE policies and procedures, supporting stakeholders in addressing issues that arise in the process.

Faculty Autonomy in Curriculum Development and Teaching Methods: The faculty members and the participants expressed a sense of autonomy in designing the curriculum according to the job market demand and selecting appropriate materials and assessment methods to ensure course learning outcomes based on the job market demand. Faculty members expect the ability to choose materials and assessment methods consistent with outcome-based Education curriculum principles, emphasising flexibility and alignment with learning outcomes.

Private University

Leadership Excellence: Participants from the private university (N=25) perceive their university's leadership as highly effective in fostering a culture of responsibility and autonomy among faculty and staff. Leadership is essential in ensuring a clear organisational structure with clear responsibilities and promoting transparency and accountability among faculty members and staff. Adequate autonomy is given to faculty and staff to innovate in curriculum design, teaching methods and assessment practices aligned with outcomes-based education curriculum approaches. The leadership upholds core values prioritising social responsibility, diversity, and inclusivity, which are integrated into teaching, research, and service activities, enhancing OBE effectiveness.

Room for Improvement: Among the participants (N=14) think responsibility and autonomy are essential for the OBE or Outcome Based Education curriculum. This will support implementing Outcome Based Education curriculum and create a culture of imparting this curriculum at the university level. Organisational structures outline responsibilities and help ensure transparency and accountability. Financial constraints of universities hamper the functioning of autonomy, which significantly affects the implementation of OBE. However,

the implementation and effectiveness of OBE must be improved to foster a desired degree of independence among faculty members in maintaining the quality of education.

Empowerment through Autonomy: Participants (N=11) emphasise the pivotal role of university leadership in fostering responsibility and autonomy with a clear and well-defined organisational structure. Adequate freedom is given to faculties with adequate financial allocations; appropriate training facilities are provided through IQAC on innovative teaching and assessment methods associated with OBE. The university actively promotes core values of social responsibility, diversity, and inclusivity, creating a supportive environment for OBE initiatives.

(c) Curriculum

Public University

Average Readiness Level for Curriculum Mapping: Most respondents (N=24) express an average readiness level for curriculum mapping for OBE implementation. Curriculum alignment with the Bangladesh National Qualifications Framework (BNQF) requirements is highlighted. Emphasis is placed on structuring programs, defining Program Learning Outcomes (PLOs), ensuring coherence with the university's mission, and adhering to credit requirements. Integration of internship, project work, and fieldwork into the curriculum is emphasised.

Positive Perception of OBE-Based Curriculum: Seventeen participants (N=17) view OBE-based curriculum positively, aligning learning outcomes with industry competencies. Faculty engagement in curriculum revision, alignment with OBE principles, and confidence in readiness for OBE transition are noted. Regular assessments are conducted to evaluate curriculum effectiveness.

Active Engagement and Preparation for OBE Implementation: Nine participants (N=9) mention faculty workshops, course alignment with desired outcomes, and readiness for OBE implementation at the honours level.

Diverse Approaches and Perspectives in OBE Implementation: Various departments exhibit different readiness levels and engagement with OBE principles. Departments such as Marketing and Bangla actively embrace OBE by focusing on active learning strategies, problem-solving, and curriculum mapping. Public administration departments emphasise integrating outcome-focused elements into courses and assessments, with some departments already implementing OBE at the honours level.

Private University

Diverse Views on Curriculum Alignment and Preparation: The study's findings on a private university's curriculum reveal a mixed perspective among participants. According to a significant number of participants (N=19), there is a positive perception regarding the university's curriculum alignment with national standards and benchmarks set by the Bangladesh National Qualifications Framework (BNQF). They believe that the curriculum for each program is meticulously prepared to meet the requirements outlined by the BNQF,

ensuring coherence with the university's mission and objectives. Program Learning Outcomes (PLOs) are clearly defined and structured within the curriculum, facilitating practical assessment and evaluation of student achievement. Furthermore, there is a strong emphasis on integrating practical experiences such as internships, projects, and fieldwork into the curriculum to enhance students' readiness for the workforce or further academic pursuits.

Lack of Clarity in Graduate Profile Alignment: A small proportion of participants expressed dissatisfaction with some aspects of the OBE curriculum. They believe that the OBE curriculum will meet the requirements specified by the BNQF, particularly in defining program learning outcomes with clear guidance on alignment and continuity across undergraduate and postgraduate profiles. There needs to be more alignment between program learning outcomes and individual courses and inconsistencies regarding what more general education courses need to do with the undergraduate curriculum. These participants highlighted the need for more documentation of academic activities in education programs and the inadequacy of incorporating practical experiences into the curriculum.

Consistency with Qualification Framework Guidelines: A separate group of participants (N=9) holds an average perspective on their university's readiness for OBE implementation. They acknowledge that the curriculum is meticulously prepared by BNQF requirements and is designed to produce graduates aligned with the university's graduate profile. Program Learning Outcomes (PLOs) are precisely defined and time-bound, ensuring students acquire necessary skills within designated timeframes. The curriculum consistently meets the qualification framework's guidelines and ensures alignment between PLOs and course content. Moreover, the university integrates internships, project work, dissertations, and fieldwork into the curriculum to provide practical learning experiences for students.

(d) Teaching-Learning Process

Public University

Clear Communication of Learning Outcomes is Crucial (N=19): Participants emphasised the importance of clear communication of learning outcomes. Ambiguity in objectives can hinder understanding and practical application of theoretical concepts. This suggests a need for faculty to ensure well-defined expectations aligned with practical skills development through Outcome-Based Education (OBE).

Need for Alternative Assessment Methods (N=11): In the conventional curriculum system, examinations were less important in evaluating practical skills, especially in departments like accounting, finance and banking. The participants suggested developing alternative assessment methods such as project-based assessment and industry visits linked to the Outcome Based Education curriculum. Apart from imparting theoretical knowledge, practical aspects of it are also included in the curriculum, limited resources or inadequate modern technology and time constraints have been identified as significant obstacles.

The desire for a Student-Centered Approach (N=10): Participants expressed a desire to shift towards a student-centred approach, advocating for active learning strategies and a

collaborative environment. They believe that fostering practical skills alongside theoretical knowledge is essential for OBE. Suggestions included incorporating more case studies, simulations, and internships to provide real-world exposure.

Need for Consistent and Transparent Assessment Methods (N=10): Concerns were raised regarding the consistency and transparency of assessment methods. Participants highlighted unclear assessment heads and delayed feedback as issues that need improvement. They hope the Internal Quality Assurance Cell (IQAC) can enhance quality assurance and monitoring of OBE implementation.

Private University

Enhancing Alignment with Outcome-Based Education System

Participants (N=18) emphasise the need for incorporating practical assessments and real-world projects to enhance alignment with the outcome-based education system. CCN University of Science and Technology meticulously designs its teaching-learning process to align with outcome-based education, prioritising developing critical thinking and higher-order thinking skills (HOTS). Teaching-learning methods and assessment practices at CCN University are tailored to foster critical thinking, analysis, synthesis, and evaluation among students. Allocation of Students Learning Time (SLT) and course planning are meticulously executed to ensure coverage of all course learning outcomes and transparent curriculum delivery.

Transparency and Accountability in Curriculum Delivery

Course plans are available to students at the beginning of each semester, facilitating effective planning and understanding of course expectations. Timely feedback on student performance aids continuous improvement, and rigorous moderation of examination papers ensures assessment fairness and validity. Clear progression rules set by the Program of Education (PoE) help students understand advancement criteria, promoting accountability and planning in their academic journey. Alignment between course learning outcomes, teaching-learning activities, and assessment methods is ensured across all courses, enhancing coherence and effectiveness in achieving intended learning outcomes.

Continuous Professional Development and Curriculum Relevance: Emphasis on continuous professional development for faculty ensures the curriculum remains relevant and aligned with industry trends. Shift towards competency-based assessments ensures accurate measurement of student proficiency and alignment with industry demands. Regular curriculum reviews and integration of industry experts in teaching processes facilitate alignment with the practical requirements of the job market.

Room for Improvement: Despite efforts, some participants (N=9) noted discrepancies in teaching methods, assessment practices, and communication of progression rules, indicating areas for improvement in alignment with outcome-based education. Participants emphasised the importance of faculty development programs, active learning strategies, and peer observation to enhance alignment with OBE principles.

Varied Perspectives on OBE Implementation: Lecturers from different departments highlight various interactive teaching and assessment methods aligned with OBE principles, such as topic-wise teaching and assessment based on Bloom's taxonomy.

(e) **Research & Scholarly Activities**

Public University

Challenge of Research Culture and Academic Integrity (N=18): A lack of a research culture impedes critical thinking and innovation among students. A high similarity index (25%) in UGC-funded projects reflects a lax attitude towards academic integrity. A comprehensive research policy is needed to foster originality, integrity, and excellence. Emphasis should be placed on collaboration with external experts and transferring research findings to industry/ community.

Role of Research and Scholarly Activities in OBE (N=9): Research identifies best practices and informs curriculum refinement. Scholarly activities lead to innovative teaching methods and enhance faculty expertise. Collaboration with industry partners ensures alignment with industry needs. Research publications guide curriculum updates and expose students to cutting-edge technologies.

Impact of Departmental Research Culture on Curriculum Mapping (N=3): Research publications contribute to curriculum enrichment. International collaborations broaden perspectives and enhance student readiness. Research findings inform the OBE framework and lead to educational innovations.

Challenges and Impact of Research & Scholarly Activities on OBE Mapping Readiness (N=7): Pressure, workload, and competition among faculty and students distract from primary roles. RSA's time, resource, and energy consumption divert attention from OBE implementation. More funding is needed to ensure outcome mapping granularity and hinders curriculum improvement. Financial constraints impede effective outcome mapping in academic programs.

Private University

Comprehensive Research Policy and Integrity Assurance: Participants emphasised the importance of having a comprehensive research policy with mechanisms to control plagiarism. This ensures the integrity of research outputs, which is crucial for supporting the credibility of educational outcomes within the OBE framework.

Need-Based Research and External Collaboration: The significance of conducting need-based research with external collaboration was highlighted. Collaborating with external partners helps address local and global issues, enriching the educational experience and aligning research efforts with OBE's objectives.

Dissemination of Research Findings: There is a consensus on disseminating research findings to the industry and community. By fostering the practical application of knowledge, universities strengthen ties with external stakeholders, enriching the learning experience for students and enhancing the relevance and impact of educational outcomes.

Quality Publications and Societal Impact: Prioritizing high-quality publications that positively impact society was underscored. By focusing on impactful research outputs, universities ensure that their educational outcomes are aligned with the needs and expectations of the community, contributing significantly to the readiness of OBE implementation.

(f) **Monitoring, Evaluation & Continual Improvement**

Public University

Inadequate Monitoring and Evaluation Resources: This study highlights a significant challenge in monitoring and evaluating the effectiveness of Outcome Based Education due to human resource constraints. IQAC has only three workforce: a director, an additional director, and a staff member. There needs to be more to effectively supervise the university's OBE curriculum, which is a significant constraint in OBE curriculum formulation and implementation. To overcome this limitation, the skilled workforce should be increased, and more capacity should be in place to help the institution implement the OBE curriculum (N=25).

Utilisation of Action Research: One respondent mentioned adopting action research as a strategy for monitoring, evaluating, and continually improving OBE. This systematic inquiry and reflection process aims to address practical problems and improve practices within the institution. The IQAC conducts and supports action research projects to identify and solve challenges within the OBE system, disseminating findings to stakeholders for discussion and implementation (N=1).

Lack of Feedback Mechanism: The absence of a systematic feedback mechanism from stakeholders, including industry needs, course effectiveness, and faculty performance, hampers the university's ability to address concerns and make necessary improvements. This gap inhibits the institution's capacity to adapt to evolving educational needs and challenges (N=25).

Effective Implementation Strategies: Some respondents (N=7) highlighted successful strategies in OBE implementation, including a well-defined curriculum framework with clear objectives and outcomes, aligned instructional methodology, transparent assessment procedures, and a culture of continual improvement. These strategies contribute to effective monitoring, evaluation, and adaptation of OBE initiatives.

Private University

Lack of Satisfactory Strategies and Institutional Setup (N=19): Some participants indicated dissatisfaction with the existing ME&CI strategies at CCN University of Science and Technology. A well-functional Institutional Quality Assurance Cell (IQAC) needs to improve effective monitoring and evaluation of policies and practices. No mechanism in place for collecting and addressing feedback from stakeholders, including students, faculty, and industry partners. Issues like changes in the industry, course effectiveness, teacher performance, and facility functionality need to be adequately addressed, hindering the dynamic and sustainable development of courses and curricula. Insufficient university-industry collaboration (UIC) for mutual benefit and improvement was noted.

Effective Strategies in Place (N=13): CCN University has implemented several strategies for ME&CI to ensure the effective implementation of OBE. Well-functional IQAC oversees quality assurance processes and continually improves them. A systematic method for collecting feedback from various stakeholders. OBE program undergoes continual monitoring, review, and updating based on received feedback. Strong collaborations with industry partners for mutual benefit and improvement are maintained.

Robust System Implemented (N=18): The university has established a robust system for ME&CI to ensure the effective implementation of OBE. Well-functional IQAC is responsible for overseeing OBE implementation, conducting regular evaluations, and identifying areas for improvement. A systematic approach to collecting feedback from stakeholders, including students, faculty, alums, and industry partners. Prompt addressing of issues related to changes in industry trends, course effectiveness, faculty performance, and facility functionality. OBE programs are continually monitored, reviewed, and updated to maintain relevance and high quality.

Recommendations

Bangladesh requires worldwide education that meets international standards to advance society productively and efficiently (Ali *et al*., 2015). The ways can achieve OBE success are:

A. Enhance Transparency and Communication Channels:

Both public and private universities should prioritise enhancing transparency in decision-making processes and communication channels between departments, Institutional Quality Assurance Cells (IQAC), and stakeholders. This can be achieved through regular meetings, clear documentation of decisions, and effective dissemination of information regarding Outcome-Based Education (OBE) objectives to students. Encouraging feedback mechanisms can also foster better communication and transparency.

B. Enhance Consistency and Clarity in Curriculum Alignment:

A comprehensive review of curriculum across all programs in line with the Bangladesh National Qualification Framework and the University's vision mission. The learning outcomes of each course and each program should be clearly defined and structured to ensure consistency and coherence. Course content should be modified and reviewed to align with specific program learning outcomes and national standards specified by faculty support and external experts. Focus on addressing any gaps or inconsistencies and provide for continuous evaluation of the effectiveness of the curriculum in meeting desired outcomes.

C. Align Vision and Mission with OBE Principles:

Public and private universities should revisit and refine their vision and mission statements to ensure alignment with OBE principles. This involves clearly articulating objectives, prioritising measurable outcomes, student-centric learning, and continuous improvement.

Stakeholders' involvement in this process can enhance ownership and commitment towards achieving OBE goals.

D. Foster Collaboration Between Universities and Industries:

Public and private universities should strengthen collaboration with industry partners to ensure the relevance and sustainability of outcome-based education programs. They must also provide skills and knowledge by establishing formal MOUs and University-Industry Collaboration processes to facilitate knowledge exchange, internships, industrial projects, and joint research initiatives at undergraduate and postgraduate levels. Universities should better align OBE initiatives with industry needs by involving industry entrepreneurs or tech holders in the continuous curriculum development and evaluation process and emphasise increasing graduate and postgraduate employability and competitiveness in the job market.

E. Strengthen Governance Structures for OBE Implementation:

Both types of universities should focus on strengthening their governance structures to support OBE implementation better. This includes empowering Institutional Quality Assurance Cells (IQAC) with resources and authority to oversee curriculum alignment with OBE principles. Additionally, efforts should be made to streamline decision-making processes, ensuring they are responsive to the dynamic needs of OBE and promote collaboration among departments.

F. Establish Strong Research Policies Across Institutions:

Develop comprehensive research policies prioritising academic integrity and originality across all universities. These policies should address issues such as plagiarism and foster a strong research culture. They should also include mechanisms for monitoring and enforcing academic integrity standards, ensuring that research outputs contribute positively to OBE's educational objectives.

G. Promote Participatory Decision-Making Processes:

Foster a culture of inclusivity by involving students, faculty, and staff in decision-making processes related to OBE initiatives. Encourage feedback mechanisms that allow stakeholders to contribute ideas, suggestions, and concerns regarding autonomy and responsibility. Implement strategies to ensure that directives from university leadership are communicated effectively and stakeholders feel heard and valued in the decision-making process.

H. Clear Communication of Learning Outcomes:

Develop a standardised framework for communicating learning outcomes across all courses. This should include measurable objectives aligned with practical skills development, following Outcome-Based Education (OBE) principles. Provide faculty with training and resources on

effectively communicating learning outcomes to students at the beginning of each course. This should involve practical examples and real-world applications to enhance understanding.

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Conclusion

Formal education is a crucial element of sustainable development. Education fosters personal and national development, allowing countries to thrive and remain competitive in the global economy. Developing basic cognitive abilities and offering opportunities for further learning are crucial for achieving success in a society that values information as a source of authority. Quantitative and qualitative knowledge is vital for skill development and increasing productivity. Education, by empowering individuals to take control of their development, has shown to be the most effective strategy for alleviating poverty in Bangladesh. According to McGrath (1999), education is also hailed for its potential to halt population growth, lower maternal mortality, boost agricultural output, enhance labour force participation, and promote democratisation. Bangladesh's higher education system does not offer instruction of a calibre that meets international standards, which is necessary to address the issues that the globe will face. Numerous researchers discovered that higher education quality is declining daily (Rabbani & Chowdhury, 2014). Currently, a small number of volunteers were recruited for this qualitative study. The views of teachers at a single university about adopting OBE were the only subjects covered by this study. No investigation was conducted into the attitudes and perceptions of educators from other universities in Bangladesh. As a result, the study was more extensive and involved many individuals utilising various research tools. The research study also includes the perspectives of university instructors regarding their past understanding of the Outcome-Based Education approach and the results of their current teaching strategies..

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Exploring the Scopes and Challenges of Implementing Formative Assessment in Primary Education in Bangladesh

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Abstract

Formative assessment has become the preferred method worldwide for tracking student learning progress and evaluating teacher performance, surpassing summative assessment in importance. Bangladesh has initiated the assessment under National Curriculum Framework 2021 despite it has been ruled out several time in the country. In the context, the study explores the implementation of formative assessment in Bangladesh's primary education system, aiming to identify its scope and challenges while providing recommendations for improvement. It employs a mixed-method research design, incorporating qualitative and quantitative data collection methods to ensure validity and reliability. Findings reveal a diverse teaching demographic with varying levels of experience and training opportunities. While most teachers underwent formative assessment training, assessment practices varied, with oral assessments being predominant. Feedback practices also varied, with positive oral feedback being common but written and descriptive feedback being rare. Despite challenges such as resource constraints and parental pressures for summative assessments, there is policy support and perceived benefits for formative assessment. The discussion highlights both strengths and areas for improvement, emphasizing the need for targeted interventions and comprehensive training programs for teachers. Policy implications underscore the importance of capacity development, resource allocation, transparency in assessment, and strategic support for student attendance. Recommendations include fostering a supportive environment for effective formative assessment practices and further research to assess their impact and explore factors influencing teachers' adoption of these practices. Overall, addressing contextual factors, investing in teacher training, and promoting a holistic approach to assessment are crucial for improving student learning outcomes in Bangladesh's primary education system.

Key words: Formative Assessment, Assessment Practice, Feedback Mechanism, Challenges of Formative Assessment.

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Introduction

Formative assessment is a vital educational approach that fosters active and purposeful collaboration between teachers and students to enhance learning outcomes (Moss and Brookhart, 2019). It offers several benefits, such as allowing teachers to evaluate the effectiveness of their instructional practices, make necessary adjustments, and provide students with feedback on their progress. Studies have shown that this approach enhances students' understanding, encourages further study, and promotes self-monitoring of their learning progress (Steve & Michael, 2011; McCallum & Milner, 2021). Formative assessment is an ongoing process that involves the continuous gathering of evidence to guide instruction, allowing teachers to modify their teaching strategies based on students' needs (Hattie and Brown, 2004). The teacher's role is crucial, as they guide students toward collective learning goals, making formative assessment a powerful tool for improving educational achievements (Black and Wiliam, 2003; Moss and Brookhart, 2019).

In Bangladesh, formative assessment was initially introduced in the late 1980s within the primary education sector, specifically in Grades 1 to 3, as part of a competency-based curriculum (National Curriculum and Textbook Board [NCTB], 2021). However, due to challenges like manual record-keeping, the practice was discontinued by a ministerial order in 2005. Recognizing the importance of formative assessment, the Education Policy of 2010 re-emphasized its role, particularly for early grade learners, to ensure foundational learning (Ministry of Education [MoE], 2010). In 2019, the government took a significant decision to fully implement formative assessment in Grades 1 to 3 and emphasize its use in Grades 4 and 5 is a commitment to improving the quality of primary education in Bangladesh (NCTB & UNICEF, 2021). In 2020, the NCTB conducted a pilot program in 100 schools to assess the feasibility of formative assessment, based on the 'School and Classroom Based Assessment (SCBA)' guidelines. While the pilot study confirmed the feasibility of formative assessment, it also highlighted challenges such as insufficient teacher orientation, lack of supervision, heavy workloads, and extensive documentation requirements (NCTB & UNICEF, 2021).

In response, the NCTB revised the guidelines and prepared training manuals for teachers and other stakeholders, incorporating these revisions into the National Curriculum Framework, 2021 (NCTB, 2021). The NCTB has also developed curriculum, textbooks, assessment strategies, teacher guides and training materials to support teachers in implementing formative assessment under the National Curriculum Framework, 2021. Before its formal introduction in 2023, student learning in primary education was primarily assessed through subjective test items in textbooks and teachers' guides. The shift to formative assessment represents a significant change in teaching practices, requiring careful planning and understanding of the potential challenges and opportunities.

Despite these efforts, past experiences, including the failed implementation of similar assessments in secondary education, underscore the need for identifying and addressing challenges early on. In past, the implementation of formative assessment in Bangladesh has faced numerous challenges. Several studies on formative assessment of secondary education in Bangladesh identified obstacles such as insufficient teacher training, large student

populations, large contents of syllabus, no reflection of the marks of formative assessment in public examinations, lack of honesty and fairness in teachers, lack of validity and reliability of formative assessment, socio-economic conditions, and heavy teacher workloads, absence of monitoring and supervision by the concerned authority, all of which hinder effective school-based assessment (Rahman et. al., 2021; Azim, 2012; Begum & Farooqui, 2009). Hence, this study aimed to explore the scope of formative assessment in primary education and identify the challenges that might impede its effective implementation. By understanding these issues during the piloting stage, the research sought to ensure that formative assessment can be successfully scaled up and contribute to the improvement of primary education in Bangladesh.

Literature Review

Formative assessment has become increasingly recognized as a critical component in the educational process (Bennett, 2011; Black & Wiliam, 1998a; Sadler, 1989; Stobart, 2008), particularly for its role in enhancing student learning and guiding teaching strategies (Black & Wiliam, 2009; Dube-Xaba & Xulu, 2020). This shift from summative to formative assessment reflects a broader global trend, where the focus is on ongoing feedback rather than merely evaluating student performance at the end of a learning period (Ozan & Kncal, 2018). Formative assessment, as described by Black and Wiliam (2009), involves activities that provide feedback to both students and teachers (Wiliam, 2018), helping to modify and improve the learning process (Wiggins, 1998). Unlike summative assessment, which is primarily evaluative, formative assessment aims to gather evidence of student understanding and use it to enhance learning outcomes (Black and Wiliam, 1998b).

The literature emphasizes that formative assessment is not just about feedback from teachers but also involves peer and self-assessment, allowing students to reflect on their learning (Sadler, 1989; Nitko & Brookhart, 2013). Feedback within this framework is seen as essential, as it provides students with timely and specific guidance on their performance, helping them to improve continuously (Pai, 2024). Nitko & Brookhart (2013) argue that effective formative assessment requires teachers to clarify learning objectives and ensure students understand these goals. The use of various tools, such as oral questioning, written exercises, and informal observations, is recommended to gather evidence of student understanding and provide constructive feedback (Ozan & Kıncal, 2018; Karaman, 2021).

Feedback, considered the cornerstone of formative assessment, is classified into informal and formal types, each serving different purposes (Black and Wiliam, 1998a; Pai, 2024). Informal feedback, which occurs naturally during classroom interactions, helps build rapport between teachers and students, while formal feedback is more structured and systematically planned (Black and Wiliam, 1998b). Both types aim to maximize learning by identifying areas for improvement and suggesting ways to overcome challenges (Narciss & Zumbach, 2022). The literature highlights that feedback should be designed thoughtfully to reflect on current learning while guiding future actions. Shute's concept of formative feedback, introduced by Havnes *et al*. (2012), emphasizes the importance of feedback in modifying students' thinking and behavior to enhance learning outcomes.

Various models of feedback have been developed to support the formative assessment process. Tunstall & Gipps (1996) introduced a basic model distinguishing between evaluative and descriptive feedback, while Mason and Bruning (2001) focused on the effectiveness of feedback by emphasizing its corrective, explanatory, and timely nature. Hattie and Timperley (2007) proposed a model that underscores the importance of feedback at the process level, ensuring further learning engagement. Lipnevich, Berg, and Smith (2016) introduced a model incorporating cognitive and affective responses, where feedback is seen as a dialogue between teacher and student, aimed at understanding and adapting learning strategies.

In the context of Bangladesh, the transition to formative assessment has been ongoing for over a decade (Rahman *et al*., 2021), with recent curriculum reforms by the National Curriculum and Textbook Board (NCTB) emphasizing a balanced approach between formative and summative assessment. The new curriculum integrates diverse assessment methods, including presentations, portfolios, and group work, to address different learning domains and ensure comprehensive student evaluation (NCTB, 2021). However, the implementation of formative assessment in Bangladesh faces significant challenges, including large class sizes, inadequate teacher training, and a lack of resources (Begum and Farooqui, 2009; Rahman *et al*., 2021). Studies have highlighted the need for technology integration to overcome these barriers (Berry, 2011; Byabato & Kisamo, 2014; Kanjee & Sayed, 2013; Maile, 2011; Omorogiuwa & Aibangbee, 2017; Dube-Xaba & Xulu, 2020; Reyneke, 2016; Arumugham, 2020) and enhance the effectiveness of formative assessment (Grob *et al*., 2017; Weiss & Belland, 2016), particularly in non-Western contexts where traditional, teacher-centric practices dominate.

In short, while formative assessment holds great promise for improving educational outcomes, its successful implementation requires a comprehensive understanding of its principles, effective feedback strategies, and the necessary resources and support structures to overcome existing challenges.

Methodology of the study

This study utilizes a multi-strategy mixed-method research design to address its objectives and key questions, incorporating both qualitative and quantitative data. This approach is recognized in social science research for its usefulness in ensuring data triangulation, thereby enhancing the validity and reliability of the results. The National Curriculum and Textbook Board (NCTB) piloted the program in 65 schools across 8 divisions in Bangladesh. The schools include government primary schools, kindergarten schools, ibtedaee madrasahs, and attached high schools. A diverse geographical representation was ensured, covering urban, rural, coastal, and ethnic minority areas. For the study, a total of 22 schools were selected, including 8 urban and 14 rural schools. The sample encompasses students, teachers, parents, education officers, and experts. The data analysis included both quantitative and qualitative approaches where quantitative data was analyzed using descriptive statistics, central tendency, and correlation, with the help of MS Excel and SPSS 20. Qualitative data was analyzed using data-driven thematic analysis, involving coding and developing themes to summarize the data. The mixed-method approach facilitated the integration of qualitative insights with quantitative findings to provide comprehensive conclusions. The study adhered to ethical standards by

ensuring informed consent from participants, confidentiality of respondents' information, and voluntary participation.

Findings and Discussion

The findings presented the scope of formative assessment practice in primary education and the challenges of effective implementation of the formative assessment. Scopes was examined through the relevant guideline, assessment and feedback strategies, teachers' knowledge and practice of formative assessment. Challenges identified resource related challenges, capacity development and motivation related challenges, and students and parents related challenges.

Scope of formative assessment practice in primary education

Assessment Guideline developed by NCTB showed how the sequential process assessment that includes 5 steps (NCTB, 2021). This sequence of steps in the assessment process ensures a systematic approach to monitoring and supporting students' learning progress. By assessing students learning competences, identifying progress, providing feedback, re-assessing, and offering remedial, teachers can create a continuous cycle of assessment and improvement to support student learning effectively (***See:*** Figure 1). According to Nitko & Brookhart (2013), comprehensive strategy of formative assessment starts with clarifying the learning objectives to the students and sharing the criteria for success. The process also includes manufacturing effective learning for the students before starting assessment of the students or records their performances. However, it was not found in the assessment guideline provided by the NCTB though learning objectives and performance indicators are determined in the curriculum and teacher guide. If the full cycle starting from learning objectives to ending at feedback/ remedial included in the assessment guideline then it would be helpful for the teachers to guide students learning and assessment.

Figure 1

Flowchart of formative assessment process in sequence

The Guideline also specified the assessment domains that include three domains – a) Knowledge, b) Skills, and c) Attitude & Values. Among the three domains, assessing knowledge involves evaluating students' understanding of factual information and concepts, assessing skills involves evaluating their ability to apply knowledge and perform tasks, and assessing attitude and values involves evaluating their beliefs, attitudes, and ethical principles which are increasingly recognized as essential components of education (Durlak *et al*., 2011). By considering these different domains, teachers can gain a comprehensive understanding of students' learning and development and tailor assessments to measure a range of competencies and outcomes.

According to the guideline, several strategies are suggested to use for formative assessment. The strategies included oral question-answer, written question-answer, observation, project or practical task, individual, pair and group work, viva-voce, self-assessment and peer assessment. Similar strategies were suggested in several papers on formative assessment to gather evidence of students performance as well as to understand own learning status by the students (Sadler, 1989; Nitko & Brookhart, 2013; Ozan & Kıncal, 2018; Karaman, 2021). These formative assessment strategies offer diverse approaches to gathering feedback, monitoring progress, and promoting student engagement and learning in the classroom. By incorporating a combination of these strategies, teachers can create dynamic and inclusive assessment practices that cater to the diverse needs and learning styles of their students.

The guideline included instruction regarding how to record students' performance and track their learning progress. It instructed teachers for using structured diaries to document observations, reflections, and student performance. These diaries help track individual student progress, identify learning patterns, and inform instructional decisions. Additionally, it suggested providing progress cards to the students that outline their achievements, strengths, areas for improvement, and future goals after each learning term (usually four month). The use of both teacher diaries and progress cards has created a scope of effective in monitoring student progress, addressing learning needs, and tailoring instruction to support the diverse needs of students. Tracking students' performance is essential to monitor their progress and evaluate the effectiveness of teachers' performance is crucial and suggested by the authors worked on formative assessment (Ozan & Kncal, 2018; Black & Wiliam, 2009).

The guideline also suggested specific feedback strategies to follow in teaching-learning activities to support students learning. It instructed teachers to employ clear and specific feedback strategies, both orally and in written form, to support student learning. Feedback can be provided during lesson practice, after lessons, or at the beginning of the next day's lesson, allowing students to make immediate improvements or reflect on their progress. Additionally, feedback can be delivered either directly by the teacher or through peer feedback mechanisms, promoting collaboration and active engagement among students. The findings of this study align with international research highlighting the importance of varied feedback, systematic monitoring of student progress, and promoting student engagement in assessment (Black & Wiliam, 1998a; Brookhart, 2013; UNESCO, 2017). Various feedback models also suggested these practice to support students learning, in specific, to help students understand their performance, identify areas for growth, and take appropriate steps to enhance their learning outcomes. Havnes *et al*. (2012) suggested for in person oral feedback and written feedback, and Pai (2024) stated that feedback varies in different types according to different purposes and situation of the formative assessment. It can be a sign, hint or a simple word varying from different situations and time. According to Carless and Boud (2018), analyzing feedback, peer evaluation and teacher feedback guides a student to work on the development while considering feedback literacy. The more students are attached with the feedback process, the better students can develop their performance. Black and Wiliam (1998b) suggested that formative assessment and feedback looks forward to monitoring the process and progress of the learners while suggesting the best possible ways to overcome the hurdle. The target of feedback remains maximizing the learning and it has been reflected in the strategies suggested in current assessment guideline in Bangladesh.

The findings regarding students, teachers and academic supervisors' knowledge on formative assessment strategies reveal notable differences in their understanding and application

of formative assessment techniques influenced by their varied experiences. Students most frequently identify oral questions (65%), written questions (57%), and class tests (54%) as formative assessment strategies (***See:*** Table 1). This suggests that students are most familiar with assessment techniques that directly engage them during classroom activities. Teachers, on the other hand, place greater emphasis on class work (67%), written question-answers (62%), and oral question-answers (56%) as key formative assessment strategies. This indicates that teachers prioritize in-class assignments and interactive questioning as essential tools for monitoring student learning and progress. Academic supervisors focus on class work (58%), oral question-answer (44%), and overall class performance (42%), highlighting their attention to broader classroom dynamics and student engagement as measures of learning. The findings shows notable gap in understanding of formative assessment strategies among the teachers, students and academic supervisors. Studies in countries such as Saudi Arabia, Indonesia, Malaysia, South Africa, and Bangladesh, also revealed insufficient knowledge of teachers and inadequate training, and negative attitudes towards formative assessment have been identified as barriers to successful implementation. Lack of understanding of formative assessment principles and insufficient training are also common issues (Al-Wassiaet et. al., 2015; Arrafii and Sumarni, 2018; Sidhu *et al*., 2018; Fook, Sidhu & Mohammad, 2011; Ong, 2010). Thus the finding suggest for the need for a cohesive approach to formative assessment, ensuring that all stakeholders—students, teachers, and academic supervisors—share a common understanding and implementation of effective assessment practices. By aligning their perspectives, the educational community can better support student learning and progress through consistent and comprehensive formative assessment strategies.

Table 1

Knowledge of formative assessment by respondent category

Techniques mentioned by students (n=220)		Techniques mentioned by Teachers (n=66)		Techniques mentioned by AS (n=34)	
Class test	54%	Class test	23%	Class test	18%
Class work	13%	Class work	67%	Class work	58%
Home work	4%	Home tasks	9.8%	Home tasks	14%
Oral questions	65%	Class performance	28%	Class performance	42%
Written questions	57%	Individual/Pair/ Group work	24%	Group/Pair/Individual work	46%
		Oral question-answer	56%		28%
		Written question-answers	62%	Self and Peer assessment	44%
		Reading & writing tasks	46%	Oral questions-answer	38%
		Observation (behavior, discipline, cleanliness, assigned work)	28%	Observation (behavior, discipline, cleanliness, assigned work)	14%
		Verification of daily lessons		Attendance in assembly	22%
		Teacher diary	24%	Participation in Co-curricular activities	
			58%		

The findings regarding formative assessment practice in classroom based on classroom observation indicate a mixed performance in teachers' formative assessment practices during

regular teaching-learning activities. Teachers often asked closed questions (Mean: 3.13) and assessed students orally (Mean: 3.73), but were less consistent in encouraging students to ask questions (Mean: 2.2) or using open-ended questions (Mean: 2.23). While teachers frequently provided equal opportunities for students to answer questions (Mean: 2.83) and assessed individual work (Mean: 2.97), self-assessment (Mean: 1.0), peer assessment (Mean: 1.6), and observational assessment (Mean: 1.4) were rarely practiced (See: Table 2). Feedback was also infrequently provided (Mean: 1.47), and reading-writing tasks (Mean: 1.35) were seldom used for assessment. The findings are similar to result found in other studies conducted in Bangladesh in previous years. Rahman (2018) found that teachers tend to ask close-ended questions, oral questions, individual tasks and home task and no use of self-assessment, peer assessment or encouraging students to asking questions, while Rahman et. al. (2021) found that teachers frequently use class test, class work, group work and homework for assessment purpose, and rarely use assignment, oral presentation to assess students' performance. Rahman, Babu & Ashrafuzzaman (2011) found that teacher-led close-ended questions were mostly used for assessment purpose and assessed competences related to the lower level cognitive domain. Ahsan (2009) also found the same result in his study.

Table 2

Observation regarding formative assessment practice by the teachers

Statements	N	Mean	SD	Cumulative Mean (SD)
1. Teacher encouraged students to ask questions	66	2.20	0.805	2.34 (0.732)
2. Teacher asked open questions to the students		2.23	1.135	
3. Teacher asked closed questions to the students		3.13	0.681	
4. Teacher gave equal opportunities to all students to answer the questions		2.83	0.699	
5. Teacher provided students sufficient time to answer questions		2.87	0.776	
6. Teacher used self-assessment technique to assess students		1	0	
7. Teacher used peer assessment technique to assess students		1.60	1.003	
8. Teacher assessed students through observation (performance)		1.40	0.770	
9. Teacher assessed students orally		3.73	0.450	
10. Teacher assessed students through reading-writing tasks (class work)		1.35	0.850	
11. Teacher assessed students' knowledge through individual work		2.97	0.490	
12. Teacher assessed students' knowledge through pair/group work		1.67	1.155	
13. Teacher assessed students' home tasks		2.83	0.699	
14. Teacher kept record of the assessment/track learning progress		3.8	0.689	
15. Teacher provided feedback		1.47	0.776	

Note: 1 = Hardly seen, 2 = Sometimes seen, 3 = Often seen, 4 = Always seen

Teachers consistently tracked learning progress (Mean: 3.8), but their overall assessment practices varied significantly based on professional education and training in formative assessment. Teachers with professional education (p-value: 0.016) and those who received formative assessment training (p-value: 0.008) demonstrated significantly higher assessment practices compared to their counterparts without such qualifications ($p<0.05$). However, no significant differences were found based on gender, years of experience, or location. These results highlight the importance of professional education and formative assessment training in enhancing teachers' assessment practices, while also identifying gaps in the use of self-assessment, peer assessment, and feedback provision that need to be addressed to improve student learning outcomes.

The findings regarding teachers' feedback practices based on observation of teaching-learning and assessment activities reveal a mixed performance. Teachers frequently provided correct answers rather than provoking or punishing students for their failures (Mean: 3.07) and often gave positive oral evaluative feedback (Mean: 3.07). However, other forms of feedback, such as oral descriptive feedback (Mean: 1.27) and written descriptive feedback (Mean: 1.0), were rarely observed (***See:*** Table 3). Similarly, negative oral feedback (Mean: 1.4) and written evaluative feedback (Mean: 1.2) were infrequently used. Feedback was sometimes provided during (Mean: 2.3) and often after teaching-learning activities (Mean: 2.67), with teachers more likely to offer feedback individually (Mean: 2.73) than to the whole group (Mean: 1.93). The findings show while positive oral evaluative feedback was prevalent, other forms such as written and descriptive feedback were lacking. This aligns with international research suggesting that varied and descriptive feedback contributes significantly to students' learning (Hattie & Timperley, 2007).

Table 3

Observation regarding feedback provided by the teachers during teaching-learning activities

Statements	N	Mean	SD	Cumulative Mean (SD)
1. Teacher provided correct answer instead provoking/ punishing students in their failure.	66	3.07	0.521	2.06 (0.692)
2. Teacher provided oral descriptive feedback.		1.27	0.691	
3. Teacher provided oral positive evaluative feedback.		3.07	0.789	
4. Teacher provided oral negative evaluative feedback.		1.40	0.932	
5. Teacher provided written descriptive feedback.		1	0	
6. Teacher provided written evaluative feedback.		1.20	0.610	
7. Teacher provided feedback during teaching learning activity.		2.30	1.022	
8. Teacher provided feedback after teaching learning activity.		2.67	0.758	
9. Teacher provided feedback individually.		2.73	0.583	
10. Teacher provided feedback to whole group.		1.93	1.015	

Note: 1 = Hardly seen, 2 = Sometimes seen, 3 = Often seen, 4 = Always seen

Similar to the assessment practice, the analysis shows that teachers with professional education (p-value: 0.021) and training in formative assessment (p-value: 0.007) demonstrated significantly higher feedback practices ($p<0.05$), while gender, years of experience, and location did not significantly impact feedback practices. Overall, the findings suggest that while teachers are inclined to offer positive oral feedback and correct errors constructively, they are less consistent in providing detailed descriptive and written feedback. These results highlight the need for enhanced professional development and training to improve the variety and frequency of feedback practices in formative assessment. The correlation between teachers' professional education and feedback practices further emphasizes the importance of ongoing teacher training in enhancing pedagogical skills (Guskey, 2002).

Apart from the quantitative result, the qualitative findings reveal a generally favorable environment for the adoption and implementation of formative assessment practices in primary education in Bangladesh. Teachers and students are already familiar with the concept, indicating that formative assessment is integrated into regular teaching-learning activities and is not a new concept to them. This familiarity suggests a level of comfort and acceptance among stakeholders, making formative assessment a viable and natural part of the educational process. Teachers perceive formative assessment as feasible within current classroom settings, emphasizing its adaptability and practicality in daily routines. For example a head teacher from Barishal stated that: *"it's a good method. There will be no pressure on students. Student's learning can be assessed normally in current school routine and classroom activities like daily work."*

The positive perception is reinforced by stakeholders who recognize the benefits of formative assessment in reducing pressure on students and offering a more organic way to assess learning progress. Educational authorities, like the National Curriculum and Textbook Board (NCTB), have provided relevant guidelines, such as the Teacher Guide and Teacher's Diary, which offer practical advice on implementing these practices. For instance, an Assistant Teacher from Chattagram said, *"Teacher guide has relevant guideline on how to do formative assessment. There is also Teacher Diary given in NCTB that include how to record students' progress. I got training that also helped me to better understand the process."* Additionally, teachers have received training to enhance their understanding and application of formative assessment methods. The qualitative findings regarding stakeholders' familiarity and support for formative assessment practices underscore the importance of creating an enabling environment for the successful implementation of such practices (Black & Wiliam, 2009).

Furthermore, policy support is evident, with the National Education Policy 2010 and the School and Classroom Assessment Guidelines advocating for formative assessment's implementation in primary education. The approval of National Curriculum Framework 2021 (NCTB, 2021) that incorporates formative assessment further strengthens this policy backing. Overall, these findings highlight a supportive framework for formative assessment in Bangladesh's primary education system, with familiarity, perceived benefits, practical guidelines, and policy support all contributing to its potential success and sustainability.

Challenges of Implementing Formative Assessment

The study identified several significant challenges in implementing formative assessment practices in primary schools, grouped into three main categories: resource-related challenges,

capacity development and motivation-related challenges, and challenges related to students and parents.

Resource-related challenges pose a major obstacle to the effective implementation of formative assessments. One of the key issues is insufficient class duration. Teachers struggle to assess all students' learning progress within the typical 35-40 minutes allotted for each class, especially in larger classes. This limited time frame hampers teachers' ability to provide individualized feedback, which is crucial for supporting student learning. For instance, a teacher from Rajshahi noted that assessing individual progress is feasible only in smaller classes with 20-25 students, a scenario often not available in many schools.

Large class sizes further complicate the situation. The challenge of managing numerous students in a single class makes it difficult for teachers to track individual performance and provide personalized feedback. This lack of individual attention can negatively impact the quality of both assessments and the feedback provided. Additionally, teachers face heavy workloads with competing priorities, which makes it difficult to allocate sufficient time to prepare and conduct formative assessments. The demands of preparing these assessments often conflict with other responsibilities, leading to potential neglect of this critical practice. For example, a Head Teacher from Barisal said, *"Formative assessments require a preparation from teachers' end that they cannot do due to the other work priorities".*

Supplementary resource constraints also play a role. Although resources like Teacher Guides (TGs) and assessment tools are available through the National Curriculum and Textbook Board (NCTB), many teachers lack access to them. The absence of TGs, which offer essential guidance for planning and conducting teaching-learning activities and assessments, limits teachers' effectiveness in implementing formative assessments. Moreover, the unavailability of updated TGs on the NCTB website exacerbates this issue, restricting teachers' access to valuable support materials. A Teacher Trainer form Chattagram stated that, *"Teachers' Guide are helpful to guide to conduct teaching-learning activities and assessment during the lesson, and can fill-up some sort of training gap. However, still teachers did not get the TG at their school. New TGs are not even provided on NCTB's website."*

Previous studies in Bangladesh also identified the factors such as a lack of infrastructure and manpower facilities, large class sizes, teaching aids, large syllabus and contents, shortage of teachers, short lesson durations, and heavy workloads contribute to the failure of school based assessment (Begum and Farooqui, 2009; Rahman *et al*., 2021). International studies also reported that time constraints and lack of resources worked as barriers for successful implementation of formative assessment (Al-Wassia*et al*., 2015; Arrafii and Sumarni, 2018; Sidhu *et al*., 2018; Fook *et al*., 2011; Ong, 2010)

Capacity development and motivation-related challenges further hinder the successful implementation of formative assessments. Many teachers report a lack of understanding of formative assessment practices, particularly in choosing appropriate assessment tools for different subjects. This challenge is compounded by inadequate training, leaving teachers underprepared to implement these practices effectively. According to the teachers, a three-day training session on the curriculum conducted which included only two sessions on assessment, was insufficient to help teachers grasp the necessary concepts.

A noticeable lack of motivation and willingness among teachers to adopt formative assessment practices also presents a significant barrier. Teachers perceive the process of preparing assessment tools alongside their regular classroom duties as time-consuming and demanding, contributing to their reluctance to embrace these practices. Some teachers express concerns that formative assessments require more time and effort than they can manage, given their existing workload. For instance, a Head Teacher from Rajshahi said, *"Teachers are not interested to follow the formative assessment as it needs more time and work to prepare tools besides their regular classroom activities"*.

Moreover, the lack of follow-up and support from academic supervisors, including head teachers and Assistant Upazila Education Officers (AUEOs), exacerbates these challenges. According to the teachers, they hardly receive the necessary guidance and support from their supervisors, many of whom are themselves not well-versed in formative assessment practices. A teacher trainer from Dhaka explained it as, *"Teachers are not solely liable for their inefficiency in implementing formative assessment. Most of the time they did not get proper support from the head teachers and AUEOs as they also lack proper orientation on it."* This lack of supervisory support leaves teachers struggling to implement these complex practices effectively. It was reported as a barrier in previous studies as well (Azim, 2012).

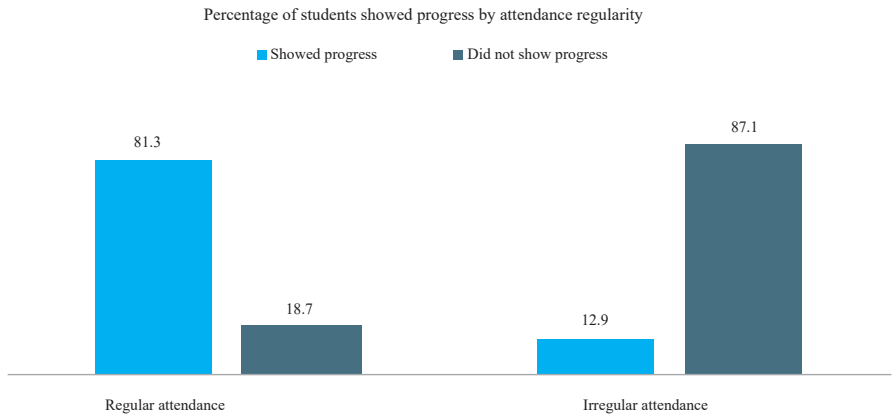
Previous studies conducted in Bangladesh found that lack of teacher understanding of formative assessment, teachers' preference for high-stakes examinations and negative attitude towards formative assessment affect the implementation of formative assessment in Bangladesh. International literature also suggested that implementing formative assessment in classroom settings is a complicated task and faces challenges in non-western countries where teacher-centric practices and high-stakes public examinations dominate ((Quyen & Khairani, 2016). Moreover, studies shows that insufficient knowledge of teachers and inadequate training, and negative attitudes towards formative assessment have been identified as barriers to successful implementation (Al-Wassia*et al*., 2015; Arrafii and Sumarni, 2018; Sidhu *et al*., 2018; Fook *et al*., 2011; Ong, 2010).

Challenges related to students and parents also complicate the implementation of formative assessments. Teachers face difficulties ensuring students' learning progress due to absenteeism and a lack of learning support at home, particularly among students from disadvantaged socio-economic backgrounds. An Assistant Teacher from Chattagram said in support of this claim that, *"due to socioeconomic background some students cannot regularly attend in class, do not get support their families as well. So these students remain lag behind"*.

Analysis of students' progress by their regular attendance also support the statement and shows a correlation between the attendance and progress (***See:*** Figure 2). Interpretation of these results suggests a clear association between students' attendance patterns and their academic progress. Students with regular attendance are more likely to show progress in their studies, while those with irregular attendance are less likely to do so. The correlation between students' attendance patterns and academic progress highlights the critical role of regular attendance in supporting student success. This finding aligns with research indicating a strong association between attendance and academic achievement (Gottfried, 2010).

Figure 2

Percentage of students showed progress by the regularity of their attendance status



Additionally, parents often pressure teachers to conduct summative assessments, which conflicts with the goals of formative assessment. Parents also express concerns about potential teacher bias and a lack of transparency in the assessment process, leading to distrust and hindering parental support and engagement in implementation of formative assessment. Rahman et. al. (2021) found that parents could not rely on formative assessment as teachers can manipulate it. They hardly believe honesty and fairness of teachers in case of assessment. Assessment bias refers to features of an assessment tool that discriminate against or unfairly penalize a subset of students based on their gender, socioeconomic status, ethnicity, religion, or other attributes that define their group (Popham, 2018). Literature suggests challenges like assessment bias are present when implementing formative assessment in primary school classrooms (Ozan & Kıncal, 2018; Kiziltas, Sata & Elkonca, 2023; Ciancanelli & Riley, 2022).

Recommendations

The findings of this report highlight the need for strengthened educational policies and practices to enhance the effectiveness of formative assessment in primary schools across Bangladesh. A key recommendation is to focus on capacity development and support. This can be achieved by implementing comprehensive training programs for teachers and academic supervisors through blended learning methods, combining both in-person and online modules. Additionally, digital resources such as video tutorials should be developed, and regular refresher courses should be conducted to reinforce learning. Professional development, particularly in the area of formative assessment, must be prioritized. Collaborating with educational institutions to design high-quality training modules and establishing ongoing support systems, including technological assistance and mentorship, is crucial. Teachers should be empowered to adapt formative assessment practices to their specific classroom contexts by providing flexible guidelines, while collaborative planning among teachers should be encouraged to share effective practices. Campaigns to shift the mindset of teachers, parents, and stakeholders towards the benefits of formative assessment are also recommended, with active engagement

of School Management Committees (SMCs) and Parent-Teacher Associations (PTAs) to involve parents in these practices.

Another significant recommendation is ensuring the availability of resources necessary for formative assessment in schools. This includes providing assessment guidelines, teacher diaries, and digital devices, and establishing mechanisms for their timely distribution and replenishment. Equitable resource allocation based on needs assessments is essential, and innovative solutions such as public-private partnerships should be explored to enhance educational access. Addressing teacher-student ratio issues is also critical to ensure that teachers can dedicate sufficient time to formative assessments. Regular assessments of staffing needs, along with reducing non-academic workloads for teachers, are necessary to allow them to focus on their core academic duties. Streamlining administrative processes and providing support staff to handle routine tasks would further enable teachers to concentrate on lesson planning, assessment, and student support.

Strategic support is vital for fostering an environment conducive to effective formative assessment. It is recommended to advocate for a holistic assessment approach that includes socio-emotional learning and character development, integrating these aspects into the curriculum and teacher training programs. Developing clear guidelines for conducting assessments to ensure fairness and consistency is essential, along with providing training to enhance teachers' assessment literacy and promote ethical practices. Initiatives such as stipend programs, mid-day meals, and attendance rewards should be implemented to improve student attendance, which is crucial for effective formative assessment. Addressing underlying issues such as socioeconomic barriers and transportation challenges is also necessary. Furthermore, developing mechanisms for monitoring and evaluating formative assessment practices is important to inform policy decisions and support continuous improvement efforts in education.

By implementing these recommendations, policymakers, educators, and stakeholders can create a supportive environment that enhances the effectiveness of formative assessment in primary schools. This will lead to improved student outcomes and contribute to the holistic development of students, preparing them for future challenges.

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Implementation Status of Outcome-Based Education System at Tertiary Level in Bangladesh: A Study on Three Selected Public Universities

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Abstract

Outcome-based education (OBE) is a new phenomenon in the country. The University Grants Commission (UGC) developed a comprehensive template for OBE in 2019 and asked all public and private universities to follow it. But it gained momentum after the recent intervention of the Bangladesh Accreditation Council (BAC). BAC is working for accreditation for programmes and institutions at the tertiary level in the country. It focuses on the OBE system at the tertiary level for obtaining accreditation. However, the study was conducted at three public universities: Dhaka University, Rajshahi University, and Chittagong University. It was a qualitative study. The study focuses on the OBE-based curriculum, course outline, lesson plan (teaching-learning strategy), question paper moderation system, and assessment system. In-depth interviews, focus group discussion, and content analysis (curriculum) techniques were followed for data collection. The study reveals that the implementation status of the OBE system in public universities is still in its initial stage. However, it is revealed that almost all the departments have already developed their curriculum following the OBE template. The course curriculum has also been developed accordingly. These are at the commencement stage. Though lesson plans have been developed, it is not practised widely. The question moderation system following the OBE template has not yet started. The traditional student assessment procedure is still followed. It is revealed that it would take time to follow the OBE system fully at the public universities in the country. The study also makes some recommendations. Among them, major recommendations include continuous effective training, introducing a proper monitoring system, preparing implementing guidelines, developing an OBE-based model department, recruiting qualified faculty members, ranking the universities, and introducing incentives. These would help implement the OBE system effectively at the tertiary level at the public universities in the country.

Keywords: Outcome-based Education (OBE), Higher Education, Tertiary Educational Institute (TEI), Bangladesh

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Introduction

The global village is moving fast accommodating and adopting various new systems and approaches. Adaptability has been a common phenomenon to survive in the competitive world. Because traditional approaches cannot meet the requirements of the new normal demands. In the pre-pandemic Covid-19 period, ultra-modern technological advancement pushes the global village to adopt ICT-enabled instruments in accomplishing daily tasks whether it is business, factory production, or providing services, including health and education. But it has intensified during the pandemic Covid-19 globally. Moreover, the fourth industrial revolution (4iR) has also contributed a lot to magnifying the adaptability of an alternative mode of action. It is also applicable to the education sector globally. The traditional mode of teaching-learning appears not enough to ensure quality education globally. Therefore, different alternative modes of teaching-learning are being practised in different ways all over the world. Consequently, the course curriculum is being redesigned to meet the present demand. The government of Bangladesh has set some national development goals such as eradicating extreme poverty, and lifting the country to upper middle income by 2031 and raising per capita income to US$ 12500 by 2041 to be a developed country in the global map (GoB, 2020). The government has also declared that Bangladesh would be a smart country by this time. Smart Bangladesh is supposed to be based on (i) smart citizens (ii) smart society (iii) smart government and (iv) smart economy (UNB, 2022). All the pillars are rooted in education. Therefore, quality education that can be measured by its applicability, especially at the tertiary level is very important to build a smart country. The tertiary level education is directly linked to national development and it could massively contribute to achieving the national goals. Hence, it needs to introduce an effective and measurable education system at the tertiary level in the country. Moreover, it is time to evaluate every action or effort through its outcome. Nowadays competency measurement is considered highly significant in the education sector. In this context, the outcome-based education (OBE) system is gaining popularity globally. To meet the present demand, the University Grants Commission (UGC) of Bangladesh developed an outcome-based education (OBE) template for tertiary-level education in the country in 2019 (UGC, 2019). But it is so far observed that the initiative could not get due importance at the tertiary level in the country and wherever it is practised, it is done sporadically and partially.

So, it motivates the researchers to explore answers to some research questions such as despite getting popularity, why the OBE system is not running effectively? Why is it not getting due importance at the implementation level at the tertiary level educational institutions? What are the problems to implement the OBE system effectively at the tertiary level in the country? What are the challenges to implementing the OBE system at the tertiary level in the country?

In the ever-changing global phenomenon, quality adoption is very important to survive in the competitive world. It is very applicable to developing countries like Bangladesh. Despite attaining sound indicators in different socio-economic areas, the country is still lagging behind in terms of quality and time befitting the education system. It is revealed in various previous studies published locally and globally. Among many others, a World Bank report reveals that more than one-third of graduates remain unemployed after completing their graduation and there is a gap between the skills they acquired and the demand in the job market (World

Bank, 2019). Another report of the World Bank also reveals that "*low labor productivity is a longstanding headache for Bangladesh. Despite the increasing rate of access to education in recent decades, low educational attainment, and lack of required skills are putting significant constraints on productivity of the labor force in the country*" (World Bank, 2018). As a result, dependency on the foreign labor force is increasing. In the meantime, Ahmed reveals that around half a million expatriates were working in different sectors in Bangladesh, and more than $5.0 billion flows out of the country annually as remittance (Ahmed, 2020).

The statistics mentioned above makes it clear that there is a huge gap in supply and demand sides in the country. On the supply side, the present educational system and approach cannot meet the requirements of the demand side of the job markets in the country. It indicates that reform in the educational system is an urgently needed issue. It also reveals that the traditional educational approach cannot uphold the expected quality on the one hand, and it cannot provide qualified graduates with the required skills to meet the job markets on the other hand. Consequently, the demand-supply gap is widening day by day. University Grants Commission (UGC) of Bangladesh in its several annual reports has also been emphasizing quality education at the tertiary level in the country (UGC, 2020).

Therefore, it is evident that the present mode of the teaching-learning approach is not enough to minimize the existing gaps between supply and demand. A more realistic and practice-oriented approach to teaching-learning activities in the education sector, especially at the tertiary level in the country has become necessary. So, considering the present global phenomenon and future demand, the outcome-based education (OBE) approach may be the best alternative option to meet the present need and future requirements in the country. Though the UGC made a comprehensive template of the OBE system for tertiary-level educational institutions in 2019, the systematic practice of the OBE approach has not been exercised fully in Bangladesh. Moreover, no practical orientation has yet been introduced accordingly at the tertiary level educational institutions (TEIs) in the country. So, the study explored the effectiveness of the OBE system at the tertiary level in Bangladesh and also explored the challenges in the implementation of the OBE approach at the tertiary level in the country.

It is observed that though UGC formulated a template for the OBE system, still there is a lack of guidelines to follow the latest approach to teaching-learning activities at the tertiary level in the country. On the other hand, it is so far revealed that there is no in-depth study about the OBE approach focusing on tertiary level education in the country. So, to implement the OBE template made by the UGC, it is needed to conduct empirical research work to explore the challenges and potential mechanisms of how to execute it effectively at the tertiary level in the country.

Rationale of the study

Bangladesh is moving fast in terms of development in economic indicators. As a result, the economy of Bangladesh enjoyed a strong rate of GDP growth. The economy was able to escape a contraction in 2020 during the pandemic Covid-19. Considering the pace of economic development, Cebr forecasts that Bangladesh will improve considerably in the World Economic

League Table, with its ranking rising from 41st to 25th by 2035 (CEBR, 2020). So, it shows that there will be a huge economic transformation. The government has also set the target to raise the per capita income to US$ 12500 by 2041(GoB, 2020). Moreover, the government has declared that Bangladesh would be a smart country by this time. The government has formed a high-power task force headed by the Prime Minister to achieve the national goal. However, Smart Bangladesh would be based on (i) smart citizens (ii) smart society (iii) smart government and (iv) smart economy (UNB, 2022). But a World Bank study shows that due to the shortage of domestic skilled labour forces, it has increased dependence on expatriate skilled labour forces in apparel, real estate, textiles, telecommunication, information, and technology sectors in Bangladesh. So, human capital accumulation is required to upscale the competency of the workforce to meet the demands of present and future jobs. Hence, the World Bank asserts that economic transformation will require the development of new skills in the workforce. Tertiary educational institutions can support this agenda if quality, relevance, and access challenges are addressed (World Bank, 2019). Many previous studies show that the present traditional education system cannot meet the demands of the present and future skills requirements (Islam et al., 2022). Therefore, it is needed to bring reforms in the education sector, covering teaching-learning methods and pedagogical issues. The 21st century emphasizes quality and the outcome-based education (OBE) system globally. The outcome-based education is designed and focused on imparting practical knowledge instead of theoretical to the learners. Moreover, outcome-based education fits the learners to be a global citizen.

Under such circumstances, it is so far revealed that few studies are done focusing on outcome-based education at the tertiary level in Bangladesh. So, it is very imperative to conduct a study to assess the implementation status of the OBE system to produce skilled human resources. It is also important to explore the challenges that are appearing now and to be traced as expected barriers to implementing the OBE system at the tertiary level in the country.

Objectives of the study

The general objective of the study was to explore the implementation status of the outcome-based education (OBE) system at the tertiary level educational institutions in Bangladesh. There were also some specific objectives of the study. The specific objectives were to:

- explore the perception about the OBE system among faculty members at the tertiary educational institutions (TEIs) in Bangladesh;
- assess the implementation status of the OBE system in the tertiary educational system in Bangladesh;
- identify the challenges in the implementation of the OBE system at the tertiary level in the country;
- explore the factors, if any, affecting the effectiveness of the OBE at the tertiary level in the country.

- make policy suggestions for effective implementation of the OBE system at the tertiary level in Bangladesh.

Literature review

Change cannot be stopped and change we need to meet the present and future demands. In the education sector, many changes have happened over time. Now the latest phenomenon in the education sector is the outcome-based education (OBE) system. The OBE system is a progressive model of the educational system that involves reforms in curriculum, pedagogy, evaluation, and assessment process to reflect the attainment of higher order learning, thinking, and applied knowledge rather than a mere accumulation of percentage of marks and course credits.

Though there is a huge literature in the academic world citing different contexts of different countries all over the world, a few pieces of literature or study are found in the context of Bangladesh. However, the researchers have already reviewed several research articles and related documents about the OBE system. Some of them are stated below.

William G. Spady is considered the exponent of the OBE approach. He coined the term in 1988. Later, the Washington Accord was initiated in 1989 and it was an agreement to accept undergraduate engineering degree courses that were obtained using the OBE approach (W. G. Spady & Marshall, 1991). Though it was designed for engineering degrees for the first time, now it has become applicable to all disciplines.

However, over time, Spady elaborated on the educational approach. He says that

> *"Outcome-based education means clearly focusing and organizing everything in an educational system around what is essential for all students to be able to do successfully at the end of their learning experiences. This means starting with a clear picture of what is important for students to be able to do, then organizing the curriculum, instruction, and assessment to make sure this learning ultimately happens"* (W. Spady, 1994).

In the meantime, Mamary asserts fourteen principles of quality outcome-based education (Mamary, 1991). Davis finds the OBE approach as one of the most important trends in health profession education. Describing the development of the OBE, he asserts the advantages and disadvantages (Davis, 2003).

Karim and Yin attempt to provide an understanding of the importance of the OBE approach for teaching and learning development. They observe that `the results of OBE approach are expressed in terms of individual student learning and they are expected to achieve the two long-term benefits: (i) the OBE can measure- 'what the students are capable of doing' and (ii) the OBE goes beyond-structured tasks 'by demanding that students demonstrate their skills through more challenging tasks' (Noor Al-Huda Abdul Karim & Yin, 2013). Killen describes outcomes-based education and its principles and possibilities. He explores the basic principles of the OBE system in the context of an Australian school and vocational education. He also

describes the philosophy of the introduction of the OBE system in the USA and UK (Killen, 2000).

Rao describes the OBE approach from the perspective of general higher education. He mentions that 'outcomes for higher education programmes are defined at three levels as program outcomes (POs), program specific outcomes (PSOs), and course outcomes (COs). The most important aspect of an outcome is that it should be observable and measurable'(Rao, 2020).

Damit and his associates describe the challenging issues in the implementation of the OBE approach among vocational college teachers in Malaysia. They reveal that the *'workload of teachers, poor curriculum implementation, unstable system implementation, and lack of administrator support'* are the major challenging issues in the implementation of the OBE approach (Damit et al., 2021). Asim and his associates assert that against the poor educational outcomes, the OBE approach has gained much attention in Pakistan and it is followed for its clear focus and organization in an educational system *'what is necessary for all students to be able to do at the end of their learning'* (Asim et al., 2021). Thirumoorthy (2021) made emphasis on the OBE system as a need of the hour. He describes its importance in the context of India (Thirumoorthy, 2021).

Though there are huge pieces of literature in the academic world about the OBE approach, its definition, principles, challenging issues, and so on, few studies have been found in the context of Bangladesh. The UGC has made a template for the OBE system for tertiary-level education in the country (UGC, 2019). But so far it is learned that there is no effective initiative from the regulatory side to implement the template at the tertiary level of education in the country. Moreover, it has yet to find any study in terms of the effectiveness of the OBE system to contribute to building a smart Bangladesh.

After reviewing the literature, it is evident that Bangladesh is lagging in terms of the implementation of the OBE approach at the tertiary level of education in the country. But quality and competency are now a very important factor to compete in the ever-changing global arena. Effective implementation of the OBE approach at the tertiary level of education can contribute to minimizing the demand-supply gaps in the local and global employment sectors. Moreover, the OBE system may contribute to building a developed country as the education approach is very much practice-oriented and measurable in terms of acquiring competency. Therefore, the study would contribute to academia to minimize the knowledge gap in this area.

Methodology

Study area and time

Three public universities were selected purposively for this study. Dhaka University, Rajshahi University and Chittagong University are selected purposively considering the volume of disciplines, faculty members, and students. The study was conducted between November 2023 to March 2024.

Nature of the study

This particular study employs a case study method as a strategy of inquiry within the framework of a mixed-research approach. A case study is a systematic investigation of a study, a setting or a single subject, or a single depositary of a document, or a specific event. It is useful to obtain an in-depth appreciation of an issue, event, or phenomenon of interest. It is used to generate an in-depth understanding of a contemporary issue or phenomenon. It is also used for the exploration of an individual, group, or phenomenon (Coombs, 2022; Starman, 2013; Crowe et al., 2011; Sturman, 1997). Thus, the issue of OBE was considered as a case in this study. This study deals with 'what' and 'how' questions which is similar to Yin's argument, what stands for explanatory `case study' and investigation of this study was explanatory case study (Yin, 2003, 2009).

The procedure of the sampling and selection of sample size

There are 50 public universities in the country. 18 Out of the 50 universities are treated as general universities and the rest are considered as specialized universities which include: 5 engineering universities, 6 agriculture universities, 16 science and technology universities, including Textile, Veterinary and Animal Husbandry, Maritime, Digital University and Aviation and Aerospace University and 5 medical universities in the country (UGC, 2022). It is revealed that the general universities dominate over the specialized universities as these universities cover almost all disciplines of the specialized universities in the country. For example, Dhaka University and Rajshahi University cover almost all the general and science and technology-related disciplines. So, statistics reveals that the general universities provide the lion's portion of the graduates every year in the job market in the country. Moreover, 82% of the total students of general universities are studying under the faculties of Arts and Humanities, Law, Education, Social Science and Business Studies (UGC, 2020). So, considering the volume of students, the general public universities are taken as the unit of analysis for this study. However, three public universities were selected purposively for this study. Dhaka University, Rajshahi University and Chittagong University were selected purposively considering the volume of disciplines, faculty members, and students.

Though three public universities were selected purposively, it was not possible to bring all disciplines/departments of these three universities into a single study. This is why, a total of six faculties of the three universities (two faculties from each university) were selected purposively. And, a total of six departments (two from each faculty) were also selected purposively from the selected faculties of the university for this study.

Then, the faculties and other entities and respondents were selected following both—probability and non-probability techniques to make it unbiased. Therefore, one representative of the UGC was purposely selected as the KII for this study. Six deans of the selected faculties of the selected universities were interviewed as the KIIs while six chairmen of the selected departments of the selected faculties were also interviewed as the KIIs. Moreover, 12 faculty members of the different departments of the selected faculties were also interviewed as the KIIs. The faculty members were taken from the Professor, Associate Professor, Assistant

Professor, and Lecturer categories to make a representative. They were selected following a simple random technique.

Data

The University Grants Commission (UGC) of Bangladesh designed a comprehensive guideline about OBE for tertiary-level education in the country (UGC, 2019). In 2019, the regulatory authority also designed a holistic template and issued it to all public and private universities to follow it in their academic activities. Further, it developed separate templates for the OBE curriculum and its associated issues. The template is divided into three parts A (OBE Curriculum-Annexure-I), B (Curriculum Framework-Annexure-II), and C (Description of courses of a programme-Annexure-III), covering several issues. Moreover, the UGC also developed a question moderation template (Annexure-IV), a lesson plan template (Annexure-V), and an assessment procedure template (Annexure-VI). Later on June 30, 2021, UGC sent the revised OBE template to all public and private universities to follow and execute it accordingly (UGC, 2022).

Data investigated

Among the issues of the OBE, data were collected about the curriculum framework, course outline, lesson plan (teaching strategy), assessment/evaluation procedure, and question moderation. To gather the intended data, the UGC-made templates were followed. The templates were used as the data collection tools.

Validity and Reliability of the data collection tools

Maintaining validity and reliability are two key aspects of every research (Bhuiyan, 2017). In the current study, the validity and reliability were maintained professionally.

The KII checklist was presented before the panel of experts at NAEM for obtaining final validation and after complying with the opinions of the expert panel, it was finalized. On the other hand, the UGC-developed templates were used as the tools for data collection. The templates were official documents of the UGC and it has not been modified.

Data collection methods

Both primary and secondary sources were considered for data collection. Faculty members were considered the main source of data. Representatives from the monitoring and regulatory authority were also the primary sources for this study. However, primary data from the university faculty members were collected mainly following qualitative methods such as key informant interview (KII), focus group discussion (FGD), content analysis, and so on. Content analysis was employed to collect primary data. For this, the curriculum of the selected programme/discipline and examination question paper were reviewed in line with the UGC-made OBE template. The lesson plan was also assessed to explore the teaching strategy. Besides, KII was conducted to collect data from primary sources. Secondary data were gathered from different sources such as UGC documents, books, reports, national and

international documents, journal articles, newspaper reports, website reports, and so forth. The policies of the Government of Bangladesh were also reviewed as well. However, as this study is exploratory and confirmatory, a major portion of primary data was collected through the interview.

Data analysis

As a means of thematic analysis, curriculum review, examination question paper review, teaching strategy, assessment/evaluation strategy, and interview data were categorized into different sub-themes under the main theme and then analyzed for meaning. For data processing and analysis, thematic and conversational analysis was adopted. Themes are abstract constructs identified by researchers before, during, and after data collection. Many themes were identified during the literature review and the fieldwork.

Ethical consideration

The ethical issues were maintained in conducting the study. During the data collection, the respondents were well-informed about the purposes of this study. All the respondents gave their consent and participated in different capacities in the data collection process.

Findings and discussions

The outcome-based education (OBE) shifts the paradigm from teacher-centred to student-centred learning. The new teaching and learning approach transforms from an emphasis on traditional input, such as course credits earned and hours spent in class, to results or outcomes. It focuses on empirically measuring student performance or outcomes. However, the OBE focuses on students achieving outcomes after undergoing the learning process through the OBE curriculum. The attainment of the outcomes is a learning process that may temporally vary from one student to the other; regarded as means and not the end objectives. OBE implementation requires that students demonstrate that they have learned the required knowledge and developed the required skills and attributes.

The faculty members who were also brought under the study claimed that there are some anomalies in designing the OBE-based curriculum. They are not properly informed or share the effective purpose of the OBE-based curriculum. They are informed of different messages at different times. One of the faculty members of Rajshahi University describes this:

> Once the IQAC asked the departments to prepare an 'improvement plan' for five and ten years for their respective departments. A three-member self-assessment committee (SAC) of each department was assigned to do so. Each department developed it. The IQAC, then, assured that money does not matter. If they can justify the improvement plan, they will be allocated a budget accordingly. A three-member expert committee reviewed the self-assessment report and remarked as satisfactory. After that, what happens? The improvement plans are now in deep-shelf.

Another faculty member of Rajshahi University says that:

> They know that a designated committee is working to develop an OBE-based curriculum at Dhaka University and the committee members are offered an honorarium for doing so. But there is no such incentive provision at Rajshahi University. Why do such differences happen? What is the problem? Is there any proper guideline? The Faculty of Arts of Dhaka University held a workshop at Cox's Bazar to develop the OBE-based curriculum.

A faculty member of Rajshahi University observes that:

> The initiative—OBE-based curriculum development is not a research-based event. It is imposed by external forces or factors. No demand is raised from the students or faculty members to develop an OBE-based curriculum at the tertiary level in Bangladesh. Under the present curriculum, they did not hear any difficulty in pursuing higher study abroad.

A faculty member of Dhaka University also observes the same situation. The faculty member describes that:

> The OBE-based curriculum would not be effective without other resources required for implementing the system at the university level in the country. The teacher-student ratio is very important to implement the OBE system effectively. In the context of Bangladesh, maintaining a teacher-student ratio is very challenging for first-generation universities.

Another faculty of Dhaka University observes that:

> For the OBE-based curriculum, the students would face a huge academic load. They would not get much time for creative thinking which is considered as the main value at the university level.

One of the key informants of Dhaka University informed that:

> A three-day long workshop on OBE-based curriculum implementation was organized under the Faculty of Arts. It was held at a hotel in Cox's Bazar on March 10-12, 2023. So, Dhaka University is working to develop the OBE-based curriculum and its further application. However, it would be implemented in phases. For this, it would take time.

One of the chairmen of Chittagong University describes this:

> The faculty members of his department are not interested in developing an OBE-based curriculum. Even they do not want to implement it in the department. Though some of the faculty members were invited as expert members for the development of the OBE curriculum in some other public universities, they devotedly contributed to developing the OBE curriculum.

The faculty members of Chittagong University who were brought under the study assert that the OBE system is not properly applicable in the country. The OBE system would push the students for examination without realizing deeply their course contents. The student would not get much time to understand their course contents, they observe.

Most of the faculty members observe that there is a lack of institutional readiness in terms of the OBE implementation at the tertiary level education sector in the country. Some of the faculty members describe that they face acute classroom shortages.

One of the Deans also raised the question that teacher-student ratio is also a part of institutional readiness. Sitting arrangement, which is an important issue for OBE system implementation, is not ready right now in many public universities, the key informant observes. One of the chairmen observes that residential facilities such as living accommodation for students especially for the fresher's—the first year students, should be ensured so that they can engage themselves in study without fear of torture (physical and mental) or eviction from their residential halls. The public universities are not ready in this regard; the key informant describes.

Educational resources are also very important for the implementation of the OBE system at the tertiary level. For this, facilities for e-library or e-educational resources should be ensured. But almost all the key informants observe that the public universities institutionally are not ready to provide such facilities either for their faculty members or the students.

In short, most of the faculty members observe that they are not ready to implement the OBE system in their respective departments. Consequently, after issuing the OBE template in 2019 by the UGC, it has not materialized accordingly in the tertiary-level education sector in the country. However, few faculty members think that they are ready to cope with the OBE system provided they are trained enough. They deem that they are partially ready. Moreover, the faculty members see no problem with the existing system. They did not hear any problem in pursuing higher study abroad with the existing curriculum. Moreover, the faculty members are not properly trained for the implementation of the OBE system at the public universities in the country. In addition, they are also not motivated to implement it willingly.

In terms of the readiness of the students to cope with the OBE system, most of the faculty members observe that the students are not presently ready for the OBE system.

Content analysis was one of the tools for data collection for this study. For this, the curriculum of the selected departments was reviewed. It is revealed that all the departments have already developed their curriculum following the OBE template. In some cases, course outlines were not aligned fully but it was tried to follow the OBE system. All the chairmen describe that it is still a new phenomenon to the faculty members.

However, the study reveals that the implementation status of the OBE system in public universities is still in its initial stage. However, it is revealed that almost all the departments have already developed their curriculum following the OBE template. The course curriculum has also been developed accordingly. These are at the commencement stage. Though lesson plans have been developed, it is not practised widely. The question moderation system

following the OBE template has not yet started. The traditional student assessment procedure is still followed. It is revealed that it would take time to follow the OBE system at the public universities in the country.

Major findings at a glance:

- ✓ Most of the departments developed curricula following the OBE guidelines
- ✓ Developed course content following the OBE guidelines
- ✓ Developed lesson plan but not practised accordingly
- ✓ OBE-based student assessment system is not practised
- ✓ Traditional student assessment system still going on
- ✓ Question papers are not moderated according to the OBE guidelines
- ✓ Initial stage of practice
- ✓ Department chairmen are facing difficulties in implementing the OBE as they have no efficient supporting staff to manage the OBE activities.
- ✓ Senior faculty members are not ready enough to cope with the new phenomenon
- ✓ Not only the senior faculty members but also the other faculty members are not ready enough to practice all OBE systems at this time.
- ✓ Lack of sufficient training to impart the OBE system among faculty members
- ✓ Lack of active and competent authority to monitor the OBE system at the institutional level.
- ✓ Lack of motivation to adopt the OBE system is another challenge to implement at the public universities in the country.

Findings at a Glance: Implementation Status of OBE System at Tertiary Level in Public University in Bangladesh

	Preparatory stage	**Commencement stage**	**Full practice with set standard**	**Sustainability stage**
Curriculum Development				
Course outline				
Lesson plan (Teaching-learning strategy)				
Question paper moderation system				
Assessment system/procedure				

Source: developed by the authors

Conclusion

In Bangladesh, an adaptation of a new system takes time in the public universities. As it is widely observed that public universities are dominated by mainstream political culture. Consequently, implementation of the OBE system at public universities would take time. However, practically public universities are currently facing manifold problems which are considered as the barriers of implementation of the OBE system effectively in the country.

Recommendations

The study puts some recommendations. Among them, major recommendations include continuous effective training, introducing a proper monitoring system, preparing implementing guidelines, developing an OBE-based model department, recruiting qualified faculty members, ranking the universities, and introducing incentives. These would help implement the OBE system effectively at the tertiary level at the public universities in the country.

Major recommendations at a glance

- ✓ Sufficient training for the faculty
- ✓ Preparation of proper guidelines
- ✓ Development of a model to follow it
- ✓ Vibrating the quality ensuring bodies
- ✓ Effective & accountable monitoring
- ✓ Introducing incentives
- ✓ Ranking the public universities
- ✓ Quality faculty recruitment

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State of Science Labs in the Rural Secondary Schools of Bangladesh: Problems and Prospects

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Abstract

Science laboratory experiences are essential, unique, and integral to modern science education at the secondary level. Recognizing the importance of lab-based learning in secondary schools, the research team chose to examine the current state of science labs in this setting. The primary goal of the study was to assess the status of science laboratories in secondary education in Bangladesh, focusing on their management, usage, challenges, and role in supporting science learning. This study employed a survey method, using five distinct questionnaires for data collection. Data were gathered from 30 head teachers, 90 science teachers specializing in physics, chemistry, and biology (30 from each subject), and 240 science students, all selected from 30 rural secondary schools in Bangladesh. Both quantitative and qualitative approaches were used to analyze and present the data statistically and descriptively. Key findings include a shortage of equipment and reagents, limited space, unappealing lab rooms, lack of individual labs for each science discipline, insufficient funding, a shortage of trained lab teachers, and an absence of national standards for secondary school science labs in Bangladesh. However, due to its focus on only 30 rural schools, these findings may not represent all secondary schools in the country, marking a major limitation of this study.

1.0 Introduction

Science, as a subject is universal and knows no boundaries. The claims of science for inclusion in the school curriculum came to be recognized after years of active and persistent efforts. Science almost revolutionaries in life d proved indispensable for existence of man. Now, supremacy of science has been established in every field. In fact, so great is its importance for man and society that the present-day people live in an "age of science". No one perhaps needs an explanation at present to include science in the school curriculum, ***Canon Wilson,*** a famous educationist in 1867, in support of inclusion of science as a school subject wrote", "Science teaches what evidence is, what proof is. English, History, Geography, Classics etc. are taught because they provide a liberal education. The main object of imparting education is to turn out intelligent citizens able to appreciate and enjoy the beauty and wonder of Nature. They should be efficient in all steps of life and should take delight in the wealth of culture of past generations and civilizations. Hence, Science should form an essential part of the

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curriculum as it is the only subject which affords knowledge of certain facts and laws and helps in achieving the main object of education. But Prakash (2013) states some arguments in favor of General Science to be placed in School Curriculum.

National Education Policy '2010 states that the chief objective of science is to understand nature. Science has been unraveling the mystery of nature by experiment, observation and mathematical logic. On one hand, it fulfills the inquisitiveness of human being and on the other; it helps human civilization to continuously move forward through the utilization of different technologies originated out of scientific knowledge. Proper study of science can only help the nation reach its destination quickly. The aims and objectives of science education in Bangladesh are: 1. to prepare the learners in a way that helps them develop their talent, practice of knowledge and creativity equal to an international standard; 2. to provide science education to the learners in a way so that the learners understand; 3. that there exists a close relationship between technology and humanities and each of them is complementary to the other; Science will be taught as a coordinated discipline.

1.1 Statement of the Research Problem

Since the independence of Bangladesh in 1971, science education has been reformed several times following western models. The reforms included development of new curricula, training of teachers, and the publication of new government sponsored textbooks. However, stakeholders remained unhappy with the outcome of these reforms. Due to the lack of academic research by science educators, the reasons for the unsatisfactory outcome of the reforms have not been identified. The research team has observed by visiting some secondary institutions that laboratory teaching –learning is not effective in our country.

Chemistry labs typically conduct experiments in which students use chemicals. When used properly, chemical experiments can enhance chemistry lessons. If improperly used or stored, these chemicals can put students, staff, and others at risk from spills, explosions, or exposure. Considering the nature of science education, it is the need of the time especially in the age of science and technology that we should make a study on science lab and its using in our secondary education.

In spite of the priority which the national policy on education places on science subjects at secondary level of education, one is not very sure whether much has been done in providing well equipped science laboratories and if there are, one is not too sure of their proper use. Do students know the basic uses of the laboratory tools and apparatus? Do the science teachers and students keep to safety precautions while working in the science laboratories? Are the science laboratory teachers/technicians ready to manage and organize the science laboratories? How much do the science teachers know about science laboratories? Therefore, this study is set to find out how science laboratories are used by teachers and student in secondary schools in Bangladesh

1.2 Importance and Rationale of the Study

Proper science education by using labs at secondary education is very much important as we live in the world of science. Many studies have been carried out concerning the availability

and importance of science education in secondary schools in our country. But none has been carried out study involving government and private secondary schools with respect to the use of laboratories. The study is intended to present the proper use of science laboratories in secondary schools. The research will also make some recommendation to government and individuals who runs secondary schools in the country. So, this study will reveal outcomes for the betterment of science education in the secondary schools.

1.3 Objectives of the Study

The general objective of the proposed study is to investigate the present status of science labs in secondary education aiming at finding out the labs' management, its use, problems and role in learning science subjects in Bangladesh. The specific objectives of the study are as follows:

a) To investigate the present status of science labs in terms of materials, equipment, and chemicals used as set in science curricula and textbooks at secondary level;

b) To find out the state of infrastructure in terms of size, storage space, labs friendly construction which effectively promote student learning;

c) To investigate the status of use of science labs equipment and materials in science labs;

d) To find out the safety standard whether it meets or does not meet science labs standard of other countries;

e) To analyze the national guideline/set standard regarding science labs at secondary level in Bangladesh for further improvement.

1.4 Scope of the Study

Conducting study on secondary science education covering the whole country is a gigantic task. Considering the importance of science education this study will be limited to only the use of science labs in science education at the secondary level schools in Bangladesh. This study will also be limited to thirty secondary schools having science labs in both government and non-government schools.

1.5 Limitations of the Study

This research study selected 30 rural secondary schools from the administrative divisions of Dhaka, Rajshahi and Sylhet as sample size out of thousands of schools of the country. This study also selected 30 Head, 30 physics, 30 chemistry and 30 biology teachers as respondents from the selected 30 schools. Moreover, this study selected 240 science students from secondary schools, taking 8 students from each school. So, the findings of this study cannot be generalized for all schools. The pie chart in Figure 1 illustrates the distribution of respondents.

2.0 Methodology of the Study

This research study has adopted survey method with questionnaires for data collection.

2.1 Sampling: The proposed study has followed purposive sampling. Considering the importance of science education and use of labs in secondary institutions in Bangladesh the sampling size was as follows:

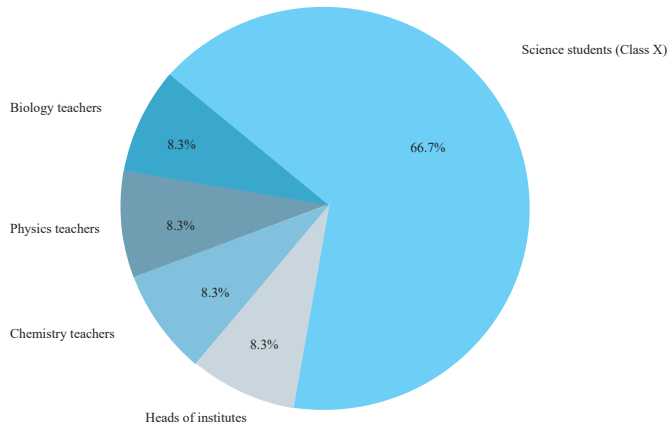

Figure 1: Distribution of Respondents

Table-2: Distribution of Sample (N=360)

Divisions	Institution & Heads	Physics teachers	Chemistry teachers	Biology teachers	Students	Total
Dhaka	15	15	15	15	120	180
Rajshahi	10	10	10	10	80	120
Sylhet	05	05	05	05	40	60
Total	**30**	**30**	**30**	**30**	**240**	**360**

2.2 Sources of Data: For this study, the class teachers of biology, physics, chemistry, and heads of secondary institutions and science students (class X) located at different places of the country were the sources for primary data. Books, journal articles, published and unpublished documents, government publications, textbooks, curriculum reports school records, etc. were used as secondary data sources for this study

2.3 Respondents and Data Collection Tools: This study has applied survey method in collecting data from the secondary level schools. For accomplishing this study, five structured questions were prepared for following respondents. These are:

a) Head of Institutions

b) Teacher of Biology

c) Teacher of Chemistry

d) Teacher of Physics

e) Science students of Class X

3.0 Presentation of Data and Method of Analysis: Analysis and interpretation of collected data has been made in the light of set purpose and objectives of this study by using appropriate tools. For the ideal condition of data presentation, all required techniques have been applied. Collected primary data have been statistically and descriptively presented. Data have been analyzed mixing both quantitative and qualitative approach. Necessary tables, charts, mean, average, percentage, etc. have been used to present and analyze data.

3.1 Presentation and Analysis of Data

For this study data and information were collected from the Head Teacher (HT), Physics Teacher (PT), Chemistry Teacher (CT), Biology Teacher (BT) and science students of class ten, through five questionnaires separately prepared for each group of respondents. Based on collected data and information the findings of the study are stated below by five sections (A-E).

Section A: Response from the Chemistry teachers

Most of the chemistry teachers (75%) have either B.Ed or M.Ed degree. Some of them (18.8%) have simple M.Sc degree without professional certification in teaching (Table-3).

Table-3: Educational Qualifications of Teachers

Educational Qualifications	HT	PT	CT	BT	Remarks
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	
H S C	02 (06,3)	02 (06,3)	02 (06,3)	02 (06,3)	
B. Sc	06 (18.8)	06 (18.8)	06 (18.8)	06 (18.8)	
M. Sc					
Total =	30 (100)	30 (100)	30 (100)	30 (100)	

Table-4: Professional Qualifications of Teachers

Professional Qualifications	HT	PT	CT	BT	Remarks
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	
C. Ed.	06 (18.8)	06 (18.8)	06 (18.8)	06 (18.8)	
B. Ed	18 (62.5)	18 (62.5)	18 (62.5)	18 (62.5)	
M. Ed	04 (12.5)	04 (12.5)	04 (12.5)	04 (12.5)	
Total =	30 (100)	30 (100)	30 (100)	30 (100)	

Table-5: Participation in Training

Training obtained	HT	PT	CT	BT	Remarks
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	
No training	02 (06,3)	02 (06,3)	02 (06,3)	02 (06,3)	
PDT (by TQI)	06 (18.8)	06 (18.8)	06 (18.8)	06 (18.8)	
EAM (NAEM)	12 (60)				
CPD	18 (62.5)	18 (62.5)	18 (62.5)	18 (62.5)	
Others	04 (12.5)	04 (12.5)	04 (12.5)	04 (12.5)	
Total	30 (100)	30 (100)	30 (100)	30 (100)	

Table-5 shows that more than one-third of the chemistry teachers (37.5%) do not have any professional training. Few of them (31.2%) have TQI training and some of them (18.8%) have

CPD training from TT colleges. Four teachers (12.5%) got professional training organized by local institutions.

Table-6: Use of Lesson Plan or Instructional Plan for Practical Class

Using lesson/ Instructional plan	Physics Class	Chemistry Class	Botany Class	Remarks
	(a)	(b)	(c)	
No	17	16	18	Most of the Teachers are negligent in Lesson Plan
Yes	13	14	12	
Total =	30	30	30	

Table-6 states that thirteen teachers (43.7%) are using lesson plan and most of the teachers (56.3%) are not using any lesson plan or, instructional plan for chemistry practical classes. This is disappointing. May be, teachers are not interested to prepare a lesson plan, or they do not have sufficient motivation for the necessity to do the same teaching session.

Table-7: Problems faced during the practical lab session

Problems	Frequency	Percentage
No water/ gas supply	07	06.3
Insufficient lab equipment	13	18.8
In sufficient number of science teachers	10	06.3
All the above	37	50.0
No lab	23	18.8
Total	90	100.00

It is revealed that selected secondary schools (81.2%) do not have sufficient lab equipment's and are also facing fund crisis for physics lab practical. Five schools (18.8%) have no lab room facility for the science students and they didn't have any responses.

Table-8: Efforts to improve chemistry practical classes

Efforts should be given	Frequency	Percentage
Separate lab for chemistry	04	13.3
Engage lab demonstrators	02	06.7
Teachers training	04	13.3
All the above	12	40.0
Lab classes should be started from class VI	02	06.7
Do not reply	06	20.0
Total =	30	100.00

Teachers were asked to suggest the efforts for improving chemistry practical lab sessions. Most of them (73.3%) suggested that subject specific training necessity, availability of sufficient lab equipment's and allocation of more funds could be the important efforts for a fruitful lab session. Some of them (13.3%) suggests for a congenial and separate practical classroom. (Table-8).

Table-9: Chemistry laboratory apparatus condition of the selected schools

Apparatus	N	Mean	Std. Deviation	t-statistics	p-value
Test Tubes	30	57.25	63.134	3.627	**.002**
Beaker	30	11.38	8.245	5.518	**.000**
Flask	30	6.38	4.272	5.969	**.000**
Cork	30	70.94	237.369	1.195	.250
Cork Borer	30	4.25	6.424	2.646	**.018**
Porcelain Basin	30	1.94	2.516	3.081	**.008**
Crucibles	30	1.25	1.528	3.273	**.005**
Funnels	30	7.88	5.005	6.294	**.000**
Mortar and Pastel	30	3.13	2.527	4.948	**.000**
Woolf's Bottle	30	5.38	4.272	5.033	**.000**
Retort	30	2.25	5.092	1.767	.098
Gas jar	30	5.69	4.347	5.234	**.000**
Pneumatic Trough	30	.31	.704	1.775	.096
Tripod Stand	30	7.88	5.772	5.457	**.000**
Ring Stand	30	4.94	4.057	4.868	**.000**
Bunsen Burner	30	3.19	2.344	5.439	**.000**
Wash Bottle	30	3.69	2.892	5.101	**.000**
Measuring Cylinder	30	5.13	4.365	4.697	**.000**
Pipette	30	2.56	2.220	4.617	**.000**
Burette	30	2.38	2.363	4.020	**.001**
Stopcock	30	1.19	1.797	2.643	**.018**
Condenser	30	1.50	1.932	3.105	**.007**
Buchner Funnel	30	.88	1.668	2.098	.053

Table-9: Individual school level observations show that most of the schools have no sufficient lab apparatus. Moreover, maximum of the schools has a great scarcity of lab equipment's. We apply a two-sided t-test to see various lab apparatus status stored in selected schools. Results indicate that almost all of the apparatus for chemistry lab are different in quantity at different institutions. Some insignificant values observed for some specific apparatus. Those are the types of apparatus either not found in the lab of schools or, some of the selected schools have only 1-2 quantity of that items. This type of results is very alarming to describe the science education. Practical labs should be well equipped for the students and there may be a little difference from school to school, which is evidently opposite of existing situation.

Section-B: Response from Physics teachers at Secondary School

Table-10: Educational qualifications of physics teachers

Qualifications		Frequency	Percentage
B.Sc		02	06.3
B.Sc, B.Ed		06	18.8
M.Sc		13	43.8
M.Sc, M.Ed		09	31.3
	Total =	30	100.00

Table-10: Results from the table revealed that fifteen the physics teachers (50%) either have B. Ed or M. Ed degree in teaching. A large number of them (43.8%) have M. Sc without professional degree and only two of them (6.3%) have only B. Sc degree but not degree in teaching.

Table-11: Participation in training of physics teachers

Training	Frequency	Percentage
No training	17	56.66
TQI 15 days	07	23.33
CPD	06	20.00
Total =	30	100.00

Table-11: More than 50% of the physics teachers have no professional training during their teaching tenure. Few of them (23.33%) have TQI training and some of them (20%) have CPD training from TT colleges.

Table-12: Use of lesson plan or instructional plan for physics practical

Using lesson plan	Frequency	Percentage
No	17	56.3
Yes	13	43.7
Total =	30	100.0

Table-12: Most of the teachers (56.3%) are not using any lesson plan or, instructional plan for physics practical classes. May be, teachers are not interested to prepare a lesson plan, or, they do not have sufficient motivation for the necessity to do the same.

Table-13: Problems faced during the practical lab session

Problems	Frequency	Percentage
No problem	02	06.3
Insufficient lab equipments	04	12.5
Small lab room for large students	02	06.3
All the above	18	62.5
Do not reply	04	12.5
Total =	30	100.0

Table-13: Result from the table revealed that selected secondary schools (80%) do not have sufficient lab equipment's, small lab room for large number of students, and also facing fund crisis for physics lab practical. Only two schools have no problems in physics lab works.

Table-14: Efforts necessary for improving the practical lab session

Efforts necessary	Frequency	Percentage
Equipment and congenial practical class rooms	13	43.8
Sufficient fund and teachers training	02	06.3
All the above	11	37.5
Do not reply	04	12.5
Total =	30	100.0

Table-14: Teachers were asked to suggest the efforts for improving physics practical lab sessions. Most of them (86.66%) suggested that, subject specific training necessity, availability of sufficient lab equipment's with congenial practical classrooms and allocation of more funds could be the important efforts for a fruitful lab session.

Table-15: Physics laboratory apparatus condition of the selected schools

Apparatus	N	Mean	Std. Deviation	t-statistics	p-value
No. of table	30	2.69	2.676	4.017	.001
Slide Calipers	30	9.44	12.463	3.029	.008
Verniers Scale	30	3.56	5.278	2.700	.016
Varner's Calipers	30	2.19	2.762	3.168	.006
Screw Gauge	30	8.00	11.911	2.687	.017
Stop watch	30	3.25	2.933	4.433	.000
Funnel / Map chong	30	5.00	4.980	4.016	.001
Balance	30	2.63	1.544	6.801	.000
Concave lens	30	3.94	3.087	5.102	.000
Plain mirror	30	4.13	2.802	5.889	.000
Convex lens	30	4.06	5.026	3.233	.006
Board pin	30	20.06	24.409	3.288	.005
Drawing Board	30	2.88	4.145	2.774	.014
Scale	30	4.31	3.497	4.933	.000
Chanda	30	3.00	3.795	3.162	.006
Square Glass sheet	30	3.25	5.447	2.387	.031
Compass	30	4.25	7.353	2.312	.035
Set square	30	2.13	3.519	2.415	.029
Targeted Pin	30	2.13	3.304	2.573	.021
Meter Scale	30	4.38	3.594	4.869	.000
Lab Stand	30	3.75	3.194	4.697	.000
Clamp	30	3.31	3.478	3.810	.002
Cross Compass	30	2.31	3.219	2.873	.012
Bar Magnet	30	6.19	4.847	5.106	.000
Ammeter	30	2.19	1.642	5.329	.000
Voltmeter	30	2.00	1.506	5.314	.000
Resistance	30	7.63	24.690	1.235	.236
Rheostat	30	1.06	1.181	3.597	.003
Key	30	1.00	1.366	2.928	.010
Battery	30	1.38	3.160	1.741	.102
Shirish paper	30	2.19	3.430	2.551	.022
Beaker	30	4.00	4.412	3.626	.002
Test tube	30	14.88	25.669	2.318	.035
Thermometer	30	6.31	6.107	4.135	.001
Spirit Lamp	30	3.25	3.975	3.271	.005
Tripped stand with net	30	3.31	3.646	3.634	.002

Summary of the upper Table

Apparatus	N	Mean	Std. Deviation	t-statistics	p-value
Stand clamp	30	1.94	2.768	2.800	.013
Thorax	30	.56	1.365	1.649	.120
Graph Paper	30	25.25	73.842	1.368	.192

Table-15: Individual school level observations show that most of the schools do not have sufficient lab apparatus. Moreover, maximum of the schools have a great scarcity of lab equipment's. We apply a two-sided t-test to see variation in physics lab apparatus status in selected schools. Results indicate that almost all of the apparatus for chemistry lab are different in quantity at different institutions. Some insignificant values observed for some specific apparatus. Those are the types of apparatus either not found in the lab of schools or, some of the selected schools have only 1-2 quantity of that items. This type of results is very alarming to describe the science education. Practical labs should be well equipped for the students and there may be a little difference from school to school, which is evidently opposite of existing situation.

Section-C: Response from Biology Teachers of Secondary School

Table-16: Educational qualifications of biology teachers

Qualifications		Frequency	Percentage
B.Sc		2	6.3
B.Sc, B.Ed		11	37.5
M.Sc		11	37.5
M.Sc, M.Ed		6	18.8
	Total =	30	100.0

Table-16: Results from the table revealed that most of the biology teachers either have B.Ed. or M.Ed. degree. Some of them have M.Sc. without professional training and a little of them have only B.Sc. education.

Table-17: Participation in training of biology teachers

Training		Frequency	Percentage
No training		9	31.3
TQI 15 days		4	12.5
CPD		13	43.8
Others		4	12.5
	Total =	30	100.0

One-third of the biology teachers have no professional training during their teaching tenure. Few of them have TQI training and some of them have CPD training from TT colleges. A little of them have some professional training organized by the local institutions.

Table-18: Use of lesson plan or instructional plan for chemistry practical

Using lesson plan	Frequency	Percentage
No	17	56.3
Yes	13	43.7
Total =	30	100.0

Most of the teachers are not using any lesson plan or, instructional plan for biology practical classes. May be, teachers are not interested to prepare a lesson plan, or, they do not have sufficient motivation for the necessity to do the same.

Table-19: Problems faced during the practical lab session

Problems		Frequency	Percentage
No problem		02	06.3
Insufficient lab equipment's/			
Small lab room for large students/ Not necessary funds		24	81.2
Do not reply		04	12.5
	Total =	30	100.0

Result from the table 19 revealed that selected secondary schools do not have sufficient lab equipment's and also facing fund crisis for biology lab practical. Only two schools have an organized lab class room for biology practical. Four the schools have no lab room facility for the science students.

Table-20: Efforts necessary for improving the practical lab session

Efforts necessary	Frequency	Percentage
Congenial practical class rooms	4	12.5
Teachers training/ more lab apparatus/ allocation of more funds	15	50.0
Do not reply	11	37.5
Total=	30	100.0

Teachers were asked to suggest the efforts for improving biology practical lab sessions. Most of them suggested that, subject specific training necessity, availability of sufficient lab equipment's and allocation of more funds could be the important efforts for a fruitful lab session. Some of them suggests for a congenial and separate practical class room.

Table-21: Biology laboratory apparatus condition in the selected schools

Apparatus	N	Mean	Std. Deviation	t-statistics	p-value
Dissecting Box	30	5.73	8.489	2.616	.020
Various types of machineries for dissecting box	30	6.07	10.566	2.224	.043
Various types of pencils	30	3.27	5.049	2.506	.025
Pencil cutter	30	2.47	2.900	3.294	.005
Rubber	30	2.40	2.898	3.207	.006
Scale	30	3.53	4.051	3.378	.005
Microscope	30	5.53	7.827	2.738	.016
Slides	30	24.60	29.413	3.239	.006
Cover Slip	30	20.87	50.221	1.609	.130
Tissue paper / Thin cloth for wiping	30	.93	1.335	2.709	.017
Towels for wiping	30	.60	.828	2.806	.014
Laboratory note book	30	5.40	16.677	1.254	.230

Microscope, Color slides, alcohol, Glycerine etc.	30	1.33	2.769	1.865	.083
Needle for boring	30	5.73	8.639	2.570	.022
Scissors	30	4.07	8.900	1.770	.099
Skull Pell	30	3.47	9.015	1.489	.159
Chimta	30	4.87	8.709	2.164	.048
Tuli	30	4.67	8.910	2.029	.062
Watch Glass	30	4.33	6.079	2.761	.015
Blow pipe	30	3.73	9.098	1.589	.134
Razor	30	3.00	8.960	1.297	.216
Magnifying Glass	30	4.67	8.764	2.062	.058
Blade	30	4.60	8.733	2.040	.061
Pin	30	9.13	14.793	2.391	.031
Dropper	30	4.47	8.895	1.945	.072

The table 21 shows that, individual school level observations show that most of the schools do not have sufficient lab apparatus. Moreover, maximum of the schools have a great scarcity of lab equipments. We apply a two-sided t-test to see variation in lab apparatus status stored in selected schools. Results indicate that almost all of the apparatus for biology practical are different in quantity at different institutions. Some insignificant values observed for some specific apparatus. Those are the types of apparatus either not found in the some schools or, some of the selected schools have only 1-2 quantity of that items. This type of results is very alarming to describe the science education. Practical labs should be well equipped for the students and there may be a little difference from school to school, which is evidently opposite of existing situation.

Section-D: Response from the Head-teachers of Secondary School

Table-22: Situation of Institutions

Division	Frequency	Percentage
Dhaka	18	60.00
Rajshahi	10	33.33
Sylhet	02	06.67
Total =	30	100.00

Table-22: 60% of the selected institutions are from Dhaka division followed by 33.33% from Rajshahi division. Only two (6.66%) institution is from Sylhet division.

Table-23: Experience of the Heads of institution

Range		Frequency	Percentage
Less than 3 years		7	23.33
3 to 5 years		9	30.00
10 to 20 years		9	30.00
21 to 30 years		5	16.670
	Total =	30	100.00

Table-23: Most of the head teachers (76.67%) have 05-30 years experiences in secondary

school management and only some of them (23.33%) have less than three years experiences in secondary school management.

Table-24: Academic training of the head of institution

Situation	Frequency	Percentage
No	27	90.00
Yes	03	10.00
Total =	30	100.00

Table-24: Only three of the head of institutions have some sort of academic training in science lab management. Interestingly, one of them has less than 3 years of experience as head and the other have experience more than 20 years.

Table-25: Number of science laboratories in the institutions

Range		Frequency	Percentage
No labs		03	10.00
1 lab at least		23	76.67
3 to 4 labs		04	15.00
	Total =	30	100.00

Table-25: Most of the selected secondary schools (76.67%) have one science lab for chemistry, physics and biology and only three schools (10%) have separate lab for each of the three disciplines.

Table-26: Number of students' accommodation in the laboratory

Range		Frequency	Percentage
Maximum 30		12	40.00
30 to 50		12	40.00
More than 50		04	13.33
Do not reply		02	06.67
	Total =	30	100.00

Table-26: Twelve schools have accommodation of 30 students at a time in practical work and other twelve schools have 30-50 students' accommodation in practical classroom. Four schools (6.67%) have accommodation for more than fifty students at a time in practical work.

Table-27: Annual budget for the science laboratory

Range	Frequency	Percentage
No budget for science lab	06	20.00
Below 10000	11	36.67
Between 10000 to 1 Lac	09	30.00
More than 1 Lac	04	13.33
Total =	30	100.00

Table-27: Nine schools (30%) have budget between Taka 10000 to 100000; eleven schools (36.67%) have below Taka 10000; four schools (13.33%) have budget more than Taka 100000; and six schools have no budget for science labs.

Table-28: Lab size in square feet

Range	Frequency	Percentage
Minimum 500 sqft	12	40.00
Between 500 to 900 sqft	14	46.67
More than 900 sqft	04	13.33
Total =	30	100.00

Table-28: Fourteen secondary schools' (46.67%) lab size ware between 500 to 900 square feet; twelve schools' lab are less than 500 square feet; and four schools lab are more than 900 square feet.

Table-29: Number of entrance door in each lab

Range		Frequency	Percentage
No lab		3	10.00
Only a single door		11	36.67
2 doors		16	53.33
	Total =	30	100.00

Table-29: Sixteen schools' labs (53.33%) have two doors for entrance; eleven schools (36.67%) have only one door for entrance.

Table-30: Roof height in the laboratory room

Range	Frequency	Percentage
Below standard (less than 10ft)	5	16.67
Standard (10ft)	12	40.0
Above standard (more than 10ft)	13	43.33
Total =	30	100.0

Table-30: Twenty five schools' roof height *(83.33%) are standard 10 feet height & above)* and the remaining schools' roof are not standard.

Table-31: Whether laboratory room have sufficient furniture

Range		Frequency	Percentage
Not adequate		17	56.67
Adequate		13	43.33
	Total =	30	100.0

Table-31: Seventeen schools (56.67%) have not adequate furniture in labs and the remaining thirteen schools (43.33%) have adequate furniture.

Table-32: Sufficient air ventilation facility available in lab room

Position		Frequency	Percentage
Not adequate		05	16.67
Adequate		25	83.33
	Total =	30	100.00

Table-32: It is found from this table that twenty-five secondary schools' lab (83.33%) have adequate ventilation facilities and five schools (16.67%) have inadequate that facilities.

Table-33: Store room available for lab apparatus preservation

Position		Frequency	Percentage
No		21	70.0
Yes		9	30.0
	Total =	30	100.0

Table-33: Twenty one schools' labs have no store room facility for preserving lab apparatus and elements and nine schools (30%) have that facility.

Table-34: Laboratory room equipment status

Position	Frequency	Percentage
Well equipped	6	20.0
Moderately equipped	9	30.0
Not equipped	15	50.0
Total =	30	100.0

Table-34: It is revealed from this table that fifteen schools' lab (50%) are well and moderately equipped and the remaining (50%) are not equipped.

Table-35: Problem for not equipped laboratory room

Position	Frequency	Percentage
No problem reported	6	20.00
Space problem	5	16.67
Fund crisis	9	30.00
Lack of teachers training	1	03.33
All the above	5	16.67
Insufficient science students	1	03.33
Do not reply	3	10.00
Total =	30	100.00

Table-35: Only six secondary schools (20%) have no problem in science lab, but twenty four schools' labs face various problems, like space problem (16.67%), fund crisis (30%), lack of teachers training (3.33%), insufficient science students (3.33%) and five schools (16.67%) have all problems stated above.

Table-36: Having lesson plan or lab instruction for students

Position	Frequency	Percentage
No	11	35.0
Yes	18	60.0
Own method apply	01	05.0
Total =	**30**	**100.0**

Table-36: Eighteen schools lab teachers use lesson plan in teaching for lab works and eleven schools do not use lesson plan.

Table-37: Reason for not preparing a lesson plan or lab instruction

Position	Frequency	Percentage
Teachers not interested	3	10.00
Few science students	2	06.67
More class load to science teachers'	4	13.33
Do not reply	21	70.00
Total =	30	100.00

Table-37: Regarding for not preparing lesson plan/instruction plan head teacher mentioned various problems, like teachers not interested (10%), few science students (6.67%), more class load to science teachers (13.33%) and remaining twenty one schools' head (70%) did not reply the question.

Table-38: Efforts for improving science laboratory

Position	Frequency	Percentage
Need more instruments	6	20.0
Adequate space required	3	10.0
Training for science teachers	6	20.0
All the above	9	30.0
Do not reply	6	20.0
Total =	30	100.0

Table-38: Regarding efforts for improving science lab most of the head teacher opined some suggestions, like need more instruments (20%), adequate space required (10%), training for science teachers (20%), nine head teachers (30%) stated the all problems above and six head teachers (20%) did not reply.

Table-39: National standard and Safety measure in science labs of school

Position	Head Teacher	Physics Teachers	Chemistry Teachers	Biology Teachers
Yes	--	--	--	--
No	30 (100%)	30 (100%)	30 (100%)	30 (100%)

Table-39: This indicates that there is no national standard and safety measure in our school labs.

Section-E : Responses from the science students of Secondary Schools (N=240)

Table-40: No. of practical classes held in chemistry/physics/biology in 2013

Subjects	Practical Classes held from 5 to10 in school	Practical Classes held from 11 to15 in school	Practical Classes held from 16 to20 in school	Practical Classes held 20 and above
Physics	19 (63.33%)	08 (26.67%	03 (10%)	-
Chemistry	18 (60%)	09 (30%)	02 (6.67%)	01(3.33%)
Biology	23 (76.67%)	05 (16.67%)	02 (6.67%)	

Table-40: This table indicates that in physics 05 to 10 practical classes held in 19 schools (63.3%), 11 to 15 classes in 08 schools (26.67%) and 16 to 20 classes held in only 03 schools (10%). In chemistry, 05 to 10 practical classes held in 18 schools (60%), 11 to 15 classes in 09 schools (30%) and 16 to 20 classes held in only 02 schools (6.67%) and 20 classes and above held in only o1 school (1.33%). In biology, 05 to 10 practical classes held in 23 schools (76.67%), 11 to 15 classes in 05 schools (16.67%) and 16 to 20 classes held in only 02 schools (6.67%).

Table-41: Time (Duration) of a practical class

Duration	Less than one hour (N=30)	1 hour (N=30)	More than one hour (N=30)
No. of schools	08 (26.67%)	17 (56.67%)	05 (16.67%)

Table-41: The duration of practical class in 08 schools (26.67%) are less than an hour, in 17 schools (56.67%) are 1 hour and in 05 schools (16.57%) are more than an hour.

Table-42: Students' feeling in practical class (N=240)

Excellent	Very good	Good	Moderate	Not good
101 (42.08%)	79 (32.91%)	18 (7.50%)	42 (17.50%)	-

Table-42: Regarding students feeling in practical class, 101 student respondents (42.08%) out of 240 feel excellent, 79 respondents (32.91%) feel very good, 18 respondents (7.50%) feel good and 18 respondents (17.50%) feel moderate in practical classes.

Table-43: Type of problems faced in practical session (N=240)

Problems	**Responses of Students**	**Percentage**
Space problems in lab	128	53.33
Inadequate apparatus and elements	143	59.58
Giving less importance in practical	78	32.50
Practical class not held immediate after the theoretical class, held at the end of the year	203	84.58
All the above	176	73.33
Not replied	03	2.14

Table-43: In responding the problem faced by the science students, 128 respondents (53.33%) face space problem in their labs, 143 respondents (59.58%) face problem of inadequate apparatus, 78 respondents (32.50%) feel less importance in practical works in schools, 203 respondents (84.58%) opine that practical classes not held immediate after the relevant theoretical class, 176 respondents (73.33%) faced all the problems stated above.

Table-44: Measures needed for making the practical class to be interesting

Measures to be taken	Responses (N=240)	Percentage
Adequate apparatus	234	97.50
Adequate reagents & elements	236	98.33
Attractive practical classroom	109	45.41
Starting practical class with the theoretical class	201	83.75
Supply instruction sheet for practical work	177	73.75

Table-44: Most of the science student respondents expressed a number of common suggestions for making the practical classes interesting. Among these, adequate apparatus (97.50%), adequate reagents and elements (98.33%), attractive class room (45.41%), starting practical class with the theoretical class, supply of practical instruction sheet by the teacher (73.75%).

4.0 Findings

a. Findings from the Responses of Chemistry Teachers

1. Most of the chemistry teachers either have B. Ed or M. Ed degree. Some of them (18.8%) have simple M. Sc degree without professional certification in teaching.
2. More than one-third of the chemistry teachers (37.5%) do not have any professional training. Few of them (31.2%) have TQI training and some of them (18.8%) have CPD training from TT colleges. Four teachers (12.5%) got professional training organized by local institution.
3. Most of the teachers are experienced in teaching and have been working for more than 16 years. A number of them (26.%) have teaching experience 3 to 7 years and some of them (25%) have teaching experience less than 2 years.
4. Thirteen teachers (43.7%) are using lesson plan and most of the teachers (56.3%) are not using any lesson plan or, instructional plan for chemistry practical classes. This is really disappointing. May be, teachers are not interested to prepare a lesson plan, or, they do not have sufficient motivation for the necessity to do the same.
5. Selected secondary schools (81.2%) do not have sufficient lab equipments and also facing fund crisis for physics lab practical. Five schools (18.8%) have no lab room facility for the science students and they didn't put any response.
6. Teachers were asked to suggest the efforts for improving chemistry practical lab sessions. Most of them (73.3%) suggested that, subject specific training necessity, availability of sufficient lab equipments and allocation of more funds could be the important efforts for a fruitful lab session. Some of them (13.3%) suggests for a congenial and separate practical class room.
7. Individual school level observations show that most of the schools have no sufficient lab apparatus. Moreover, maximum of the schools have a great scarcity of lab equipments. We apply a two-sided t-test to see various lab apparatus status stored in selected schools. Results indicate that almost all of the apparatus for chemistry lab are different in quantity at different institutions. Some insignificant values observed for

some specific apparatus. Those are the types of apparatus either not found in the lab of schools or, some of the selected schools have only 1-2 quantity of that items. This type of results is very alarming to describe the science education. Practical labs should be well equipped for the students and there may be a little difference from school to school, which is evidently opposite of existing situation.

b. Findings from the Responses of Physics Teachers

8. Fifteen the physics teachers (50%) either have B. Ed or M. Ed degree in teaching. A large number of them (43.8%) have M. Sc without professional degree and only two of them (6.3%) have only B. Sc degree but not degree in teaching.
9. More than 50% of the physics teachers have no professional training during their teaching tenure. Few of them (23.33%) have TQI training and some of them (20%) have CPD training from TT colleges.
10. Most of the teachers are experienced in teaching and have been working for more than 13 years. A number of them (23.33%) have teaching experience 3 to 7 years and some of them (13.33%) have teaching experience less than 2 years.
11. Most of the teachers (56.3%) are not using any lesson plan or, instructional plan for physics practical classes. May be, teachers are not interested to prepare a lesson plan, or, they do not have sufficient motivation for the necessity to do the same.
12. Most of the selected secondary schools (80%) do not have sufficient lab equipments, small lab room for large number of students, and also facing fund crisis for physics lab practical.

    Only two schools have no problems in physics lab works.

13. Teachers were asked to suggest the efforts for improving physics practical lab sessions. Most of them (86.66%) suggested that, subject specific training necessity, availability of sufficient lab equipments with congenial practical classrooms and allocation of more funds could be the important efforts for a fruitful lab session.
14. Individual school level observations show that most of the schools do not have sufficient lab apparatus.

c. Findings from the Responses of Biology Teachers

15. Most of the biology teachers either have B. Ed or M. Ed degree. Some of them have M. Sc without professional training and a little of them have only B. Sc education.
16. One-third of the biology teachers have no professional training during their teaching tenure. Few of them have TQI training and some of them have CPD training from TT colleges. A little of them have some professional training organized by the local institutions.
17. Most of the teachers are experienced in teaching and have been working for more than 11 years. A number of them have teaching experience 4 to 7 years and only one of them have teaching experience less than 2 years.
18. Most of the teachers are not using any lesson plan or, instructional plan for biology practical classes. May be, teachers are not interested to prepare a lesson plan, or, they do not have sufficient motivation for the necessity to do the same.

19. Most of the selected secondary schools do not have sufficient lab equipments and also facing fund crisis for biology lab practical. Only two schools have an organized lab class room for biology practical. Four the schools have no lab room facility for the science students.
20. Teachers were asked to suggest the efforts for improving biology practical lab sessions. Most of them suggested that, subject specific training necessity, availability of sufficient lab equipments and allocation of more funds could be the important efforts for a fruitful lab session. Some of them suggests for a congenial and separate practical class room.
21. Individual school level observations show that most of the schools do not have sufficient lab apparatus. Moreover, maximum of the schools have a great scarcity of lab equipments. We apply a two-sided t-test to see variation in lab apparatus status stored in selected schools. Results indicated that almost all of the apparatus for biology practical are different in quantity at different institutions. Some insignificant values observed for some specific apparatus.

d. Findings from the Responses of head teachers

22. Most of the head teachers (76.67%) have 05-30 years experiences in secondary school management and only some of them (23.33%) have less than three years experiences in secondary school management.
23. Only three of the head of institutions have some sort of academic training in science lab management. Interestingly, one of them has less than 3 years of experience as head and the other have experience more than 20 years.
24. Most of the selected secondary schools (76.67%) have one science lab for chemistry, physics and biology and only three schools (10%%) have separate lab for each of the three disciplines.
25. Twelve schools have accommodation of 30 students at a time in practical work and other twelve schools have 30-50 students' accommodation in practical classroom. Four schools (6.67%) have accommodation for more than fifty students at a time in practical work.
26. Nine schools (30%) have budget between Taka 10000 to 100000; eleven schools (36.67%) have below Taka 10000; four schools (13.33%) have budget more than Taka 100000; and six schools have no budget for science labs.
27. Fourteen secondary schools' (46.67%) lab size is between 500 to 900 square feet; twelve schools' labs are less than 500 square feet; and four schools lab are more than 900 square feet.
28. Sixteen schools' labs (53.33%) have two doors for entrance; eleven schools (36.67%) have only one door for entrance.
29. Twenty five schools' roof height (83.33%) are standard 10 feet height & above) and the remaining schools' roof are not standard.
30. Seventeen schools (56.67%) have not adequate furniture in labs and the remaining thirteen schools (43.33%) have adequate furniture.
31. Twenty-five secondary schools' lab (83,33%) have adequate ventilation facilities and five schools (16.67%) have inadequate that facilities.

32. Twenty one schools' labs have no store room facility for preserving lab apparatus and elements and nine schools (30%) have that facility.
33. It is revealed from this table that fifteen schools' labs (50%) are well and moderately equipped and the remaining (50%) are not equipped.
34. Only six secondary schools (20%) have no problem in science lab, but twenty four schools' labs face various problems, like space problem (16.67%), fund crisis (30%), lack of teachers training (3.33%), insufficient science students (3.33%) and five schools (16.67%) have all problems stated above.
35. Eighteen schools lab teachers use lesson plan in teaching for lab works and eleven schools do not use lesson plan.

e. Findings from the Responses of science students (N=240)

36. In physics 05 to 10 practical classes held in 19 schools (63.3%), 11 to 15 classes in 08 schools (26.67%) and 16 to 20 classes held in only 03 schools (10%). In chemistry, 05 to 10 practical classes held in 18 schools (60%), 11 to 15 classes in 09 schools (30%) and 16 to 20 classes held in only 02 schools (6.67%) and 20 classes and above held in only oi school (1.33%). In biology, 05 to 10 practical classes held in 23 schools (76.67%), 11 to 15 classes in 05 schools (16.67%) and 16 to 20 classes held in only 02 schools (6.67%).
37. The duration of practical class in 08 schools (26.67%) are less than an hour, in 17 schools (56.67%) are 1 hour and in 05 schools (16.57%) are more than an hour.
38. Regarding students feeling in practical class, 101 student respondents (42.08%) out of 240 feel excellent, 79 respondents (32.91%) feel very good, 18 respondents (7.50%) feel good and 18 respondents (17.50%) feel moderate in practical classes.
39. In responding the problem faced by the science students, 128 respondents (53.33%) face space problem in their labs, 143 respondents (59.58%) face problem of inadequate apparatus, 78 respondents (32.50%) feel less importance in practical works in schools, 203 respondents (84.58%) opine that practical classes not held immediate after the relevant theoretical class, 176 respondents (73.33%) faced all the problems stated above.
40. Most of the science student respondents expressed a number of common suggestions for making the practical classes interesting. Among these, adequate apparatus (97.50%), adequate reagents and elements (98.33%), attractive class room (45.41%), starting practical class with the theoretical class, supply of practical instruction sheet by the teacher (73.75%).

5.0 Conclusion and Recommendations

The study reveals that a good number of teachers without professional training are teaching in our secondary schools. Moreover, the findings based on collected data clearly indicate that there are many problems in science lab work- inadequate science equipment and reagents, lack of discipline-wise lab, uncomfortable lab environment, lack of gas supply, low importance given on lab work, starting lab work at the end of the education year, lack of budg*et al*location, etc. and no guideline to maintain national standard for school science lab for lab work and lab management.

However, keeping the findings of this study and considering the standards of science lab in some developing and developed countries in mind the research team has drawn some recommendations.

Recommendation-1: Secondary school science teachers must have B. Ed degree. Each Schools Management Committee (SMC) should ensure for having B. Ed degree of their teachers. The SMC and DSHE should have an instruction for the un-trained teachers to obtain B. Ed degree within a specific time period.

Recommendation-2: DSHE with the assistance of NAEM, TTC, and HSTTI should introduce training program for the physics, chemistry and biology teachers separately in science lab works.

NAEM should include a module name 'Management of Science Lab' in the training program of Educational Management and Administration for Head Teachers.

Recommendations-3: Each SMC should ensure using of lesson plan/instruction plan by the teachers in lab works. Officials of upazila secondary education should monitor the use of lesson plan in teaching lab work.

Recommendation-4: Each school should have three science labs-one for physics, one for chemistry and one for biology with three Lab Assistants. DSHE should create this post for secondary schools.

Recommendation-5: Each school should be supplied water and gas line for using in science lab. **Recommendation-6:** The budget for the science lab in secondary school is very poor excepting a few. Each SMC should ensure adequate money for lab in their schools. DSHE may provide guidelines to the SMC for the science lab budget.

Recommendation-7: There is no uniformity in time allocation of a science lab class in our school. DSHE should ensure it by mentioning number of lab classes in each class and time allocation for a class.

Recommendation-8: There is no safety measure in secondary school science lab in our country. So, proper safety measure should be taken.

Recommendation-9: The findings of the study show that there are many problems in using science lab and its managements in our secondary schools. The researchers seem that lack of national standard for secondary school science lab is the main problem. So, DSHE should take initiative to prepare a national standard for secondary school science lab. If it is done most of the problems may be solved easily.

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