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ABSTRACT

In modern times, the progress of a country largely depends on its Science Education facilities. Coordination between two significant wings of Science Education, i.e., Theoretical Science Education, and Practical study Oriented Science Education together boost innovations by accelerating the journey toward digitalization and modernization. However, practical study-oriented science education is blind provided that theoretical Education is disregarded. And when Theoretical Science Education is enriched, open and profound, Practical Education oriented fields of a country become more dynamic. Bangladesh turned out to be a middle-income country in the year 2019. Provided that the country plans to achieve its long-cherished aim, i.e., 'Vision 41 Digital Bangladesh', it's high time to revisit its Theoretical Science Education facilities and strengthen the field to exert human potentialities in the development of science and Technology sectors.

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ABSTRACT

In modern times, the progress of a country largely depends on its Science Education facilities. Coordination between two significant wings of Science Education, i.e., Theoretical Science Education, and Practical study Oriented Science Education together boost innovations by accelerating the journey toward digitalization and modernization. However, practical study-oriented science education is blind provided that theoretical Education is disregarded. And when Theoretical Science Education is enriched, open and profound, Practical Education oriented fields of a country become more dynamic. Bangladesh turned out to be a middle-income country in the year 2019. Provided that the country plans to achieve its long-cherished aim, i.e., 'Vision 41 Digital Bangladesh', it's high time to revisit its Theoretical Science Education facilities and strengthen the field to exert human potentialities in the development of science and Technology sectors. Bangladesh's endeavor to standardize people's livelihood through utilizing the blessing of science and technology may no longer be a matter of dependency and intervention by foreign companies if the country wanders toward a widespread plan on improving the quality of theoretical Science Education.

Keywords: theoretical science, bangladesh, globalization, developing world.

Author α σ: Institution: Mirzapur Cadet College.

I. INTRODUCTION

1.1 Background Research

In the modern era, the countries which are progressing in the field of science and technology have already started working on enhancing self-sufficiency a long time ago to transform their citizens into significant assets by providing them with proper science education facilities (both theoretical and practical) by nurturing their capability of direct contribution in their economies. Even though the developed countries have produced adequate skilled citizens to look after their significant scientific sectors and scientists to work for required advanced innovations to keep pace with the global competition in this era of Globalization, the developing countries fail to do the same due to insufficient resources and manpower with that level of expertise.

1.2 Problem Statement

Bangladesh, despite being a third-world country, has pulled on immense interest and efforts for the modernization of its leading science-based sectors to ease people's lives and accelerate the progress of livelihood development. Besides, the widespread roots of corruption, poverty, illiteracy, natural disasters, and lack of access to Higher Education are several serious factors increasing its dependence upon other countries in science sectors.

1.3 Research Objectives

The research paper mostly reflects the necessity of theoretical Science Studies in Bangladesh by considering some crucial factors like benefits, circumstances, goals, and ability of the country.

In this entire research paper, we will be working on some of the most demanded and necessary theoretical science subjects like Astronomy, Astrophysics, Nuclear Science, Quantum Physics, Theoretical Physics, Earth Science, Space Science, and so on.

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II. THEORETICAL SCIENCE EDUCATION ACROSS THE BORDERS

2.1 Theoretical Science Education in Developed Countries

The developed countries started their progress in theoretical science education way long before Yuri Gagarin first traveled to space or Neil Armstrong walked on the moon. If we look at the Physical Science Research Index, the United States is leading the list while China has done significantly better in the last few years [1]. Thereafter Germany, France, Switzerland, and Japan lead the list. In Switzerland, CERN has brought seven of its finest discoveries under light (Higgs Bosons, GOD particles to the World Wide Web), all of which are significant innovations in the field of theoretical science Education throughout the world. In the USA, there are more than 100 Universities that include Quantum physics as one of the majors in their courses. In all of the countries which are mostly termed as Developed; Space Science, Astrophysics, Astronomy, and Nuclear Science Studies have been included decades ago in their Higher Education Curriculum and most of those have conducted several research works based on the Education they have been offering to their students.

Besides meeting the demand of contribution in their own countries, graduates of the developed countries are often offered decent jobs in third world countries in nuclear Electricity fields, Satellites Administration, and in universities to teach theoretical science subjects as these countries fail to produce that sort of expertise to meet their demands.

2.2 Bangladesh and Theoretical Science Education

The Higher Education facilities in Bangladesh are not enriched enough despite having a good number of Universities and Colleges within her small territory. Putting the entire higher Education faculty aside, if we talk about the science Education facilities, this sector is also standing below standards. The country has already begun constructing two 500 MWe nuclear reactors (costs of US $2.9-3.7 Billion) with a target to produce 600 MWe units and 1000 MWe, the country has become the 57th country in history to have an artificial satellite of its own, the country is often said to have Uranium in few of its mountains, nevertheless, the country is not having a decent education facility in Universities for producing skilled citizens for maintaining and leading all of these above-mentioned science-based significant projects for the country. However, Theoretical Science Education can be an answer.

2.2.1 Higher Education Facilities in the Universities of Bangladesh

Higher Education in Bangladesh is a legacy of the British Colonial Education System. At present, there are 85 Universities, of which 30 are public, and 55 are Private.[2] Even though the number of private Universities is double the number of Public Universities, most local parents tend to send their children to public Universities due to unaffordability. As a result, the competition in public universities is so hyped compared to that of private Universities.

Of the total number of universities, five are 'Science, Engineering, and Technology based, while ten are general and others are mostly divided into Agricultural and Open Universities. The number of students in each University is huge, the ratio between teachers and students is too unbalanced, and only an average of 23% of students get jobs related to their subjects after graduation. For illustration, the Bangladesh University of Engineering and Technology (BUET) has ranked 185th worldwide this year in the QS ranking.[3]

2.2.2 Theoretical Science Education in the Bangladeshi Universities

At this point, the most significant discussion that we must understand does begin. We have researched all of the Universities providing Science-based Education facilities in Bangladesh and have collected data about their available majors. Among a total of 67 such Universities, the number of universities that offer Quantum physics as a major is three. (Jahangirnagar

University, Islamic University of Technology, Rajshahi University). The number of universities providing opportunities to study Space Science, Astrophysics, and Astronomy is even less. The University of Dhaka has the oldest Physics Department, established in the year of 1921. Nevertheless, in the journey of 101 years, it couldn't include some other significant physics-related majors like Quantum physics, Nuclear Physics, Astrophysics, Cosmology, and so on. Theoretical majors like Nuclear Engineering, Nuclear Science, and short courses are offered at Dhaka University, Chittagong University of Science and Technology, Military Institute of Science and Technology, and Khulna University respectively. However, even though the Universities are claiming these subjects to be available, mentionable outcomes and results from these Departments are completely absent.

2.2.3 Theoretical Science Education in Local Universities

Dhaka University has a Department of Nuclear Engineering since 2010. However, this department doesn't have a well-equipped computer lab for the students and faculty members (Reactor simulators like MCNP, DRAJON, and GEANT4 are important in this case).

Another factor is that the University mostly focuses on studies about running Nuclear Power Plants. The department cited, "The Government of Bangladesh has decided to build some nuclear power plants within the shortest possible time to ensure energy security and sustainable economic growth in the country. A number of highly trained nuclear engineers will be needed for the planning, design, construction, installation, maintenance, and operation of these power plants. Considering the expansion of nuclear-related activities for power generation and the increased demand for skilled engineers, scientists and researchers, the department has been established. The syllabus is designed to provide a clear idea to the students about the various aspects of Nuclear Science and Engineering and peaceful applications of nuclear energy." [4]

Military Institute of Science and Technology (MIST), a renowned Semi-Government University established its NSE (Nuclear Science) Department in 2014 and the department is claimed to be the first accredited NSE Dept. in Bangladesh. Here, students can study modern nuclear techniques for acquiring skills in nuclear security and safeguards, radiation-based therapy, and contraband detection. Whatsoever, the scientists produced from here are destined to be employed in nuclear power plants, power industries, and nuclear medicine centers in Bangladesh as well as abroad. It provides facilities like radiation detection and medical application lab, nuclear technique and materials lab, nuclear reactor and control system design lab, etc. [Official website: NSE-MIST]

III. THE NECESSITY OF THEORETICAL SCIENCE EDUCATION IN BANGLADESH

In our surveys, we even asked people whether they think that the concerns for Theoretical Science Education should emerge in Bangladesh despite every possible oddity like financial constraint, lack of resources, and so on. In the response, we found that 1106 persons or 89.3% of all responses agreed that it is urgently required to teach Theoretical Science Education in Bangladesh as soon as possible, while 3.5% said no.

A developing country, Vietnam used to be much dependent on its agriculture like Bangladesh is today. However, if we look at Vietnam's success in Science and Technology fields, the record will seem very uncongenial to what usually happens in a developing country. In Vietnam, Electronics has emerged as a spearhead of the sector. In 2013, high-tech products contributed 28.7% to the country's GDP. By 2014, Vietnam was ranked 3rd in the Sub-Continental Region and 12th in the world in the export of electronics.[5] There cannot be a better contribution by the technology sector of a developing country than the ability to export electronics and stand out in the world ranking.

Now we will focus on how Astrophysics and Astronomy can contribute to progress. We have mentioned at the beginning of the paper that

Bangladesh became the 57th country to launch an artificial satellite. An important note is that the Bangladesh Government is planning for 'Bangabandhu Satellite-02' in the near future. [6]

Bangladesh is marching gradually to incorporate the uses of nuclear science and technology in medicine, industrial, agricultural and environmental sectors. There is a long-standing need for nuclear scientists, engineers, and professionals to take care of nuclear infrastructure, equipment, and material such as nuclear power plants, nuclear fuels, and radioactive waste, especially for power generation, industrial development, and healthcare diagnostics. Therefore, Nuclear Science education is very important, necessary, and demanding for Bangladesh. Besides, the research opportunities if created through Nuclear Physics in Bangladesh, may keep remarkable contributions to the advancement of nuclear energy production in Bangladesh. Keeping our statements unchanged here we reemphasize the demand for nuclear physics and science to ensure quality maintenance of the massive project of Bangladesh like the Ruppur Power Plant.

IV. REASONS BEHIND HAVING LACK OF THEORETICAL SCIENCE EDUCATION FACILITIES IN BANGLADESH

If we talk about the reasons behind our inability to establish Theoretical Science Education facilities in a developing country, precisely Bangladesh, financial constraints or lack of affordability will undoubtedly be the biggest factor. However, while researching the reasons, we have found ample drawbacks and loopholes which are going to hold back any kind of greater initiative to start the journey of these facilities. From those, some of the major factors are pointed out below:

4.1 Financing the Universities and financial constraints

Most public universities are dependent on the government for funding. However, of the 26 public universities, the National University is financially independent of the government and very solvent. It collects funds from registration and examination entry fees. The 'Open University of Bangladesh' is able to bear almost 30% of its expenses from the fees collected in entrance exams and the rest is usually financed by the Government through the 'University Grants Commission' of Bangladesh. [7] Since the budget is fixed for almost every year, it doesn't become possible to open an entire Science faculty from that budget. As a result, it's impossible for a university to take steps for establishing enriched Theoretical Science Education facilities. In fact, only the government has the affordability to take the initiative and make it happen.

In Bangladesh, public universities cost TK. 12 (about 20 US cents) per month for the educational needs of the thousands of meritorious students and the amount has remained unchanged for the last 75 years. [8] In reality, the sum can't even cover the cost of maintenance records. As a result, these universities are dependent on the government for 95% of their total expenditure. One catching sector of the revenue expenditure on the educational sector is that an estimated 71% of the fund allocated for education was spent on teachers' salaries, pension, and fringe benefits, and the rest 13% only was available for education contingency in the year 2019-2020. [9]

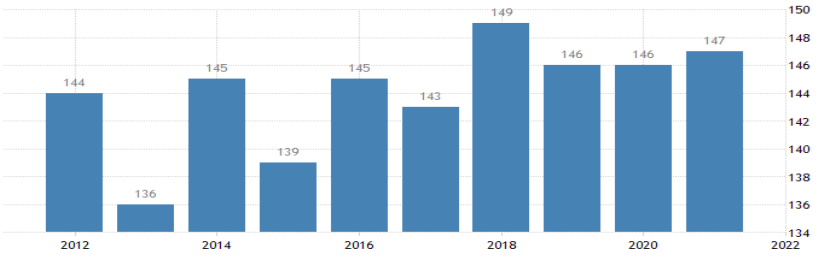
4.2 Lack of Job Opportunities

Even though we have mentioned nuclear power plants in Bangladesh and its artificial satellite, these sectors cannot be adequate for the graduates to rely on as job opportunities after graduation. From 'The Bangladesh University of Engineering and Technology', 27% (approx. 90000 students according to UNESCO) of the total students graduating every year go abroad for Higher Education, and 18% of them never come back to Bangladesh as the country fails to provide jobs in such a crucial sector like Engineering.

> *In our survey, we asked the attendees whether they were interested in studying theoretical Science. Among the students who are below 12th grade or are in 12th grade, 33.3% replied negative while 26.7% responded in the affirmative.*

4.2 Corruption

The deep-rooted corruption and dirty politics within the University Administration and students respectively are hindrances to the interest of theoretical science education among the students of our country. Transparency International's 2021 'Corruption Perceptions Index' ranks Bangladesh in 147th place out of 180 countries in the Index, where the country perceived to be most corrupt is ranked 180. [10]



The Solution: 'The Six Thinking Hats

To proceed further, we have decided to use the Six Thinking Hats techniques for presenting the issues, prospects, solutions, and understanding multiple scenarios through cognitive analysis. According to mindtools.com, "*'Six Thinking Hats' is a way of investigating an issue from a variety of perspectives, but in a clear, conflict-free way.*"

The Six Thinking Hats are as follows:

The White Hat: Facts, Insights, and Analysis

- The annual report-data of the University Grants Commission (UGC) in 2020 shows that out of 46 public universities in the country, a number of 38 universities have spent a total of Tk. 72.91 crore in the research sector while from 107 private universities, a number of 77 universities have spent tk. 111.73 crore on research. In the 2019-2020 national fiscal year, emphasizing the research sector, the government passed budgeted funds only for research purposes. What's shocking is that a total of 35 universities did not spend any amount on research and around 50 universities did not make a single publication throughout the year 2020. [11] Although Public Universities are offering education to a massive number of students every year while Private Universities are limited, Private Universities are doing a better job and utilizing an impressive amount of research despite not receiving any help from the government. If Theoretical Science Education in Bangladesh begins its journey, the feasibility and the expected outcomes may not bring a positive picture due to the above-mentioned failures of the Public Universities to utilize research funds.
- According to the 'Global Knowledge Index' 2020, Bangladesh ranked 112th with a score of 35.90 in the pre-university education category while in the higher education sector, the country ranked 129th with a score of 24.1. [12] The rankings are quite disappointing in comparison to our expectations for Theoretical Science Education.
- As of 2020, the percentage of unemployed graduates is 66, which includes all who have completed bachelor's degrees and post-graduation from more than 2000 public and private colleges affiliated with the National University. [13] The future prospects of public university graduates in the country's job market have been dire for the last decade. Even though public universities are claimed to be far better than private universities, such a job market threatens the initiatives that we are discussing here.

Survey-Report: In our survey, we asked people whether the limitations in theoretical science education areas of Bangladesh are one of the biggest reasons why Bangladesh University fails to come up with important innovations. Here, 81% of the responses agreed with the necessity while 19% disagreed.

The Yellow Hat: The benefits that Bangladesh will witness if Theoretical Science Education facilities are provided

Let's have an optimistic view on our topic. We are going to have a direct look at what the people (mostly the survey respondents) think of all the facilities we have been talking about:

- Emphasizing the research field, one survey *respondent* said, "Basically a large amount of research is needed for the development of a country, and to get an effective outcome in research fields one needs to study pure science subjects like Theoretical Physics, Mathematics, and Chemistry."
- Another irrational opinion that we received: "As per my opinion, theoretical science education is the precondition of the practical invention. If we want to explore and hereby want to develop science, precisely want to use science for the sake of humanity; first, we need theoretical science knowledge and only then we can move to the practical use of it."
- Our last comment, "Theoretical science is the science which leads to the creation of theories, though it may sound utopian for Bengalis. The European renaissance had occurred by dint of theoretical sciences, hence when our students or people are capable of developing new theories, they can also contribute to the creation of better technologies."

The Black Hat: Drawbacks that Bangladesh might witness if Theoretical Science Education facilities are provided

We have, after a long time, moved to one of the most important hats. Some points arise:

- According to UCG, "Many people were not interested in conducting research in the country in the previous years but preferred to go abroad to do the job." [UCG 46th Report-2021] Students well-studied in theoretical science subjects may leave the country, too, due to the lack of proper jobs. Ultimately, the tendency may cause no benefit to the country.
- Every year, 61% of the students from public universities rush into the competitive examination of Government jobs like BCS (Bangladesh Civil Service), Banks, Jobs at Secretariat, Military Services and all of which do not provide any opportunity to pursue a career on what they have learned during receiving higher education. The tradition has created fierce competition among the graduates and often brings failure of a large number of graduates.

Survey Report: In our surveys, when students were told if they are provided with the opportunity to study theoretical subjects like Astronomy or Nuclear Science, only 57.1% agreed to receive the opportunity. Interestingly, when they were asked the same question again, but with the assurance of their jobs, 97% of students were happy to study the above-mentioned majors. That means the students are interested in studying theoretical-based subjects. but bitterly, the only main barrier that works between them is the lack of job opportunities.

Figure: Two results presenting two different circumstances on the question where the responders were asked whether they would study Theoretical Science Education or not. The first figure presents theoretical science education without job assurance while the second one represents the answers when job opportunities were assured

The Red Hat: Is it really possible for Bangladesh to ensure Theoretical Science Education in Bangladesh?

In this research paper, we have already talked about the issues that may stand as obstacles to the possibilities of achieving an enriched Theoretical Science Education facility. In this section, we will throw some constructive views on whether the aforementioned barriers can really hamper the journey toward enriching Theoretical Science Education facilities in Bangladesh.

As we have repeatedly addressed the lack of affordability or financial constraints for fulfilling this project, now we can discuss these issues thoroughly. As the public universities are the only place for most of the Bangladeshi students aspiring for Higher Education, regardless of their parent's eligibility, we shall consider the Government's initiative as one of the most feasible ways for making this project true. Here we will be looking at how much of the budget is being fixed for the overall expenditure of the public universities of Bangladesh. According to a report in 'The Daily Star', the UGC approved a budget of 1067 million USD for 49 public universities in the country for the 21-22 fiscal year. Of the amount aforementioned, the size of the revenue budget is Tk 5,875 crore and the development budget is Tk 4,157 crore according to UCG. In 2021, UGC approved Tk 8,485 crore budget for public universities. [14] From the amount mentioned above, 'The University of Dhaka' received the highest allocation and 'Habiganj Agriculture University' received the lowest this year. If the News is analyzed, the positive side is that the amount of the budget is increasing every year. Now, if the government doesn't increase the allocation in the next year, instead, if the government allocates an increased budget for Theoretical Science Education, starting up with a new set of Theoretical Science departments at the top tier Universities of Bangladesh is never going to obstructed by financial constraint or lack of affordability.

Although teachers and students at universities have always complained about a research environment and financial inadequacy, almost the entire amount of allocation by the government every year remains almost unspent. In the 2019-2020 fiscal year, placing priority on the research sector, the government allocated funds for public university teachers for purposes of research in science and technology, arts and humanities, social sciences, business studies and science and technology. Prof HM Jahirul Haque, Vice-Chancellor of 'The University of Liberal Arts Bangladesh' said: "We always aim at ensuring research-based education and producing skilled human resources to take part in the Fourth Industrial Revolution. [15]

But the picture is harsh yet. If we think practically, we can count the lack of job opportunities as a long-lasting problem in this country. If Job opportunities can be created by expanding the slightest of possibilities,

Bangladesh can go ahead with the dream of achieving an enriched Theoretical Science Facility

The Green Hat: Ways to get started with Theoretical Science Education

Some other points regarding how to introduce this new arena to the infrastructure of developing Bangladesh:

- Bangladesh Government's Education Ministry may appoint an ambassador to represent Bangladesh in different renowned foreign universities and negotiate resource exchange with those.
- Bangladesh may negotiate on Faculty Exchange programs with the world universities for getting qualified teachers of theoretical science education until Bangladesh produces undergraduate students who are eligible to teach the subjects like Quantum Physics.
- For subjects like Astrophysics and Astronomy, Bangladesh may reach out to developed countries for important equipment like telescopes for now. Even the neighboring country India has been doing several research on astronomy, if India shows generosity, Bangladesh can propose for assistance from India as well.
- The nuclear power plant of Bangladesh is under construction. The Bangladesh Government may use a specific Zone in this place for research purposes so that students studying Nuclear Science may get precious chances for research.

The Blue Hat: Concluding Remarks

- The project is going to take time to get started in full swing.
- Bangladesh is less likely to afford the entire project without asking for support from other countries for resources.
- Without ensuring job opportunities, the possibility of achieving an enriched theoretical science education facility is negligible.
- As Lab equipment is going to be one of the most crucial and necessary resources in Theoretical Science Majors, Bangladesh will have to ensure it from the very beginning.
- Provided that the quality of the project is not ensured, the tendency of going to foreign Universities for Higher Studies but not coming back will always remain the same as today.

V. CONCLUSION

According to the research findings, it is understandable that theoretical science Education in Bangladesh is hindered mostly because of financial constraints mostly among other issues. The surveys that we have conducted have found a positive response among the majority of the responders on whether Bangladesh should proceed on this path. Through surveys, we can confidently come to the decision that Theoretical Science Education facilities will be widely accepted among Bangladeshi students.

Now, it comes to the question of how much Bangladesh can afford. Even though it is going to be quite tough for Bangladesh to start this project to a large extent, it is time for the country to enrich its theoretical science education as much as it can afford. However, the budget for Higher Education in Bangladesh must specify a significant amount of budget for this purpose. Else, the project may progress but will never succeed.

Even though a huge budget is allocated every year for education purposes, it has been claimed that the money is never spent properly due to corruption. As our findings show that it is a major obstacle in the path of this goal, therefore, the government must revisit the entire budget allocated for Higher Education and sort out the loopholes.

This is certain that Bangladesh will have to enroll in an enriched Theoretical Science Education facility if it really wants to prosper and succeed 'Vision 2041: A digital Bangladesh'. The earlier it happens, the better the outcomes will be.

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Survey Links

1. Survey 1. <https://forms.gle/GKb7Cu8ivkBHegED9>
2. Survey 2. < https://forms.gle/u3LQgdz3JFRWxHXE7>

Websites and Documents

- The Six Thinking Hats: < https://www.mindtools.com/pages/article/newTED_07.htm>
- UCG annual report <http://ugc.portal.gov.bd/sites/default/files/files/ugc.portal.gov.bd/annual_reports/0b944cc5_aa77_44b7_b1db_cc1a20e0eb37/2021-09-08-06-49-e0bf991565e624555d9915b54629624d.pdf>
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