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2014

# Role of Education in Reducing Environmental Pollution in Bangladesh

Uddin, Mirza Md. Moyen

University of Rajshahi

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# **Role of Education in Reducing Environmental Pollution in Bangladesh**



**Mirza Md. Moyen Uddin**

B.S.S (Honors) in Economics, M.S.S in Economics

A Thesis Submitted

To

**Institute of Education and Research (I.E.R)**

**University of Rajshahi**

For the degree of

**Master of Philosophy**

in

Economics

**April 2014**

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**A Thesis of Master of Philosophy**

**Researcher**

**Mirza Md. Moyen Uddin**

M Phil Fellow

Roll No: 02

Registration No: 2019

Session: 2011-12

**Supervisor**

**Dr. Md. Abdul Wadud, Ph. D. (Newcastle, U.K.)**

Professor

Department of Economics

University of Rajshahi, Bangladesh

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**University of Rajshahi, Bangladesh**

**April 2014**

**Dedicated**

*To*

**The Memory of my Respected and Beloved**

*Mother Rabeya Khatun and Father Mirza Md. Chan Miah*

**Who opened my eyes to the Bounties of Nature**

## DECLARATION

I do hereby declare that the thesis entitled “**Role of Education in Reducing Environmental Pollution in Bangladesh**” is prepared by myself. This thesis is an original work done under supervision of Professor Dr. Abdul Wadud, Department of Economics, University of Rajshahi. The study is designed to explore the environmental pollution awareness of the students of secondary level formal education, existing pollution management system and causality between education and environmental pollution in Bangladesh.

I humbly submit this thesis to the University of Rajshahi, Bangladesh for evaluation of an M. Phil. degree. The contents of this thesis or part of it were not submitted to any other institutions for achieving any other academic degree.



(Mirza Md. Moyen Uddin)

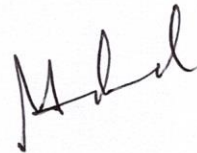
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University of Rajshahi, Bangladesh

## CERTIFICATION

This is my proud privilege to certify that the thesis entitled “**Role of Education in Reducing Environmental Pollution in Bangladesh**” is an original research work prepared by Mirza Md. Moyen Uddin, Assistant Professor (Economics), Government College, Directorate of Secondary and Higher Education (DSHE), Ministry of Education, under my direct supervision. Mr. Mirza Md. Moyen Uddin has successfully completed one year course works during the session 2011-2012 and carried out his field works meticulously. This thesis is a comprehensive presentation of the investigation he made about the Role of Education in Reducing Environmental Pollution in Bangladesh.

To the best of my knowledge this thesis or part thereof has not been submitted for the award of any other academic degree, diploma or associate-ship of any other similar title to any other university or institution.

Mr. Mirza Md. Moyen Uddin has made distinct contribution to the field of Education and Research. Therefore, I am forwarding this thesis to be examined for the degree of Master of Philosophy to the Institute of Education and Research (I.E.R), University of Rajshahi, Bangladesh.



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**April 2014**



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**Mirza Md. Moyen Uddin**

## ABSTRACT

Bangladesh is recognized to be the worst sufferer by natural catastrophes for its geographical location. Its population density is very high. Literacy rate of the people is also very low. So consciousness regarding environmental preservation is not strong. But education is a vital factor related to human life. It is regarded as the fundamental tool for achieving harmonious development of body and soul. Significant and sustainable development is also impossible without education. In this respect government policies, awareness of the people, find causal relationship among education, environmental pollution and economic growth is important. In this thesis, the data from primary survey and secondary sources are used to show the impact of education in reducing environmental pollution. Primary sources of data are collected from 280 respondents of Dhaka and Rajshahi divisions of Bangladesh purposively through questionnaire and interview during March to June 2013. On the other hand, for finding the short and long run causal relationship among education (literacy rate), environmental pollution ( $CO_2$  emissions) and economic growth (GDP) in Bangladesh, the annual time series data from 1974 to 2010 are used. The econometric methodologies; unit root test, cointegration and Granger Causality test and Error correction modeling (ECM) approach are applied.

Among 280 respondents, 220 are students, 50 are teachers and 10 are intellectuals. We involve these three groups of respondents to get about their knowledge, attitude, practice and policies. The findings of primary survey on environmental knowledge, attitude and practice reveal that the most of cases they have the positive and expected trend of awareness of the respondents regarding environmental pollution. But in several cases they have the misconception.

The Augmented Dickey-Fuller (ADF) and the Phillips-Perron test are used to check the unit root problems of the secondary data. Results from Augmented Dickey-Fuller (ADF) test show that the variables  $CO_2$  emissions, literacy rate, GDP in education, industry and transport share in GDP are non stationary in level form but they are found to be stationary in first difference form, indicating that they are integrated of order one. Cointegration tests

used to show the long run equilibrium relationship among the variables. Both the Maximum Eigen value and Trace Statistics show that there is one cointegration relation at the 0.05 level of significance among education, environmental pollution and economic growth. ECM results show that there is unidirectional causality between education share in GDP and literacy rate i.e. more education share in GDP intensify literacy rate and increase in literacy rate creates awareness among the people that reduces environmental pollution.

As the long run relationship among education, environmental pollution and economic growth is found, more spending on education help create awareness among people. The implication of the result is that education as an independent variable stimulates for reducing emissions, i.e., environmental pollution in short and in the long run.

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# Chapter 1: Introduction and Background Information

## 1.1 Introduction

The constitution of Bangladesh asserts that 'it shall be a fundamental responsibility of the state to attain, through planned economic growth, a constant increase of productive forces and steady improvement in the material and cultural standard of living of the people'(Article-15). In pursuit of this goal of prosperity of the people through planned development, the individual and the society come to interact with the environment and have to take care of it, least not to speak of global warming, excessive use of natural resources like land, water and forest turn this land into a dust bowl with individuals scratching a living like a scrawny hen' (Fifth-Five year plan, 1997-2002; GOB).

Bangladesh suffers from frequencies of hazards arising from drought, flood and other natural calamities for its geographical location. The surface water of the country is being polluted through capricious disposal of untreated industrial effluents and municipal waste water, runoff pollution from chemical fertilizers and pesticides and oil and lubes spillage in the coastal area from the operation of sea and river ports and ship wreckages. High level arsenic contamination in ground water is also a national problem. Air pollution is one of manmade environmental disasters that is creating environmental hazard all over the world. There are two major sources of air pollution in Bangladesh namely, vehicular emissions and industrial emissions, which are mainly concentrated in the urban areas. There are also numerous brick-making kilns working in dry season all over Bangladesh. These kilns are another vital source of air pollution. An emerging issue of great concern in the cities and towns is the high concentration of lead in the air from vehicular exhausts. The high level of concentration of lead is very harmful for human health especially for child health. The quality of soil has deteriorated due to reckless use of agrochemicals, unplanned use of land, undesirable encroachment on forest areas for agriculture and settlements and indiscriminate disposal of hazardous industrial wastes. The depletion of biodiversity is the result of various kinds of human interventions that impinge on it through destruction and degradation of land, forest and aquatic habitats. These activities encompass the sectors of agriculture, forestry, fisheries, urbanization, industry, transport, tourism, energy, chemicals, and minerals (GOB, 2010).

The environmental condition of the Bangladesh is deteriorating at an alarming rate due to changes in human activities triggered by inappropriate economic activities and rapidly changing demographics and socio-economic patterns. The problems are the outcome of dynamic interaction of poverty, population growth and its changing distribution and the misuse of resources, wasteful production and human greed. Paradoxically, underdevelopment as well as haphazard development processes are also responsible for its precarious situation (Chowdhury, 2004). Environmental literacy is the main target of environmental education and it is constituted from understanding, ability, attitude and patterns and developing continuous attitudes between human and environment both for short and long term (Teksoz, 2010). In this respect associative effect among education, environmental pollution and economic growth is also significant.

Man is the main offender in polluting these natural resources to the point of no return. The ecological state of biosphere is becoming more and more misbalanced day by day due to man's technical and industrial achievements, as well as population explosion. Vast changes are taking place in the environment due to interaction between human society and environment itself. Man is exploiting the natural resources for its own interest and many such instances are there as clearly indicate that man has disturbed the natural balance for the sake of small benefits and has changed the environment of many places to such an extent that they are not fit for inhabitation by living beings (Rahman, 2008).

In Bangladesh, environmental education is a recent phenomenon particularly in the formal higher education sector where few universities teach environmental studies. Recently popular environmental movements have heightened awareness of environmental issues as well as the need for education and skilled environmental management in Bangladesh (Salequzzaman and Davis, 2003).

## **1.2 Rationale of the Study**

Bangladesh is confronted with a host of environmental issues and problems, for example, pollution, deforestation, salinity, urbanization, global warming and climate change, and so on (GOB, 2010). To face these challenges it is important to acquaint our younger generation with appropriate knowledge, skills and attitudes relating to environment,

because this generation will affect and be affected by the environment management policy undertaken today (Sarkar, 2011). Significant program of environmental education and development of local expertise are needed for massive changes in behavior with respect to the environment. The formal education system provides a ready framework for reaching a large part of the existing population and can help make future generations conscious of the importance of environmental conservation. Students are receptive and curious, making them appealing to motivate. Practical approaches that involve the students in solving local environmental problems have more influence, develop skills and give reinforcement to the idea that people can make a difference. Most Asian countries have made efforts to introduce environmental education into primary, secondary and tertiary levels with varying success due to lack of appropriate Environmental Education (EE) policies, inadequate equipment facilities and low under staff teaching systems. Pedagogical approaches have included making separate environmental studies and management courses, incorporating environmental education into existing curricula at primary and secondary levels and using a combination of both approaches (Salequzzaman and Davis). But one of the EE problems in the formal education system is the lack of supplementary reading materials for the pupils as well as of appropriate audio-visual aids to teaching. The existing curriculum is book knowledge-based and examination oriented. There is a lack of vertical and horizontal integration of curriculum components. School children do not have the opportunity to develop skills to analyze and evaluate local or national environmental problems or issues. It is very often E.E is not a priority especially when the curriculum is overcrowded, even many teachers, students and parents do not perceive it as a priority in the curriculum (Chowdhury, 2004).

It is accepted that environmental quality management is an important stage of development. Improvement of environmental quality by education is critically important for the sake of human health as well as for the economic growth. It is estimated that the economic loss of Bangladesh particularly from air pollution related premature mortality fall in the range of \$64--\$568 million and cost of sickness related to air pollution falls between \$120--\$240 million. Of total health costs premature mortality represents particularly from air pollution approximately 60% of the total value, and morbidity represents 40%. The combined total economic cost is between \$200--\$800 million (The

Daily Star, Dhaka, August 23, 2011). At present the two most important environmental factors affecting the health of the urban poor are the inaccessibility of clean water and the lack of sanitation. Majority in developing countries, it is estimated that 1 billion people worldwide have no access to clean water and additional 1 billion live in areas with chronic water shortages; 1.7 billion have no access to sanitation. Between 1970 and 1988, the number of urban households in the developing world without adequate sanitation rose by 247% and those without safe water increased by 56%. In 1995, at least 25% of urban communities and 58% of rural ones were without clean water for sanitation needs (Todaro and Smith, 2001). Because there are no alternative sources, many of the poor collect drinking water from rivers, streams and canals that are polluted with human excreta and chemicals. Raw sewage runs in the streets, mixing with garbage and contributing to the spread of diseases. This is reflected in the fact that death rates in urban shanties are occasionally higher than in rural areas. The World Bank's recent Country Environmental Analysis (CEA) estimates that environmental factors account for as much as 22% of the national burden of diseases, particularly in the form of respiratory infections from indoor and urban air pollution and diarrheal diseases. High use of chemical fertilizers in agriculture and release of untreated effluents in to the open water bodies by a growing number of industries are also responsible in this regard. In addition, food safety of the country is challenged due to poorly regulated environment, production and processing, lack of sanitation shortage facilities etc. The CEA argues that achievable goals for reduced exposure to environmental health risks could result in economic savings equivalent to as much as 3.5% of Bangladesh GDP (GOB, 2011).

Bangladesh is one of the most vulnerable country due to negative climate change. If the sea level rises for the negative climate change, then one third portion of Bangladesh will be submerged by sea water and salinity problem will be a great problem for agricultural production. Already 830,000 hectare cultivable land of south-western part of Bangladesh has become unable to cultivate due to salinity problem. Information is that the average temperature of the world may increase 1.1-6.4°C by 2100 and the sea level may increase up to 34 c.m by 2080. In this circumstances many countries like Bangladesh will totally submersed by sea water (Tapon et al., 2012). Recently environmental pollution has attracted the attention of mass people. Government has enacted some rules and regulations in this regard. Limited number of project is being implemented with a view

to improve the environmental quality. In spite of this, environmental quality in these areas is deteriorating. Environmental education (EE) quality management demands well equipped institutions with efficient and honest manpower, well-guided programs, proper laws and regulations with strict enforcement, coordination among the concerned authorities, public-private partnership and above all mass awareness. Thus it needs comprehensive and systematic study about environmental pollution control system of Bangladesh. This study attempts to identify the knowledge of secondary students environmental awareness and their role related to environmental pollution control with a view to prepare environmental quality management plan which will be compatible with socio-economic condition of Bangladesh. Actually education is the best way to create awareness among people about environmental pollution. Without creating awareness pollution cannot be reduced. As no such comprehensive study has been made in Bangladesh, thus this study provides the opportunity to know the overall environmental pollution education (EPE) management system at secondary level formal education.

### **1.3 Research Questions**

Bangladesh is recognized to be the worst sufferer from the impact of global warming and climate change and this climate change is posing a great threat by creating environmental imbalances which impede the process of accelerating development (GOB, 2010). In this situation formal education system provides a ready framework for reaching a large part of the existing pollution and can help make future generations conscious of the importance of environmental conservation (Salequzzaman and Davis, 2003). Thus this study sets the followings as its research questions:

- i) What are the knowledge, attitude and practice about environmental pollution of the students at secondary level formal education in Bangladesh?
- ii) What are the policies that are needed to address the environmental pollution by the government at secondary level formal education curriculum?
- iii) What types of causality do exist among education, environmental pollution and economic growth in Bangladesh?
- iv) How the best is to curb the environmental pollution and gain expected sustainable development?

#### **1.4 General Objective of the Study**

The general objective of the study is to find the role of formal education in reducing environmental pollution in Bangladesh.

#### **1.5 Specific Objectives of the Study**

The specific objectives of the study are as follows:

- i) To study the knowledge, attitude and practice about environmental pollution at secondary level formal education students in Bangladesh.
- ii) To study the policies that are needed to address the environmental pollution by the government at secondary level formal education curriculum.
- iii) To identify the causality among education, environmental pollution and economic growth in Bangladesh.
- iv) To identify the ways to curb the environmental pollution and gain expected sustainable development.

#### **1.6 Definition of the Key Terms**

##### **Education**

Education, in its broadest sense, is the most crucial input for empowering people with skills as well as knowledge and for providing them access to productive employment in future. Education is not only accepted as to enhance efficiency but also to augment the overall quality of life. Education acts as engine of growth for economic and social development of a nation (GOB, 2011).

Education is the complete development of individuality of the child so that he can make an original contribution to human life according to the best of his capacity (Nunn, 1976)

Education is the process of living through a continuous reconstruction of experience. It is the development of all those capabilities in the individual which will enable him to control his environment and fulfill his possibilities (John Dewey, 1902)



Education refers to the systemic process of achieving literal and intellectual knowledge. It is an academic procedure through which a child can achieve harmonious development of his mind and soul. It requires institutional service for social and psychological development of a child (Sharma, 1996)

Education is the deliberate and systematic influence exerted by the mature person upon the immature, through instruction, discipline and harmonious development of physical, intellectual, aesthetic, social and spiritual powers of human being according to the individual and social needs and directed towards the union of the educand with the creator as the final end (Redden, 1955).

### **Environmental Education**

Environmental education (EE) is a learning process that increases people's knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action. The concept of "sustainable development" as presented by the Brundtland Commission, that "humanity meets its needs of the present without compromising the ability of future generations to meet their own needs", is akin to some oriental or endogenous philosophy. Environmental education that is interwoven with "education in sustainable development" includes awareness raising and is critical for achieving sustainable development. It should therefore "be provided for all ages, at all levels" (UNESCO, 1977). Environmental education should not be confined to the narrow scope of school education – it should reach a wider public in order to effectively address environment issues. In other words, environmental education should be understood not only in the aspect of formal education, but also in that of non-formal and informal settings. It is "the process of helping people, through formal and non-formal/informal education, to acquire understanding, skills and values that enable them to participate as active and informed citizens in the development of an ecologically sustainable and socially just society" (ASEAN Secretariat, 2001). Environmental education (EE) refers to organized efforts to teach about how natural environments function and, particularly, how human beings can manage their behavior and ecosystems in order to live sustainably. The term is often used to imply education within the school system, from primary to post-secondary.

## **Environmental Pollution**

'Environmental pollution is the unfavorable alterations of our surrounding, completely or largely as byproducts of man's action through direct and indirect effects of changes in energy patterns, radiation levels, chemical and physical constitutions and abundance of organisms' (EPP,U.S)

Environmental pollution is the contamination of air, water and soil by discharging harmful substances. Major areas of environmental pollutions identified as air, water and soil. The air pollution is the accumulation of substances in the atmosphere that insufficient concentrations of different gases and endanger human health. In Bangladesh, the major sources of air pollution are emissions of transport, agricultural chemical, solid wastes, and industrial effluents. The pollutions of brick industry on the neighboring cultivation plot and waste dust pollutes air and water sources and environment of the locality. Water pollution is the introduction into fresh waters of chemical, physical, or biological materials. This degrades the quality of the water and affects the living beings. This process ranges from simple addition of dissolved or suspended solids to discharge of the most insidious and persistent toxic pollutants such as pesticides, heavy metals, and bio-accumulative, chemical compounds. Industrial effluents, the water discharged from after having been used in production processes and this waste water may contain acids, alkalis, salts, poisons, oils and in some cases harmful bacteria, mixing up with fresh water and contaminating this valuable element. Besides agricultural pesticides, fertilizers and herbicides that wash into rivers and degrading the quality of water. Sewage disposal and domestic wastes are often allowed to pollute water. Soil pollution is the deterioration of the Earth's surface through misuse of the soil by poor agricultural practices, mineral exploitation, industrial waste dumping, and indiscriminate disposal of urban wastes that reduce the quality of food products. It includes visible waste and litter as well as pollution of the soil itself such as chemicals in herbicides and pesticides or poisons which kill insects and other invertebrate pests. Litter that dumped in public places like streets, parks, bus stops and near shops poses a serious threat to public health (Dix, 1989). Noise pollution means when sound becomes loud or disagreeable, results in physiological or psychological harm and damaging human hearing and causes heart diseases is called noise pollution. In the present discussion researcher discussed about four major elements of environment that is air, water, soil and

noise; their various sources of pollution, consequences and how we can reduce this kind of pollution for sustainable improvement of environment.

### **1.7 Scope and Limitations of the Study**

The study provides a greater scope to identify the bottlenecks of existing management of environmental pollution at secondary level formal education through their education curriculum.

- As no such comprehensive study has been made in Bangladesh, thus this study has provided the opportunity to know the overall environmental pollution education (EPE) management system at secondary level formal education.
- The study provides a scope to prepare an effective management system with a view to sustainable improvement of environmental education quality
- For the limitation of time and lack of budget the study focuses only on secondary level education curriculum about environmental pollution.

## 1.8 Organization of the Thesis

The rest of the thesis is organized as follows:

In Chapter 2, the reviews of the literatures are described, so that the study has the idea about the related research issue.

In Chapter 3, the research design or methodology has been discussed regarding study area, population, sample technique and selection of respondents, type, sources and method of data collection, data processing and analysis procedure, reliability and validity of data and overall research framework.

In Chapter 4, conceptual analysis regarding environmental education at secondary level, education and environmental pollution reference for Singapore, education and sustainable development, environment and sustainable development, nexus between environmental pollution and poverty has been discussed.

In chapter 5, theoretical issues have been discussed related to explanation of the variables of air, water, soil and noise pollution, greenhouse effect, global warming and ozone layer depletion.

Chapter 6 shows data description of primary survey and secondary data. These are presented using various Tables and Charts.

Chapter 7 discusses empirical econometric methodologies to evaluate the relationship among education, environmental pollution and sustainable economic growth considering the short run and long run equilibrium of the variables.

In Chapter 8, the results of the primary survey and secondary data have been discussed with the help of various Tables and Graphs and econometric methodologies.

Eventually, Chapter 9 gives the policies and probable recommendations of the allied issue.

## Chapter 2: Review of Literature

### 2.1 Introduction

The central premise of this study is to analyze the increasing educational attainments of the population that can help to increase the awareness regarding environmental pollution. In this chapter we have discussed several studies regarding the link between environmental knowledge and practices, environmental policies and enforcement, environmental education and pollution and causality between environmental pollution and economic growth. The literatures are reviewed from various articles, journals, books and empirical study on developed and developing countries and we have tried to find out the research gap. In this respect, especially studies on Bangladesh are given more emphasized.

### 2.2 Literature Reviews

Only after reviewing the related literature, a researcher can answer the question of what information is already available and what the knowledge gap is. In research project, literature review serves as a road map or travel map for research journey. For this we studied a number of research works on supporting the relationship among environmental pollution, education and expected sustainable development. The main aim of this chapter is to review of the results of some of the previous studies that are related to the present research work. Some of the pertinent literature is reviewed below.

#### 2.2.1 Environmental Knowledge and Practices

Apntaku (2005) attempted to investigate the influence of the level of awareness and the use of environmental education information obtained from public extension education program on environmental sanitation and disposal practices by residents of Abeokuta South Local Governmental Area. A total of 450 residents were interviewed. Results indicated that majority of residents disposed wastes improperly, making the town a bit dirty. The level of awareness and the use of environmental education information obtained through extension education are low. Radio and TV were the commonest sources of environmental education information. Resident's level of income and years of

formal education acquired had significant relationship with their waste disposal and environmental sanitation practices. Wastes were disposing improperly because of inability to afford outdoor refuse drums (bins), fees charged by private environmental sanitation agencies and for location of refuse disposal houses. Author recommended that intensification of public extension education programs on environmental sanitation, stricter enforcement of environmental sanitation laws, building more refuse disposal houses and provision of outdoor refuse bins should be placed in strategic places by the government and the large bins should be cleared by government agencies free of charge.

John and Mamatha (2010) stated that, environment pollution is the result of urban industrial technological revolution, and speedy exploitation of every bit of the natural resources. Such activities by man have created adverse effects on all living organisms in the biosphere. Rapid industrialization has left us with polluted rivers, contaminated soil, depleted wildlife and exhausted natural resources. They mentioned that pollution is the introduction of contaminants into an environment that causes instability, harm or discomfort to the ecosystem, i.e., physical systems or living organisms. The objectives of the study are to assess the adolescents' knowledge, attitude and practice on environmental pollution; ascertain influence of intervention strategies on adolescents regarding environmental pollution; and to appraise the influence of Environment Education in promoting awareness of environmental pollution among adolescents. It is hypothesized that the interventional strategies will have a positive influence on the awareness of environmental pollution among adolescents; and Environmental Education is effective in prevention of environmental pollution. They conclude that the natural resources must be conserved to prevent further deterioration of the environment. Environment pollution is one of the most compelling ecological crisis to which we are subjected to today, with far reaching consequences; hence awareness on environmental pollution and its remedial measures has gained paramount importance in today's milieu.

Mohapatra and Bhadauria (2009) mentioned that to explore the secondary students' (class X) understanding of an environmental problem about causes, consequences and remedies of water pollution was determined using a closed form of questionnaire that was designed containing 32 questions in the form of statements distributed in three sections. Many of the Indian students in the study were unaware of the devastating effect of deforestation, chemical fertilizers employed in agricultural fields, offshore mining,

smoke, volcanic eruptions, weathering of soil and rocks on pollution of water and its impact on humans, viz., blindness, DNA damage, deformities of bones etc. Prevalent alternative conceptions and misconceptions were sewage, pesticides, soil erosions do not pollute water; water pollution causes acid rain; radioactive waste dumped in oceans and greenhouse effect could minimize water pollution. They also states that rapid increase in the world population within last 30-35 years, improvement in industry and technology, natural resources started to extinct have let environmental problems to come to the agenda. Circulation of matter in cells, tissues, system and organism, chemical reactions, sustainability and consistency of the structure are ensured with water. Water is so significant from this point. But now a day the water resources are becoming polluted at a very high scale and producing alarming effects on human too.

Negev et al. (2010) included both multiple choice and open questions among twelfth grade students describing the qualitative analysis of the answers to an open question regarding a local environmental Problem. The grounded theory enabled for a categorization, which emerged from the data, resulting in 12 problem categories, 6 cause categories, and 11 solution categories. Most participants specified solid waste, open spaces or air pollution as the main issues. The perceived solutions were generally at the governmental level, including planning, infrastructure, legislation, and enforcement. The authors described relations in these responses between the problems, their causes and solutions, and between the quality of these answers and the general environmental literacy of the participants. The authors finished with a discussion of the special contributions and potential of open-ended questions for environmental education research. This pressures the importance of including local environmental issues in the curriculum in the Israeli education system.

Thang and Kumarasamy (2006) mentioned that in the Malaysian education systems, from the primary to secondary levels, students are introduced to environmental issues through a range of core subjects. According to authors the purpose of this study is to investigate students' perception of environment topics in the English language syllabus. Students learn more, as through sharing responsibility for creating their classroom environment they become more skilful learners. Teachers also get a chance to better understand their students as well as adapt their teaching to specific groups of students. They stated that, United Nations' Belgrade Charter lists awareness, knowledge, attitude,

skills, evaluative ability and participation as the six objectives for environmental education. Findings of the study show that through the use of environment content in the English class, students have a positive attitude towards the environment and have gained content knowledge about the environment. When students practice speaking, listening, reading and writing about the environment they would then be using English creatively, purposefully and functionally as advocated in CLT, as well as enhancing their participation in environmental education. However, the higher the proficiency level the more positive is students' attitude towards the environment. In addition, students seem to be of the opinion that they gain more content knowledge than English language skills from studying the environmental topics.

Bangladesh State of Environment (2001) stated that the exposure to air pollution is the main environmental threat to human health in many towns and cities. Particulate emission is mainly responsible for increased death rate and respiratory problems for the urban population. This problem is acute in Dhaka being the capital of the country and also the hub of commercial activity. The other urban areas i.e. Chittagong, Khulna, Bogra, Sirajgonj and Rajshahi have much lesser health problem related to urban air pollution. The principal sources of emission in the rural areas are from brick kilns, and from cooking stoves. In rural areas, wood, coal, and bio-mass are used as sources of energy. Thus, it is likely that in rural areas the principal air contaminants are particulate matter and volatile organic compounds (VOCs). There are numerous brick-making kilns used seasonally (in dry season) all over Bangladesh. Almost all of these kilns use coal and wood as their source of energy resulting in the emission of particulate matter, oxides of sulfur, and volatile organic compounds. In addition to these usual sources of fuel, spent or used rubber wheels of vehicles are also burnt, which emit black carbon and toxic gases. These are hazardous for health. In the urban areas ambient air quality is dependent on many factors like air movement, traffic volume, congestion, emissions from motor vehicles, and resuspended dust particles. Various other activities related to the extremely high population density also result in severe air and other forms of pollution. The salient parameters of air pollution are suspended particles, sulfur oxides, nitrogen oxides, hydrocarbons, carbon monoxide, lead, ozone and other gases. Aircrafts, railway engines, power plants, open burning incineration, solid waste disposal sites, and dust particles also contribute to air pollution. Dust pollution due to road diggings, constructions and



other development activities further aggravate the air pollution situation in cities. It is observed that the brick making kilns, of which the majority are of the conventional type, use coal and wood as their source of energy. This is mainly due to the non availability of natural gas in most parts of Bangladesh. The air pollution from these kilns is not only due to the type of fuel used, but also due to the thermal inefficiencies of the conventional kilns. This causes emissions like SO<sub>x</sub>, CO, particulate matters, and volatile organic compounds that deteriorate air quality. Another significant factor is that brick kilns are usually clustered near big cities in various parts of Bangladesh. Therefore, the parts of the city in the immediate vicinity of the clustered brick-fields have serious air pollution problems.

Parveen and Nakagoshi (2001) stated that the progress towards the food self sufficiency in Bangladesh on the contrary increased to the environmental degradation due to the intensive use of agrochemical and other modern technology. The use of pesticide has been increased to 400% per acre and its cost increased to 600% during the last couple of decades. Between 1985 and 1990 the sales of pesticide became double. At present, 84 pesticides active ingredients belonging to 242 trade names have been registered in Bangladesh. Out of the total pesticide use, over 80% are used in rice fields. The rapid increase of pesticide use is causing detrimental effect on environment and health of farm workers and consumers. Pesticides are contaminating ground and surface water, which is causing depletion of inland fishing resources and ecosystem. Some extremely hazardous pesticides are used in Bangladesh, although these are prohibited in the producing countries. Among the insecticides used by the Bangladeshi farmers, Bashudin 10 G, Diazinon 60 EC, Sumithion 60 EC and Padan 50 SP have already been banned for use on rice in Indonesia in 1986. But in Bangladesh, these are not restricted yet. Moreover, in Bangladesh the existing pesticide laws and regulations are not strictly enforced in relation to import, formulation, repackaging, distribution, advertising and use of pesticides. Therefore, obsolete pesticide like Bashudin are also still being using by the farmers and available in market even in low price compared to others. The environmental degradation linked to agriculture is the impact of toxicity from improper pesticide use. Here, the damage is less on agricultural productivity than the people who may be inadequately protected from the chemicals. The greatest threat of toxic exposure is from the used crop, which puts both producers and consumers at risk. The other type

of toxicity-related damage is from pesticide run-off, and especially from pesticide residues in ground water. Therefore, modifications in regulations concerning pesticide handling and application will minimize most pesticide-related environmental and health damage. They mentioned that, there is an urgent need to assess the impact of pesticides on human health and pollution level of pesticides in soil, water, and air in Bangladesh. The hazardous pesticide should be withdrawn from the market as early as possible. The provision of penalty for violating the regulations might be included in the registration terms and conditions. Along with strict regulation, the farmers, the end users should be educated to be perceived the probable impact of their practice towards the health and environment. The farmers should be provided with proper training and mass media campaign.

Parveen (2010) examined mainly the farmers' level of knowledge about environmental pollution due to unsafe use of pesticides in rice cultivation and the factors influencing it and explored suitable ways of reducing their uses. Results showed that the majority of the farmers knew the harmful impacts of pesticides on fish, insect resistance, health of human and animals, soil and beneficial species superficially. It was also found that formal schooling, training on pest management, information through television, more contact with extension personnel, credit facilities and awareness of farmers on integrated pest management (IPM) were the critical factors in order to improve rice farmers' understanding ecological hazards due to over use of pesticides. Most of the farmer suggested that application of correct doses of agro chemical, monitoring pests, timely removal of weeds and affected plants, creating awareness among farmers, improving technical knowledge of users and cultivation of pest tolerant varieties were necessary to reduce the quantity of pesticides in minimizing environmental hazards. According to author, this article concluded that there is an urgent need of increasing farmers' awareness and knowledge on ecological hazards and IPM through intensive training and on farm demonstration under the supervision of extension personnel along with credit facilities with a view to successful reduction of pesticides use. IPM should be combined with other strategies like soil fertility management. Strong commitment of extension agents to work with different categories of farmers efficiently and sympathetically is very necessary to mitigate looming problems related to sustainability in agriculture. In addition to strengthening farmers training on IPM, the vital roles of agricultural

institutions and local community and the potentials of traditional farming practices could reinforce to diminish risk of exposure to pesticides for continued quality rice production and improving livelihood security of farmers. The subject of environmental issue should be integrated in the academic curricula at all levels of educational institutions. Hence it is of urgent matter to undertake a complete set of multifaceted and comprehensive programme ensuring strong linkage among different stakeholders to deal with various environmental issue towards achieving sustainable crop production, food security, ecological balance and poverty alleviation in Bangladesh.

Morgan (2004) stated that an education and awareness program can be developed for various sectors of the community to raise awareness and provide a catalyst for a change in behaviour to reduce the amount of pollution. Education and awareness are the non-structural methods that can be used in an integrated approach to best practice for environmental pollution management. Author analyzed that, the Australian guidelines place primary importance on education and awareness. This is consistent with the principle that any attempt to incorporate sustainability into the community must also explicitly address education and awareness. Once they are aware and have learnt simple solutions to reduce or avoid causing water pollution, changes to their behavior are more likely. However, it has been found that in addition to education, it is important to have a supporting infrastructure and social structure close to people so that it is easy for them to comply with educational messages (e.g., providing adequate recycling stations). Author also mentioned that the development of an environmental education program that can be split into a nine-step process and these nine steps recognize that for the program to be effective, a thorough understanding of the environmental issues, stakeholders, behaviour targeted and the best way to achieve an improved environment is needed.

Sharmin (2003) mentioned that the environmental awareness of the students who have completed primary education both from the non-formal schools of BRAC and formal government schools. Students showed better awareness for safe water and safe sanitation practice compared to other environmental issues. It indicates that more current environmental problems like arsenic pollution of water, depletion of biodiversity in Bangladesh, and protective measures to resolve these problems should be included in the primary level curriculum. The students with primary education have better awareness about safe water, safe sanitation practice and importance of trees. Author found that the

students are poorly aware about environmental pollution (like air, water and soil pollution) and the problem of arsenic. Performance of the students of both the government as well as the non-formal primary school of BRAC is almost similar. The study findings also revealed that in addition to schoolbooks, media also provided a source of awareness raising. She also claimed to use the positive impact of mass media, it could be used more actively for raising awareness and the elderly people of the community could also play important role in awareness rising since a good number of respondents treat them as a source of knowledge beyond their school books.

### **2.2.2 Environmental Policies and Enforcement**

Kjellstrom et al. (2006) analyzed that the environmental pollution has many facets, and the resultant health risks include diseases in almost all organ systems. Thus, air and water pollution control links with diarrheal diseases, respiratory diseases in children and adults, cancers, neurological disorders, and cardiovascular disease, as well as with health care issues. According to author, the evidence shows that a number of chemicals that may be released into the air or water can cause adverse health effects. The associated burden of disease can be substantial, and investment in research on health effects and interventions in specific populations and exposure situations is important for the development of control strategies.

Alam (2011) stated a number of laws and policies that have helped Japan's environment and recycling issues. These laws have produced tremendous results in Japanese society. Through enforcement of these laws the country sends a decreasing amount its solid waste to landfills which has had intense problems during the high growth of economy. He also mentioned that to achieve sustainable development in the 21st century and to create a recycling-oriented economy, the Japanese Government enacted "Basic Law for Promoting the Creation of a Recycling-Oriented Society in 2000" This law focuses on three priorities for society (the 3 Rs): Reducing waste by using things as long as possible and not simply throwing them away and buying another; Reusing things rather than throwing them away after limited or minimal usage; Recycling anything that can possibly be used again in some form. The objectives of this law are: (i) reducing wastes; (ii) reusing end of life products and parts; (iii) recycling wastes as raw materials; (iv)

recovering heat; and (v) appropriate disposal as final waste. As a result, the final disposal amount of industrial waste has been decreasing. He again reported that the most significant lessons for Bangladesh from Japanese environmental practices are: (a) Appropriate waste disposal and recycling, (b) Encouragement of the use of recycled products and materials, (c) Assessment of products and packaging with regard to the "3Rs", (d) Establishment of waste management facilities, (e) Importance of environmental education, (f) Implementation of economic measures such Environmental Business, (g) Research and development. He concluded that Bangladesh government can emphasize the points: industrial pollution, law enforcement, and environmental education.

Ruppel (2011) analyzed that environmental journalism is a key to sustainable development in Namibia. Environmental degradation and the depletion of vital resources are examples of the kind of complex topics that need to be incorporated in both the agendas of politicians and the media. People are suffering and dying from lack of clean water and inadequate sanitation and the media should play a more prominent role in telling these stories. The media can influence the direction environmental policy and growth will take place. Author claimed that every development issue such as agriculture, industrial development, maternal and infant health, education, combating diseases such as HIV/AIDS, malaria etc., empowering women, eradicating poverty and hunger and ensuring environmental sustainability have a direct or indirect relation with the provision of water and sanitation within the households and communities across the country. Factors such as climate change, desertification, flooding and erosion are environmental issues in Namibia that need to be brought into the media scene with more vigor. He also stated that the media and the press should provide a more enabling environment for public debate. Environmental journalists raise awareness and highlight environmental issues that require specific attention.

Costantini and Martini (2006) mentioned that the sustainable development is strictly connected with basic needs of the individuals. According to them during last years a number of empirical studies have tried to discover and quantify the causal relations between economic growth and environmental consumption and degradation. They analyzed that the formulation of the role of institutions as an endogenous covariate allows understanding which factors indirectly affect sustainable development. It is worth

noting that initial conditions such as high levels of GDP per capita or health and education have positive effects in terms of institutional quality, and this result is useful to interpret the opposite effect of institutions for developed and developing countries. Within developing countries, especially those characterized by low development levels, the role of institutions is mainly directed towards the enhancement of basic needs and/or increasing economic performance, while environmental concerns are typically a luxury good. As well as income per capita and the development level raise, institutions are pressed by public opinion to include environmental protection in the policy agenda, therefore playing an active role to designate policy actions (and regulations) oriented towards sustainable development path. Finally, they wanted to underline that the positive role of technological transfer through FDI reinforces the recent position of United Nations expressed by the Millennium Development Goals (UN, 2000) when claiming for an international cooperation for promoting human and sustainable development at a global level.

Peng et al. (2011) analyzed that the government regulation influences environment pollutions while environment pollutions have no influence on government regulation in the short term. Besides, environment pollutions and public participation have no influence on each other. In the long term, there exists the Granger causality among public participation, government regulation and environment pollutions. Their results also show that improving the public participation's ability in environmental protection and strengthening government regulation's intensity are the basic measures to improve China's environmental pollution in the long run. They also concluded that this paper suggests three ways to solve China's environmental problems. First, the public as stakeholders must participate in policy making and environmental management, to make up for the government failure cases as government regulation was insufficient; Second, the government as regulator must undertake major responsibility of environmental management, weighting the environment as important as economic development; Finally, industrial enterprises as the main source of environmental pollution, should constantly conduct technology innovation, improving the industrial structure, transforming from pollution maker to environment operator.

Ali et al. (2006) reviewed on air pollution and chest diseases. According to them the ambient air pollution is now recognized as an important problem, both nationally and

worldwide. Their scientific understanding of the spectrum of health effects of air pollution has increased, and numerous studies are discovering important health effects from air pollution at levels once considered safe. Elderly, children and infants are among the most susceptible to many of the air pollutants. In addition to associations between air pollution and respiratory symptoms, asthma exacerbations, and asthma hospitalizations, recent studies have found links between air pollution and preterm birth, infant mortality, deficits in lung growth, and possibly, development of asthma. They mentioned that the environmental pollution comprises an important and challenging topic in respiratory medicine. Their diagnosis, treatment and most prominently their prevention have major public health implications. The present day environment crisis demands a change in public attitude to rescue the environment from destruction. Industrialized nations have a big share in the present day environment problems. In developing countries like Bangladesh, environmental protection is still a luxury and hard to afford. Some are finally becoming aware of the environment abuse, but a large part of population, foreign debts and unplanned industrialization have kept them off the environment conservation process. The situation may improve only when people realize that there are certain rules that they must go by to protect the environment. In Bangladesh, we should strictly abide by the "Environment Conservation Act 1995" and the "Environment Conservation Rules 1997". Side by side, awareness programs should be taken up by the Government and non-government organizations through mass media, especially Radio and Television. Concerted efforts like epidemiological and experimental studies should be organized involving multi-discipline peoples like Scientists, Doctors, Engineers, Lawyers and Journalists etc. Without control of environmental pollution, present situation will be worse in near future and will push the world towards a corner, making the proposition uncertain whether or not it will remain habitable for coming generations.

Afsah et al. (1996) analyzed that the factories in developing countries exhibit great variety in environmental performance despite the widely acknowledged weaknesses of the regulatory framework. Even in the poorest countries, some plants would satisfy emissions standards. Similarly, a great variety in environmental performance is observed in developed economies. These facts create a problem for conventional thinking about controlling industrial pollution. Given the weaknesses of the regulatory framework in developing countries, plants should treat the environment as a 'free' input and undertake

no effort to control emissions. On the other hand, factories in societies with stronger regulatory agencies should generally be in compliance with the standards. Since neither conclusion is consistent with the facts, they must question the premises and develop a new paradigm for understanding the performance of industrial polluters. Author's view of pollution control has been fundamentally changed by their collaboration with regulatory agencies in developing countries. To summarize, they mentioned that the conventional policy discussion is both too shallow and too narrow: too shallow, because it devotes inordinate attention to instrument choice while ignoring the preconditions for applying any instrument effectively; too narrow because it continues to focus on the State/Factory interaction as the sole determinant of environmental performance. In this paper, authors have argued for a less heroic approach to new regulatory programs, and a broader model which includes the Community and the Market as major players in the determination of factories' environmental performance. Finally, they have summarized their current thinking in five key principles for agency reform: Information intensity, orchestration, community power, structured learning, and adaptive instruments. Authors expected that these ideas may help promote a richer policy dialogue with their partner countries, better project opportunities and, ultimately, better pollution management.

Begum et al. (2010) stated that the air pollution particularly by transport mode has been identified as the major source of air pollution in Dhaka, the capital city of Bangladesh. Pollution standard in Dhaka has been exceeded comparing to the pollution standard decided for Dhaka by the USEPA (United States Environmental Protection Agency) and WHO (World Health Organization). According to author, the rapid growth of population along with unplanned land use development and inefficient traffic management system caused tremendous pressure on existing road network in Dhaka city. A number of short term measures have been undertaken that have improved air quality at certain level. Short-term measures can only improve temporary situations. Moreover the present state of air pollution and its impact on urban dwellers are much higher than the improvement initiatives so far undertaken. Therefore long-term strategies have no alternatives at all. Reducing travel demand is a modern strategy to mitigate air pollution problem in Dhaka city. A systematic and integral planning approach is sought for considering all different existing approaches and future possibilities of reducing travel demand and associated air pollution.



Chowdhury (2004) stated that, in order to create awareness of the importance of conservation of the natural environment, action is needed at various levels and in various modes. Among the different levels, are the national policy makers, community leaders, professionals of various disciplines; teachers, students and youth groups, women, cooperators, religious leaders and other special groups, peasants and so on. In terms of the mode of dissemination, the awareness programs may be a part of the formal educational curriculum; these may also be part of informal programs delivered through other communication media. Though various governmental and non-governmental organizations have been trying to promote and foster environmental education, the overall achievements have not been satisfactory so far. One of the environmental education (EE) problems in the formal education system is the lack of supplementary reading materials for the pupils as well as of appropriate Audio-visual aids to teaching. The existing curriculum is book knowledge-based and examination orientated. There is also a lack of vertical and horizontal integration of curriculum components.

Islam (2008) mentioned that, Bangladesh will face serious environmental problems in near future. The environmental condition is degrading day after day. Environmental degradation threatens all development endeavors. In the context of developing economics Bangladesh to faces a wide array of environmental problems which affect the well-being of its citizens. Bangladesh government, NGOs and civil society has taken some policies and programs to control the environmental problems but these efforts are not fruitful. Lack of citizen's response is cause of failure. Individual citizen response is essential for all development activities especially environmental activities. If the fruits of plans have to reach the common man, it will essential to ensure that at every stage of planning and implementation there is full participation of the citizens. Citizen's response to various environmental issues such as air and water need to be properly studied. According to author, the findings of this study revealed that the level of understanding awareness and participation of the respondents are low. Along with many other recommendations, respondents put stress on acquiring environmental information and tree plantation to overcome this situation. Maximum respondents are not aware about environmental problems, not only that respondents viewed that most of the people around them are not also aware. It is proved that the poor people depend directly on the natural resources for their livelihood (agriculture, forestry and fisheries etc). So there is a

limited scope for the poor to become conscious about environmental degradation. Respondents suggested that literacy rate should be increased to overcome this situation. Though they are not conscious, they are concerned about the initiatives government is taking. They are not aware but they take measures to make their family member aware. Thus it can be inferred that they are playing dual role, in some respect they are conscious but in other respect they are not. Another important finding is that there is positive correlation between modernization and environment degradation. Modernization means more industrialization, more urbanization, more advanced technology which have adverse effects on environment. One of the findings of this study is that the level of participation of the respondents is not good. Very few respondents are the member of any organization; among them maximum are the members of NGO, not civil society or any other voluntary organization. Maximum respondents do not watch environmental programs on TV/Radio. They do not take part in any environmental discussion. Even they do not participate in any program taken by the government. Thus it can be inferred that either they do not get enough scope for participation or they are reluctant to participate or they do not realize the importance of participation. Author stated that there should be taken adequate coverage of environmental education in the teacher training programmers for primary and secondary school teachers. According to author, the arrangement should be made for the provision of audio visual materials on environmental education for both formal and informal education courses on environmental should be strengthened and updated in all the universities and institutions of higher education in the country. The press should give more coverage to environmental issues. Since a large population in Bangladesh is illiterate there should be regular weekly or fortnightly programmes on radio and TV on issues relating to the environment. The department of mass education should arrange film shows on environment and nature conservation in both rural and urban areas. The NGOs should be provided with assistance and support in their efforts of creating awareness about the environment and its protection.

### **2.2.3 Environmental Education and Pollution**

Adhikari (2012) analyzed an estimate of health benefits from a reduction in air pollution from the current level of the national ambient air quality standard level in Katmandu

valley of Nepal. According to author, rapid urbanization in the Katmandu valley has resulted in a significant deterioration in air quality. Vehicular emissions, poor infrastructure, re-suspension of street dust and litter, black smoke plumes from brick kilns and refuse burning are among the many sources contributing to increased air pollution in the Katmandu valley. Research has established that high concentrations of lower atmospheric pollution- ozone, lead and particulate matter contribute to human morbidity and mortality. Prolonged exposure to air pollution may lead to irritation, headache, fatigue, asthma, high blood pressure, heart disease and even cancer. Such health problems clearly have economic costs arising from expenses incurred in treating the disease and loss of productivity. He also mentioned that the benefits estimation will enable policy makers to assess the economic viability, within a cost benefit framework, of the different air pollution programs currently under consideration. It would also provide the basis for long-term alternative energy initiatives in the valley. The author found that the annual saving from reduced mitigating expenditure to a representative individual in Katmandu valley to be USD 3.70 per annum. The savings from the two cities (Katmandu and Lalitpur) in health cost per annum is USD 4.37 million. He felt that it is important to have an estimate of health benefits over time. Author also claimed that health benefits would be in the range of USD 84.53 million over the next 20 years if the plan is implemented and air pollution reduced to the safe level.

Pathak et al. (2012) stated that, the pollution of environment has become a threat to all living beings in this world as a result of over exploitation of natural resources and creating problem in the ecosystems. In the recent times, the concept of environmental education and capacity building is getting prominence in both the field of academic and socio-economic life. They mentioned that pollution is a matter of concern for sustainable development; today civil society is putting a mounting pressure on the state to consider the matter with great urgency. The problem touched all of us and the same is emanating as serious concern to all and the stake holders are very much in the need of environmental education. According to them, the prime motive of the environmental education is to find the level of pollution at the diversified locations and to disseminate the ill effects among people through formal education. The focus of their research is to study the status of awareness and education level of target groups like secondary school, college students and the members of civil society agencies located in the Rangia sub-

division of Assam and its sensitivity with facts and figure. This paper also carries a vivid study of real life situation, conservation of natural resources, and ways for sustainable development amidst environmental pollution with suggestive capacity building measures to meet the challenges in the study area.

Chukwuemeka (2012) stated that there is no environmental education at all as was observed during the field investigation. Furthermore, some of the waste management staff were poorly trained and no plan in the future to give them further training or to improve already acquired skill. Based on the findings, some of their major recommendations are that solid waste management should be provided with a separate head in the budget for the purpose of adequate revenue allocation, implementation and monitoring. The participation of the local communities in solid waste management should be encouraged. Environmental education should be intensified by both the state and local government. Also primary, secondary and tertiary schools curricula should inculcate detailed topics on solid waste management. They think that the environmental education and public participation option lead to an increasing awareness that environmental precautions are important for continued socio-economic development in the long run. A degraded environment cannot sustain a continued growth and it impacts negatively on the entire development of a nation.

Dorevitch (2008) assessments of knowledge about air quality among low-income minority communities are lacking, as are community-based programs to educate the public about using the AQI methods. An air quality education program and system for disseminating air quality information were developed to promote pollutant avoidance during the reconstruction of a major highway in a low-income minority community on Chicago's South Side. They found that, air quality education workshops conducted by community educators can increase knowledge about outdoor air quality and its impact on health over the short term. They also suggested that the short-term and long-term effects of air quality on morbidity and mortality; air quality education efforts should be further developed, evaluated, and promoted for the general public.

Gadi (2005) reported that the residents in Ulaanbaatar have faced two kinds of problems due to air pollution. (i) The gaseous pollutants are considered as main factor to growth of diseases and death among about 1 million residents non discriminating rich and poor ,

(ii) Greenhouse Gas emissions created by air pollution contributing to Global Warming, has resulted in desertification, and land degradation which affect pastoral and cultivated plants productivity. In this meaning, the economics of the country will be deteriorated. According to author,  $SO_2$ ,  $NO_2$ , CO and dust exceed more times than accepted maximum level. This directly influences to growth of various diseases among the residents. The main problem facing to reduction and elimination of air pollution is only top down approach. He claimed that the air polluters and citizens don't have understanding on air pollution. Also they don't have comprehensive knowledge on causes and consequences of air pollution and almost don't involve in any measures for reduction of air pollution. There is still inadequate use of legal and economic tools to reduce air pollution. As a result of this research, they concluded that it is necessary to support / increase / cooperation of the Government, civil society organizations, business sectors and citizens, to increase their participation as well as to build a consensus of all stakeholders on reduction and elimination of air pollution. He also added that, it is needed to develop complex policy proposals and to create a legal system of polluter payment principle. Citizens should have been delivered the systemized information and training on reduction and elimination of air pollution. To do this, the mass media such as Radio and TV organizations, researchers, civil society organizations, governmental organizations should improve their roles and future close cooperation.

Kolukisa and Ugurlu, (2010) mentioned that the industrialization's reaching to its peak along with the drastic increase in population and urbanization have led to an increasing ignorance in using natural resources. As a result of ignorant use of soil, weather and water resources and changes in the climate, the life of living creatures, including humans and other entities, has come face to face with the danger of extinction. Negative conclusions like drought and desertification, environmental pollution's damaging the living life and the extinction of the living kinds have put the perception of sustainable development as an important issue on the world's agenda. So as to achieve sustainable development, lots of activities have been carried out regarding the management of natural resources. However, providing sustainability is not possible only through politics achieving natural resources management but also through making people gain environmental awareness, who use these resources. They also concluded that the environmental dimension of the sustainable development is necessary for the

continuation of the living life on the earth and therefore, all countries in the world should follow a particular environmental policy. However, in this matter people should also be informed. According to authors the peoples' fulfilling of their responsibilities leads to a good deal of development by which the natural life is affected positively like decreasing of energy consumption and preventing environmental pollution. The thing which is necessary for peoples' awareness is to provide them as citizens who are environmentally aware, active and participant about environment beginning from primary school.

Oztas and Kalipçi (2009) mentioned that, generally it is accepted that the environmental education deals with a wide range of environmental experiences, methods and processes. Teaching the subject of the environment should not be considered as an easy task. It should not only cover pure ecology education; but also include the citizenship responsibilities and the problems that are sourced from other interdisciplinary factors. Therefore teachers should have the responsibility to facilitate environmental issues. Hitherto no researcher has undertaken a comprehensive study that focuses on environmental education in teacher training programs. They claim that this study aims to detect basic environmental knowledge of Turkish teacher candidate at the onset of their studies and emphasize the gap between environmental challenges and teacher training curriculum. The results found in this research have shown that teacher candidates possess less pro environmental knowledge. An interpretation of these results is that the teacher candidates do not fully comprehend the underlying ecological and environmental concepts related to environmental issues. Therefore, the design of pre service programs should take into account the characteristic of the student population which are the outcome of their social, cultural, and physical environments, and include all the necessary components for adequately preparing future educators to effectively address the environmental education of their future students.

Ribeiro et al. (2012) analyzed that environmental education is a tool that helps people tackles socio environmental problems and conflicts. It is designed to educate the population about the problems caused to human health and the planet. Environmental education can give individuals experiences of the wider world and the opportunity to discuss environmental issues, the importance of the environment to health and life quality, and the relationships between the prevailing economic model and environmental degradation. They also added that environmental education is fundamental for raising

awareness and preparing the citizens of the future. It must be given consistently throughout the curriculum and cross disciplinary boundaries.

Stavridou and Marinopoulos (2001) mentioned that the majority of students considered the phenomenon of pollution a local event without conceiving its global dimension. They also believed that when air pollutants and waste go in the atmosphere or in water they cause only physical but not chemical phenomena. After the intervention, the students' answers improved substantially. Concerning air pollution, students came to realize that fumes and pollutants can come from (and spread) everywhere because the molecules of the pollutants get diffused in the atmosphere, are diluted and transferred everywhere. They found with respect to water pollution, students also realized that waste molecules are diffused or diluted into water and can be transferred everywhere. In addition, after the intervention students thought that not only physical but also chemical phenomena can take place in the air (acid rain) or in the water. The results deriving from the present study lead us to some directions concerning teaching and learning about environmental issues teaching should help students understand the global dimension of pollution as well as the ways air and water pollutants transfer from one place to another. For this reason, the author mind that the science curriculum should include science concepts relevant to the diffusion/dilution of pollutants in the atmosphere, the role of movement of the air masses, the distinction between physical and chemical phenomena, and the acid rain formation. In their view, environmental education, combined with a change of attitudes towards the environment, should not be solely based on emotional factors, but be supported also by a good understanding of the basic mechanisms, which underlie the appearance of environmental problems.

Teksoz et al. (2010) analyzed that the environmental education is one of the most interested social and economical aspects of the environmental pollution. The main target of environmental education is environmental literacy. Environmental literacy is constituted from understanding, ability, attitude and patterns, and developing continuous attitudes between human and environment both for short and long terms. According to them environmental literacy in higher education has become one of the major issues to be dealt with in order to set up a sustainable future. Since, environmentally literate young generation who will take responsibilities in both business and family lives is the major concern while creating a sustainable future. Thus, under the light of these circumstances

the purpose of this study is to develop the concept of environmental literacy and determine environmental literacy (EL) of the pre-service teachers in 4 public universities in Ankara. The responses of the pre-service teachers had been evaluated by taking into account 4 dimensions of environmental literacy which were named as environmental knowledge, environmental attitudes, environmental uses, and environmental concern. The results of descriptive statistics showed that the environmental knowledge scores of the pre-service teachers were un-acceptable. However, the responses showed that the participants had an eco-centric point of view and favorable environmental awareness. It is to be more specific, when pre-service teachers have satisfactory level of environmental knowledge, they also have higher tendency to hold favorable attitudes, environmental uses, and higher feelings of concern towards environmental issues.

Alam (2010) mentioned that the present study investigated the long run relationship between globalization, poverty and environmental degradation along with other socio-economic and demographic factors, such that education, industrialization and agriculture output, urbanization and population in case of Pakistan. The Study simultaneously found a long run relationship between economic growth, environmental degradation, globalization, poverty and other socio-economic and demographic factors mentioned above. According to author, the study demonstrated that expansion in intensive industrial and agricultural activities and rapid urbanization affect environment adversely, while increased globalization has caused to decrease the rate of environmental degradation. The evidence also suggests that industrial and agricultural output and globalization played positive effect on economic development, whereas rapidly growing population is a big hurdle to achieve economic development. The analysis suggested that poverty may cause to increase environmental degradation and it may slow down the process of economic development if it would not be alleviated. The present study found that the poverty and environmental degradation may adversely affect sustainable development unless problem of poverty alleviation and control of environmental degradation are dealt with simultaneously. The education which is the indicator of human development generates the awareness in people to protect environment and it further improves the economic development of a country. The results further suggest that the effect of education is significant to reduce the environmental degradation; while it can play a positive role to attain sustainable development. According to author for sustaining our



development, we have to control water pollution and protect our environment. He also claimed that to attain sustainable development, we have to globalize our resources, increase the serious efforts of poverty reduction, own green and clean technologies to increase industrial and agriculture output, control the growing population and urbanization rate. Eventually he also suggested that, there is need to enhance the level of education that can help to alleviate poverty, increase the awareness of environmental protection and generate the understanding to globalize resources.

Xiaolin et al. (1998) explained that the environment awareness (EA) has become a hot topic in China in recent years. A number of public surveys of EA were conducted during the 1990s. They found that the most serious environmental problems perceived by urban dwellers are water pollution, air pollution, solid waste pollution, noise pollution, and public area pollution; those perceived by rural dwellers are water pollution, reduced biodiversity, pesticide pollution, solid waste pollution, and public area pollution. A large portion of people know little of various ecological problems and global environment problems. In choosing between economic development and environmental pollution (EP), most Chinese people think both are very important, but the majority of people choose EP over economic development. Most Chinese people have a reasonable level of willingness to pay for EP, including buying green products with higher prices, paying certain amounts of money for EP and donating money to EP related. Authors also states that the most Chinese people think other people's EA is weak and that other people do not take good care of public areas. People's high reliance on government and their powerless feelings when facing serious environmental pollution reflect the aftereffects of old management systems under a planned economy.

Alam (2009) mentioned that the environmental pollution is as old as the civilization itself. It has become a major concern in the last few decades. It is the byproduct of the development of civilization and in fact a price for the progress. It is more prone in case of Bangladesh. Air pollution of Bangladesh is mainly caused by the vehicle emission, industrial discharge and burning of fossil fuel. The water resource of Bangladesh becomes a major health hazard due to arsenic contamination, inadequate solid waste and industrial effluent management. Environmental issues have become major concerns due to impact on public health and development of Bangladesh. Air and water pollution, groundwater contamination, nuisance from solid wastes and noise pollution are the main

environmental pollutions of Bangladesh. Dhaka City is one of the most polluted cities in the world. He also added that the environmental problems occur mainly due to population growth, urbanization, industrialization, rapid rise in transportation, inadequate and improper traffic management, poor sanitation systems and inefficient solid waste management. Air pollution from transportation systems in urban areas mainly occurs due to smoke emission from automobiles, burning of fossil fuel, use of low lead gasoline, and high sulfur in diesel, increasing number of two stroke engine and overall poor traffic management. Industries cause air and water pollution through smoke emission, inadequate solid waste management and dumping of untreated effluent to lakes, rivers and ground water. The arsenic pollution of groundwater has become a major disaster for Bangladesh. The noise pollution is a major health hazards in the country. It is a serious but neglected issue throughout Bangladesh. Government as well as other organizations must take adequate steps to reduce the environmental pollution of Bangladesh. Necessary steps are to be taken to protect the environment for our own existence.

Bhuiyan et al. (2010) stated that, eco-tourism is one of the fastest growing industries in the world today. It is a form of natural resources based tourism focused on experiencing and learning about nature. The term ecotourism can be well described with the following five criteria: nature conservation, low impact, sustainability, meaningful community involvement, and environmental education. Environmental education is one of the five criteria for performing ecotourism. It helps to understand the natural ecosystems and conservation with their role in environment. Ecotourism and environmental education are highly related and depends on each other. The success of ecotourism cannot be achieved without proper environmental education. Environmental education must be fulfilled to perform ecotourism and is the step towards the process of understanding the natural ecosystems. The aim of environmental education is to teach and educate the people about the natural environments and ecosystems in order to live sustainable. Authors claimed that, Bangladesh is an attractive eco-tourism destination in south Asia. Recently, the government of Bangladesh has passed a law named "The Bangladesh Protected Tourism Area and Special Tourism Zone Bill-2010" in its parliament. By passing the law, ecotourism will be a potential sector for Bangladesh. Again, environmental education also enhance by developing ecotourism. So, collective efforts from government and

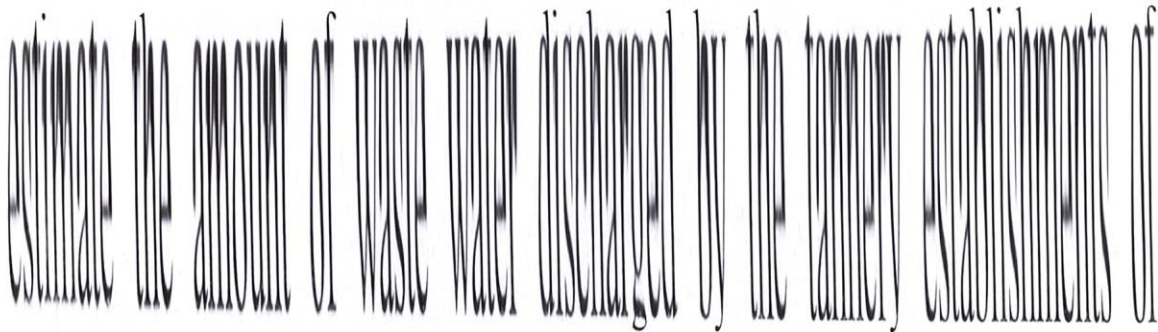
private organizations are necessary to foster clear learning regarding environment and concern about economic, social, and ecological aspects of eco-tourism.

Faruk (2001) stated that environmental problem is not only the problem of Bangladesh but it is now also a global problem. He argued that the involvement of environmental consciousness in curriculum and its development in formal education system should be spontaneous. He also mentioned that the initiative at various level of formal education about environmental pollution awareness curriculum, it needed initiative at national level ahead. Environmental education is a running process. So, he demanded for establishing 'Environment Education and Training Centre' (EETC) belong the infrastructure of environment directorate for the better management of the environment.

Joarder et al (2012) mentioned that Bangladesh suffers from a range of environmental problems, arising from drought, flood and other natural hazards because of its geographical location. Frequencies of hazards are on the increase day by day. The quality of soil has deteriorated due to needless use of agrochemicals, unplanned land use, undesirable encroachment on forest areas for agriculture and settlements and indiscriminate disposal of hazardous industrial wastes. Unplanned land use and intrusion of saline water are causing degradation of soil in the coastal area. The surface water of the country is polluted through capricious disposal of untreated industrial effluents and municipal waste water, runoff pollution from chemical fertilizers and pesticides and oil and lubes spillage in the coastal area from the operation of sea and river ports and ship wreckage. The arsenic concentration in the ground water in many areas is a major problem in Bangladesh now. According to author, air pollution is one of the manmade disasters that are taking place all over the world. There are two major sources of air pollution in Bangladesh, namely vehicular emissions and industrial emissions, which are mainly concentrated in the cities. There are also numerous brick making kilns working in dry season all over Bangladesh, which is another source of air pollution. Almost all of these kilns use coal and wood as their source of energy, resulting in the emissions of sulfur-dioxide and volatile organic compounds. An emerging issue of great concern in the cities and towns is the high concentration of lead in the air from vehicular exhausts. The depletion of biodiversity is the results of various kinds of human interventions that impinge on it through destruction and degradation of land, forest and aquatic habitats. These activities encompass the sectors of agriculture, forestry, fisheries, urbanization,

industry, transport, tourism, energy, chemicals and minerals etc. and have caused serious environmental hazards.

Razzaque and Rahman (2005) mentioned that the emission of industrial wastes into the environment in all forms-gaseous, liquid and solid, poses a massive threat to environment. In the context of Bangladesh, the leather processing or tannery industry has long been criticized as one of the most polluting industries. Pollution from the tannery industry is also considered responsible for various health hazards. According to one



Hazaribagh is 15800 cubic meters per day and such waste is contaminating the water of Buriganga and destroying its aquatic life. They claimed that as a part of present study a number of households living in areas adjacent to Hazaribagh tanneries were interviewed and found two-third of them could be considered as poor. About 62% of the household's heads have primary education while among the non-poor household, there is none without basic literacy. According to them the tannery industry is degrading the environment, creating health hazards and thereby affecting the life of the residents. Although the problem is widely acknowledged one, there is no evidence of government intervention or NGO programmes addressing it. They found all the respondents are of the view that the leather processing industries should be located far from the city to reduce the detrimental effects caused by pollution. They found that all the respondents adjacent to the Savar Export Processing Zone (EPZ) reported that contamination of water due to industrial pollution is a serious problem and intensity of air pollution to be high is almost twice in the EPZ area. Respondents also considered that due to industrialization, there has been extensive deforestation in the EPZ adjacent villages and 86% of the respondents of the area considered that the problems of industrial pollution have a serious adverse impact on water resources. They found that the respondents also pointed out various problems caused by industrial pollution such as infirmity, increase incidence of pest attacks, reduced fish stock, water logging etc. Various diseases like diarrhea, dysentery, skin diseases have also been reported and 90% respondent mind that industrial wastes and garbage might have been responsible for these diseases. They also mentioned that the high density and the lack of basic services or amenities the conditions in the slum areas are unhygienic. About 80% respondents were highly dissatisfied with

drainage and 86% of garbage disposal system. A significant portion of household's head of this area cannot read or write. Respondents were mainly from agricultural households.

Rahman (2005) mentioned that exhaust from the brick kilns contain suspended particulate matter (SPM) rich in carbon particles and a high concentration of carbon monoxides and oxides of sulphur. As the number of brick kilns have expanded fast, especially in areas adjacent to urban centers, their pollution effects on crops and plants and in the air felt increasingly by the communities proximal to the brick kilns that are among the major contributors to severe air pollution in the city. Brick kilns have emerged as major source of Sulphur dioxides and SPM pollution in urban and rural areas during winter.  $SO_2$  and  $NO_2$ , the two major polluting gases in the air, show that the primary sources of  $SO_2$  is traffic vehicles (55.8%); followed by brick manufacturing industry (28.8%) and other industries (10.5%). He also analyzed that the brick kilns damage the suitability of lands for agriculture, at least for a few decades, if not permanently. The major fuel used for brick kilns is wood and coal. The National Environment Management Action plan identified the brick manufacturing industry as one of the major environmental concerns for Bangladesh. Brick burning is a significant contributor to greenhouse gas emissions in the Indian sub-continent. He also added that the acid rain is a regular phenomenon in areas close to brick fields because of the excessively high sulphur content coal used as fuel for burning bricks. Crop loss, corrosion of metallic objects and loss of soil fertility are also caused by the brick field emissions. He claimed, attaining the target reduction of pollution from brick kilns it would need constant vigilance and monitoring of compliance.

Rahman (2008) mentioned that the education for Sustainability (EfS) is the best program to deal with the environmental problems. It is most fundamental in our efforts to combat and control pollution, overpopulation and misuse/abuse of natural resources. According to author the management for environment and its sustainability will be achieved by the formation of a training program directed at adult and youth education, including primary and secondary school teachers; workshops and seminars in selected areas for NGOs, government and private sector organizations; working with volunteer and community organizations to promote formal and non-formal education in local communities and the provision of academic support through lectures, articles, audio and audio-visual materials on education for sustainable development. He concluded that the outcome of

environmental pollution is global warming which is a serious problem of the existence of life on earth. Due to this, climate has been changed, the glacier of the mountains and ice of the Polar Regions are increasingly melted down and the low elevated countries like Bangladesh are under a great risk of inundation. Modern technology-based economy did not consider the laws of nature; as a result, the world is facing manifest problems like health hazards, low agricultural productivity, food, water and energy crises and soil degradation etc. Since, the world economy is driven by technological advancement; it is very difficult to bring back the world environment to a state of harmony and peace without moral education. So, the responsibility of Education for Sustainability is enormous to build a sustainable earth for coexistence of all lives with love and peace.

Salequzzaman and Davis (2003) found that Bangladesh presents unique challenges to the search for ecologically sustainable development with a very high population density, a still high population growth rate and limited natural resources. A significant program of environmental education and development of local expertise is needed for massive changes in behaviour with respect to the environment. The formal education system provides a ready framework for reaching a large part of the existing population and can help make future generations conscious of the importance of environmental conservation. Primary school education is the main focus of attention because of the inherent flexibility in curricula enabling infusion of environment into existing subjects and the higher level of enrolments in primary schools compared to secondary school. In Bangladesh, NGOs and universities with environmental education departments play a significant role in teacher training and providing materials for formal and non-formal education. It is clear that graduates from the environmental disciplines should have a significant role the environmentally sustainable development of Bangladesh. Therefore the Government of Bangladesh, national and international NGOs and other organizations should take the initiative to involve environmental studies graduates in the challenges of sustainable national development as well as global sustainability. They claimed that one successful example being a ban on public use of polythene bags. The paper describes some of these programs and makes recommendations for strengthening environmental education in Bangladesh. It highlights the need to deploy environmental expertise in public and private sector management systems as the focus of government policy in Bangladesh matures from a short-term focus on self sufficiency to the pressing issues of

sustainability within the environmental opportunities and constraints offered by the environment.

#### **2.2.4 Causality between Environmental Pollution and Economic Growth**

Ahmed et al. (2012) claimed that the purpose of this study is to test the relationship between environmental pollution and economic growth. This is the first research done using time series data for 34 years from 1975-2008 for Maldives. The famous Environment Kuznets Curve and OSL methods were used to test the hypothesis and relationships. Unit root tests were performed to test the statistical properties of the data used in variables. Results show strong positive relationship between environmental pollution and economic growth. EKC estimation shows Maldives could overcome the rapid rate of environmental pollution by growing its economy at a faster rate. Granger Casualty Test indicates changes in GDP per capita Granger-cause Emission. The result of this study will help the environmental authorities to understand the effects of economic growth on the environmental degradation and manage the environmental problems using macroeconomic methods. The unit root test shows all the variables are stationary at first difference. EKC turning point shows that the economy will face the reduction in increase in carbon emission in the near future. According to authors this result indicates that Maldives economy can enjoy reduction in the increase in emission if the economy grows at a higher rate that leads to early decline of emission increasing rate.

Ru, X., et al.,(2012), analyzed the relationship between economic development and the factors causing the environmental pressures is the basic premise of formulating and adjusting the environmental policy. A sound environmental policy should be effective to reduce or mitigate the environment pressures and simultaneously maintain economic development. According to the theory of dematerialization, which is a method to describe the relationship between economic growth and the environment pressures, they divide target research stage (1960-2008) into 5 sub-time periods, that is 1960-1969, 1970-1979, 1980-1989, 1990-1999, 2000-2008, then inspect the relationship among GDP per capita, carbon emissions and intensity of carbon emissions in China. We find that absolute dematerialization occurs in 1960-1969, materialization occurs in 1970-1979, relative dematerialization occurs in 1980-1989, 1990-1999 and 2000-2008. On terms of the whole study period, relative dematerialization is occurring; from 1960 to 2008, when

economic development changes 1%, carbon emissions, carbon emissions intensity and environmental pressures change 0.59%, -0.34% and 0.84% respectively, which shows that the relationship of environmental pressures and economic development, carbon emissions and economic development are relative decoupling.

Odhiambo, (2011) examined the causal relationship between  $CO_2$  emissions and economic growth in South Africa using the newly introduced ARDL-Bounds test. The empirical results show that there is a distinct unidirectional causal flow from economic growth to  $CO_2$  emissions in South Africa without a feedback. The results also show that energy consumption Granger-causes  $CO_2$  emissions and economic growth in South Africa. The results, however, failed to find any causal flow from  $CO_2$  emissions to either economic growth or energy consumption. The results apply irrespective of whether the causality is estimated in the short run or in the long run. The study, therefore, recommends that energy conservation policies, as well as appropriate forms of renewable energy, should be explored in South Africa in order to enable the country to reduce its carbon emission footprint without necessarily sacrificing its output growth.

Saboori et al. (2012) investigated the dynamic relationship between carbon dioxide emissions and economic growth in Indonesia based on the EKC hypothesis for the period 1971–2007 by incorporating energy consumption and trade openness. Co integration analysis was conducted using ARDL bounds testing approach developed by Pesaran et al. (2001). Negative and positive coefficient of  $\ln Y$  and  $(\ln Y)^2$  respectively, indicating a U-shape relationship between per capita  $CO_2$  emissions and per capita real GDP. This confirms that  $CO_2$  emissions declines at initial level of economic growth then reaches a turning point and increases with the higher level of economic growth. Therefore our results do not support the EKC hypothesis. The elasticity of  $CO_2$  emissions with respect to energy consumption is 1.246 and 0.854 in the long and short-run respectively and highly significant. This implies that for each 1% increase in energy consumption per capita  $CO_2$  emissions will rise by 1.246% in the long-run and 0.854% in the short-run. The coefficient of trade openness is positive and significant in the long-run while it is negative and insignificant in the short-run. This is indicating that 1% increase in foreign trade will lead to 0.229% increases in per capita  $CO_2$  emissions in the long-run while its



contribution to  $CO_2$  emissions is negligible in the short-run. Correctly signed and statistically significant coefficient of ECM (-1) supports the existence of cointegration among variables.

Alkathlan (2012) mentioned that the environmental protection is an important challenge for the policymakers of a highly oil dependent economy such as Saudi Arabian economy. The growing economy requires more energy consumption which produces more carbon dioxide emissions. This paper examines the relationships among economic growth,  $CO_2$  emissions, energy consumption and the employment ratio in Saudi Arabia during the period of 1980-2008. The study applied the ARDL test and VECM based test techniques to establish the short run and long run relationships between the variables in the model. Empirical findings suggest that a long run relationship between economic growth, energy consumption and the employment ratio exist in Saudi Arabia. The long run estimated elasticity coefficient of  $CO_2$  emissions is positive and significant, implying that an increase in per capita  $CO_2$  emissions will increase GDP in the country. Since more energy consumption leads to more economic growth, which causes more  $CO_2$  emissions, then it is expected to have such positive and significant relationship between these two variables. The results indicate that the elasticity of  $CO_2$  emissions intensity is lower than that of energy consumption in Saudi Arabia. The estimated elasticity coefficient of the employment ratio reflects a significant increase in the GDP over a possible change in the employment ratio in the country. The application of the ECM-based Granger Causality test is found to be consistent with the outcomes of the ARDL test. The results indicate that GDP does not Granger Cause  $CO_2$  emissions and demonstrate that in a logarithmic model, the EKC hypothesis does not hold in the case of Saudi Arabia. In the Short run, the Granger causality results support the neutrality hypothesis that there is no causal relationship between economic growth and energy consumption in Saudi Arabia. Therefore Saudi Arabia's environmental friendly policy adopted since 2001, to conserve and protect the natural resources and environment of the country, will not affect the growth process of the country. However, the long run income elasticity of carbon emissions is greater than the short run income elasticity of carbon emissions, which implies that income leads to greater carbon dioxide emissions in the country. The significant and positive impact of energy consumption on economic growth suggests that

energy consumption is crucial for growth, but the rapid pace of  $CO_2$  emissions requires the adoption of alternative sources of energy and approaches to development to protect the environment in Saudi Arabia.

Islam et al. (2012) mentioned that this paper deals with the assessment on the intensity of the relationship between the international trade and environmental pollution regarding the carbon ( $CO_2$ ) emissions of a developing country, Bangladesh. The paper deals with the exploration of the situation only and consequently draws attention on the environmental regulations without causing harm to international relation. The flow and essence of the paper have been drawn from the empirical analyses of the data of 32 years (1976 – 2008). The quantitative analysis of this paper indicates that there is a strong positive relationship between international trade and carbon ( $CO_2$ ) emissions from the gas fuels. Ultimately carbon emissions from gas fuels indicate the carbon emission from various manufacturing sector of Bangladesh that are involved with the international trade. Hence, the empirical analyses suggest the reinvestigation of environmental policy of Bangladesh and ensure the application with the environmental management systems of the organizations.

Bloch et al. (2011) analyzed the relationship between coal consumption and GDP in China using both a supply side and a demand side framework. The error correction mechanism (ECM) is used to examine both short run and long run Granger causality. Furthermore, generalized variance decompositions and impulse response functions are employed to confirm the robustness of the causality tests. The empirical results show that there is a unidirectional causality running from coal consumption to GDP in the short and long run under the supply side analysis where GDP is interpreted as a measure of aggregate output in China. The result is confirmed in the impulse response function that shows positive and persistent impact on GDP growth from shocks to oil consumption growth, with these shocks accounting for about half of variance in GDP growth in the long run according to the variance decomposition. The demand side model indicates that there is a very strong link between carbon emission and coal consumption, with the findings that there is a bi-directional causality between the variables. The findings give support to increasing concern of the global community regarding the detrimental effect of coal consumption toward the overall climatic degradation. The results shows that coal

prices Granger cause coal consumption, so a reduction in pollution without restricting economic growth may be possible by withdrawing the current policy of coal subsidization by the Chinese Government and replacing it with a policy of subsidizing greener energy sources.

Gunter (2010) mentioned that Bangladesh, a country with a population of 160 million, with the seven largest population of the world is currently contributing 0.14 percents to the world's emission of Carbon Dioxide ( $CO_2$ ). Looking at the implications of different GDP growth rates on Bangladesh's  $CO_2$  emissions, it may look like that slightly lower growth rates will be helpful to stabilize the world's  $CO_2$  emissions. Our projections have shown that just one percentage point lower GDP growth implies about 30 percent less  $CO_2$  emissions by 2050. However this clearly is the wrong interpretation as lower GDP growth rates provide an only temporary delay in  $CO_2$  emissions. Taking into account that lower GDP growth rates imply higher population growth, the long term impact of low GDP growth on  $CO_2$  emission is actually worse. Higher GDP growth rates will increase  $CO_2$  emission faster, but will then also imply that the peak of  $CO_2$  emissions will be reached earlier and due to the lower population, at a lower emission level. In other words, development can be considered to contribute to lower long run  $CO_2$  emissions.

### **2.3 Utility**

Researcher conducts a research on environmental pollution and education in Bangladesh applying questionnaire of knowledge, practice and attitude of the student at secondary level formal education; literacy, education and awareness for the teacher respondents and interview at intellectual level and observation schedule using an observation checklist. On the other hand for showing the causal relationship among environmental pollution, education and sustainable economic development by secondary data, here applied the econometric methods like Unit root test, Cointegration, Error Correction Modeling approach and Granger Causality test. It would also be a guideline for researcher in future for pursuing extensive study on the relevant research issue. Besides, this research could show the policy makers in formulating education and environmental policy in

Bangladesh. The proposed study will be a remarkable work if completed successfully, because no such an empirical research has so far been carried out in this field. So, it can be said that by the proposed study the students and the policy makers would surely benefited.

#### **2.4 Gap in the Existing Literature**

A number of experiential research works have been conducted related to the present research. Very few studies are found on the relevant field. But the relationship among the variables in the current study did not get prime of life in developing countries like Bangladesh. Some researcher conducted studies related to the proposed study for developing countries including Bangladesh. In those studies they failed to show the relationship among education, environmental pollution and sustainable economic development using empirical econometric model. So the researcher thinks, there prevails an immense research gap which is the main justification of the research.

#### **2.5 Conclusion**

A number of empirical research works have been conducted in this respect in developed and developing countries. Environmental pollution education is a new research area and in Bangladesh it does not get maturity. Some researchers conducted studies in this respect, but they did not show the relationship among the variables empirically. In this respect, the objectives of the study are to identify their knowledge, attitude and practice regarding environmental pollution through education. It has also tried to show the relationship among the variables using different econometric models and recommended some policies for expected sustainable economic growth. As a developing country for Bangladesh education can play a vital role in accelerating environmental pollution awareness. In this respect there is a tremendous scope to research on the proposed study using primary survey and improved econometric methodologies and variables through secondary data.

## **Chapter 3: Research Design and Survey Methodology**

### **3.1 Introduction**

A research design is the plan and structure arrangement the methods and procedures for collecting and analyzing data with an ultimate goal of answering research questions. By plan, we mean the overall scheme or program of research, which tells us what the investigator will do from formulating hypothesis to the final analysis of data. In this chapter the research design aimed at techniques for selecting respondents through questionnaire survey, interviews and observations and sampling techniques for choosing respondents. The processing and analysis procedure of collected data and their reliability and validity has discussed in this chapter. Finally the conceptual framework has used to specify the relationship among the study variables.

### **3.2 Types of Research**

The research for this study includes both exploratory and evaluative type. Exploratory in the sense that the awareness of the students who are educated in formal education at secondary level regarding environmental pollution (especially air, water, soil and sound), opinion regarding the existing management system of environmental pollution and alternative way to control the pollution has explored and described in this study. On the other hand, existing policies along with their enforcement has evaluated and described by using the primary and secondary data according to need and availability.

### **3.3 Study Area**

The two divisions in Bangladesh, Dhaka and Rajshahi have been selected as the study area of this research. From Dhaka division two districts, Dhaka and Gazipur have been selected. Another is from Rajshahi division; there also two districts Rajshahi and Sirajgonj have been selected for this research purposively. Dhaka is the capital city of Bangladesh. A lot of people and vehicles are gathered here. Many factories and industries are grown up improperly in this city and now Dhaka is called one of the most polluted city of the world. Gazipur is mainly factory and industry based district.

Industrial garbage, chemicals, smoke, transport etc. are also important in this respect. Rajshahi is often referred to as Education city and is situated in the north-west of the country and on the northern banks of the river Padma. Another district Sirajgonj is the transit route to the northern area of the country with the south-east side and most of the part of the country. This Sirajgonj district is also situated on the western bank of the river Jamuna.

### **3.4 Population**

Actually the students who are at secondary level formal education in Dhaka and Rajshahi division are the population of this study. However, the target population is the students of secondary level educational institution of the selected areas.

### **3.5 Sample Techniques and Selection of Respondents**

It is found that, some researchers like, Bradley et al., (1999) think that environmental attitudes are most likely formed as a result of life experiences. The urban and rural settings in life experiences are different. Because of their different settings and opportunities, the urban context offers far different arrays of experiences than the rural contexts. For example, students in rural areas usually have more opportunity to keep in touch with the natural environment, whereas students in urban areas often have more access to the media like paper, television, internet etc. of environmental concerns. Such exposures may have direct impact on the type of thinking and reasoning power. Consistently, Muttaqui (1983) found significant difference in post-primary students' environmental attitudes from urban and rural settings in Bangladesh. Thus, it has considered both areas in participant selection within this study. The secondary schools in these selected districts have divided into urban and rural category according to their geographical location. Three secondary schools from each district of Dhaka and Rajshahi and two schools from each district of Gazipur and Sirajgonj have been selected and twenty two students from each of these schools have selected randomly. In this manner, 220 participants have been included altogether with equal number of boys ( $n = 110$ ) and girls ( $n = 110$ ). Mittelstaedt et al., (1999) found that there is significant sex difference in students' environmental knowledge and attitudes. That is why both boys and girls

students have been included. There also 50 teachers respondents have been selected, 5 from each school to know their views and opinions.

### **3.6 Type, Sources and Method of Data Collection**

The information and data require for this study were collected from various sources which are mentioned as bellow.

#### **3.6.1 Primary Sources of Data Collection**

To collect the primary sources of data the researcher adopted following data collection techniques;

- Questionnaire Survey
- Interviews
- Observations

##### **3.6.1.1 Questionnaire Survey**

The questionnaire survey method is employed by and large to collect data from individual units. Data on environmental pollution, sources and causes of pollution, their types and conditions, awareness regarding environmental pollution, diseases caused by pollution, causes of industrial and vehicular emission, potentiality and enforcement of laws and regulations, awareness regarding emissions standards and fine for violation of emission standards, opinion in respect of pro-environmental organizations and political attitude for sustainable improvement of environmental quality, educated people's attitude and opinions to reduce and control this environmental pollution were procured by this method. This involved conducting a questionnaire which was designed for three group of respondents; a) Students at secondary level, b) Teachers at secondary level institutions, and c) Policy makers.

## **Justification of Selection of Respondents**

### **Students at Secondary Level**

Students at secondary level were selected as a respondent with a view to explore their knowledge, attitude and practice about environmental pollution. Yousuf and Bhutta (2012) showed that students have positive attitude towards protection of environment and eager to find solutions of environmental issues. In this context researcher think that today's students will be the dutiful citizen and in future they will take part in many important activities regarding environment. So their knowledge, attitude and practice about environmental pollution are important for building a pollution free healthy environment.

### **Teachers at Secondary level Institutions**

Environmental pollution is related with many factors. It needs some level of education in order to realize the causes and consequences of environmental pollution. Teachers are well educated and sometimes they are trained. To explore the views and opinions of the teacher respondents who teach respective environment related themes for sustainable improvement of environmental quality is critically important.

### **Policy makers**

Actually the policy makers are highly educated and experienced personalities in their field. They play important role in formulating education curriculum, rules and regulations etc. regarding environmental pollution. So their views and opinions in respect of environmental pollution and its sustainable improvement are critically important.

#### **3.6.1.2 Interviews**

Scheduled interviews have been arranged to find out the opinions and suggestions of the officials, professionals, experts and government agencies and policy makers regarding environmental pollution education at secondary level and environmental management system.



### **3.6.1.3 Observation Method**

Observation is one of the oldest methods of scientific information collection and reporting. In the social science it has played an important role, particularly in collecting qualitative information. Technical information can be obtained better by observation than asking questions. Measurement of time and distance could be more reliable by observation. The danger of false information through observation remains low in comparison to questionnaire and interview method (Karle E. Weber and Idrap, Ttiwari). Observation method was conducted to collect the data on following issues using a observation checklist: Observing the cleanliness of the school ground and classroom facilities of air and light, use of waste basket, sufficiency of latrines and their cleanliness, environment related topics in the bulletin board etc.

### **3.6.2 Secondary Data and Information**

In the study, secondary data are collected from books, recognized journals, statistical review, academic papers, government documents, newspapers, electronic journals, published dissertations available in the libraries of various universities, education policy, education curricula, syllabuses and web-sites of related local and international institutions for analysis and comparison. Secondary data which are used in model setting have been collected from World Development Indicators, Bangladesh Economic Reviews, Bangladesh Bureau of Statistics, and Carbon Dioxide Information Analysis Centre (CDIAC).

### **3.7 Data Processing and Analysis Procedure**

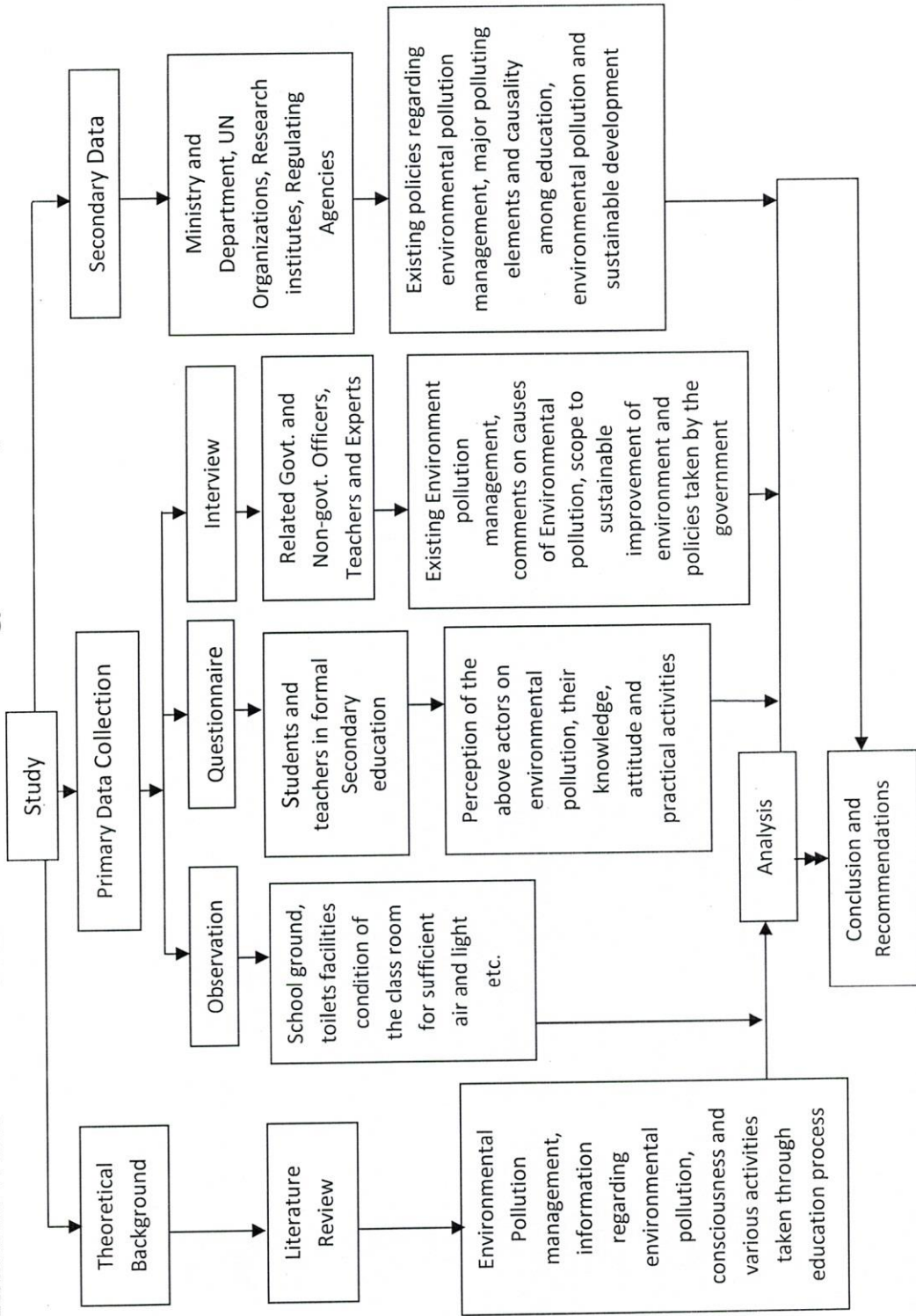
The collected data is reviewed, scrutinized and edited to avoid inconsistency and error in the light of objectives. At the same time edited data is classified and coded. The findings from the quantitative analysis is presented by tables, charts, graphs and diagrams in an attempt to make those more meaningful and easily communicable to the readers. Interpretations are made by analyzing the quantitative results of different tests. However, qualitative data and comments which are collected through open and close ended questionnaire is also considered to enhance legitimacy and validity of the findings.

Quantitative data are analyzed by using appropriate statistical technique. In this respect, econometric measures of Unit root test, Cointegration, Granger causality and Error Correction Mechanism (ECM) are used to show the relationship between and among variables.

### **3.8 Reliability and Validity of Data**

To ensure reliability and validity of data in this study, we have taken a pretest of the questionnaire before formulating the final questionnaire. Researcher has also cross checked the data with teachers and intellectuals over the period in different contexts. The researcher himself approached the respondents, asked questions and written down in front of them to ensure the reliability and validity of the data. Observation method has also used to collect data from field survey for unbiased and authenticity of data. Besides, for supporting this research work, with a time series data the empirical time investigation has been carried out for the period 1974 to 2010. The reliability of the data can be attributed to the fact that all the data used in this study are from government and world renowned international organizations. Thus data are reliable and valid for policy research.

### 3.9 Framework of Research Work



## **Chapter 4: Conceptual Analysis**

### **4.1 Introduction**

Education is the key elements of human development. It is also one of the principal sources of an individual and collective process of creating awareness, sustainable development and enhanced welfare to the society. Education has tremendous effect on creating awareness about environmental pollution, health hygienic, poverty, technology and sustainable development.

### **4.2 Environmental Education in Our Formal Secondary Level education**

In Bangladesh, the education system consists of three major levels: Primary, Secondary and Higher education. Secondary education has three sub stages: junior secondary (grade vi-viii), secondary (grade ix and x) and higher secondary (grade xi and xii). In the secondary level (grade ix and x), students choose their future study direction from the group of Science, Humanities and Business Studies. Student of science group study three units of Science-Physics, Chemistry and Biology separately, while students of the other groups study an integrated science unit named General Science (NCTB, 1996).

The introduction of environmental education (EE) was started in Bangladesh following the Qudrat-E-Khuda Commission Report on 1974, which lead to the introduction of new curricula and syllabus for various stages of school education by 1978. (Chowdhury, 2004).

In secondary level environmental education is provided to students through different subjects, such as Language, Social Science, General Science, Geography and Environment, Agriculture Study and Biology. These subjects deal with various themes relating to environment, even though no general objectives of secondary education explicitly states any direct emphasis on environmental education (NCTB, 2012).

Environment related themes are emphasized in the General Science unit at secondary level which is studied by the students from both the Humanities and Business Studies group, which consists of almost 75% of the total students at secondary level (BANBEIS,

2006). The General Science curriculum includes four specific objectives relating to environment. These are:

- 1) to understand regarding fossil fuels, its production, various uses, alternative sources of energy and its conservation;
- 2) to acquire knowledge regarding energy; its sources, classifications, various needs and uses and its conservation;
- 3) to understand the elements of ecosystem; its classifications, plants and animals and their inter-dependency, flow of energy and balance of the environment;
- 4) to understanding about inter-relationship between population and environment, effects of growth of population on environment, nature and danger of greenhouse effects and importance for the control of population growth (NCTB, 1996b). Reflection of the above objectives is found in the General Science textbook. Five chapters in the textbook present environment related content: Population and Environment, Energy, Fuel, Ecology and Disaster Management (Haque et al. 2007).

In the Science text book (NCTB, 2012) where one chapter present environment related content: Living with Hazards. This chapter discussed about effect of climatic change: Bangladesh and international perspective, environmental hazard, global warming, carbon pollution, various technique of nature's protection (Tapon et al., 2012).

The Geography and Environment text book present five chapters relating to environment. This is consistent with what is presented as objectives for the General Science curriculum. These are:

- 1) Atmosphere; its composition, importance, elements and global warming.
- 2) Hydrosphere; its concepts, ocean current and its effects.
- 3) Population; over population and its effect on natural resources, distribution of population, population problem and its solution.

- 4) Development Activities of Bangladesh and Environmental Balance; pollution, consequences of environmental imbalance, and the way to keep the balance of environment.
- 5) Natural Disaster of Bangladesh; kinds of disaster, disaster management and development (Shajahan et al., 2012).

In the Biology text book, one chapter discusses about themes relating to environment namely Environment of Living being where discusses about ecosystem, food chain, biodiversity, way and importance of environmental conservation (Haider et al., 2012).

In the Social Science text book for secondary students, where three chapter discussed about the themes relating to the environment namely atmosphere, humidity and rainfall, temperature, growth of population and its effects on economic development, disaster management and Bangladesh (Begum, et al., 2011).

Also in the Agriculture Study text book for class ix-x, where two chapters discusses about agriculture and climate, climate change and its effects on agriculture, adaptation technique, forestation and its protection (Ashrafuzzaman et al., 2012).

In addition, in the language (English) text book, which is designed as compulsory for all students where two chapters present various environment related content under the themes of climate change, environmental pollution, save the planet, renewable energy and its sources (Shams, et al., 2012). An overview of the above discussion presented appear to indicate that although there is no separate environmental education course in the secondary education in Bangladesh, environment related ideas are intended to provide all students from both the science and non-science groups through different subject areas.

### **4.3 Education and Environmental Pollution Evidence for Singapore**

According to the survey of Greenpeace Natural Organization; India, Bangladesh, China, Vietnam, the Philippines, Indonesia and Hong Kong are regarded as the dirtiest countries in Asia, while Singapore, Japan and Malaysia are regarded as the cleanest. Thailand, South Korea and Taiwan are in the middle.

Singapore is an island of about 646 square kilometers in area. The average population density in Singapore is about 4,500 people per square kilometer. Their literacy rate is about 94%. People of Singapore are also very much conscious regarding environmental pollution as well as environmental policies and regulations.

The control of hazardous chemicals comes under the purview of the Pollution Control Department (PCD) of the Ministry of the Environment. The hazardous chemicals under control are listed in the Poisons Act and its Rules. Large parts of Singapore are used as water catchment areas. It is necessary to ensure that chemical storage facilities and transport of chemicals avoid such areas as far as possible. This is to prevent pollution and to protect drinking water sources against contamination. There the pesticides are not allowed for local use. This had helped to minimize any release of persistent organic pollutants (POPs) in the environment.

As a well educated country, Singapore adopted the strategy to control environmental hazardous as: (i) Avoidance of the danger as far as possible; (ii) Prevention of the danger from occurrence; and (iii) Mitigation of the impact of an accident occurrence.

The controlling programs based on the above strategy are implemented through the following steps.

#### **A) Education and Training**

An important area which contributes to good and effective implementation of the controls is to encourage and develop appropriate training and education programme for industries. PCD has worked with the relevant government agencies and industry organization, such as the Singapore Chemical Industry Council to set up training courses, workshops and briefing for industries. PCD has jointly with the Maritime and Port Authority (MPA) and Fire Safety Bureau (FSB) set up a special training course viz. 'Handling and Transportation of Dangerous Substances' for drivers of vehicles and tankers carrying hazardous chemicals. More than 1,000 drivers had undergone the specialized training course. These drivers are also required to attend refresher courses once every three years.

It is found organizing of various exhibitions related to environment, celebration of 'Youth for the environment day', technique of saving energy and recycling of them in

their educational institution, eco friend award for encouraging trend of increasing environmental consciousness amongst the young age group for the sake of reducing environmental pollution in Singapore.

### **B) Licensing Control**

The licensing control of hazardous chemicals prevents unauthorized persons from handling such chemicals and ensure proper safeguards are taken at all times in the handling of the chemicals to prevent accidental releases and mitigate any adverse effects if they should occur. The licensing controls are implemented under the Poisons Act and the Poisons (Hazardous Substances) Rules. The legislation controls the import, export, sale, storage, transportation and use of hazardous chemicals. Only Poisons License or Permit holders may apply for such Transport Approval. A Transport Approval is given subject to the following conditions:-

- (a) The containers conveying hazardous chemicals must be designed, constructed and tested in accordance with an acceptable Code of Practice;
- (b) Drivers of the vehicles or tankers carrying hazardous chemicals must have attended a training course on 'Handling and Transportation of Dangerous Substances';
- (c) The routes used must be approved;
- (d) The transportation is restricted to the hours of 9.00 am to 5.00 pm and
- (e) An adequate emergency action plan is put up to deal with any accidental release of the hazardous chemical.

### **(c) Monitoring and Enforcement**

Enforcement will ensure that the minority of companies which violate the controls are penalized accordingly and would not gain unfairly from their violations.

All imports of hazardous chemicals are monitored electronically through the 'Tradenet System' which requires traders to make import declarations on the types and quantities of hazardous pollutants chemicals they are importing.

PCD officers also carry out audit checks to ensure the safe storage and handling of hazardous chemicals at the factories and chemical warehouses. Surprise road checks are



also carried out jointly with the Traffic Police and Fire Safety Bureau to ensure that hazardous chemicals are transported with the necessary approval and in accordance to requirements.

#### **4.4 Education and Sustainable Development**

Sustainability is now one of the most widely used words in scientific communities and its associated education systems, particularly in the field of environmental science. Knowledge, either traditional or institutionalized from formal education, is an essential prerequisite to attainment of sustainability in human society and endeavor. The concern with sustainability itself is partly a product of the integration of ecology into the basic science curriculum of schools in industrialized countries for the last 30 years. The existing information, education and mobilization process have also an important role in the evolution of environmental management around the world. Universities and other equivalent institutions play a leading role in promoting of environmental ethics and the principles of sustainable development (Salequzzaman and Davis, 2003). According to Filho, "... universities must give future generations education and training that will teach them and through them, others to respect the great harmonies of their natural environment and of life itself (Filho et al., 1996).

Education for sustainable development (ESD) is an investment in our future and each respective country should ensure that appropriate resources are made available for its development. Education is an essential tool for achieving sustainability. People around the world recognize that current economic development trends are not sustainable and that public awareness, education and training are the keys to moving society towards sustainability. Education from being a human right is a prerequisite for achieving sustainable development and an essential tool for good governance. ESD will take many forms around the world. ESD was first described by Chapter 36 of Agenda 21, Earth Summit in Rio de Janeiro in 1992. This chapter identifies four major thrusts to being the work of ESD: i) improving basic education, ii) reorienting existing education to address sustainable development, iii) developing public understanding and awareness and iv) training. It is said in the summit that " Education for sustainable development enables people to develop the knowledge, values and skills to participate in decisions about the

way we do think individually and collectively, both locally and globally, that will improve the quality of life now without damaging the planet for the future” (Chowdhury, 2004). In practical field, environmental education (EE) can play a vital role in creating awareness and motivation that change people’s views, opinion, values, behavior and skills in society. In this respect, environmental education and development of local expertise are needed for massive changes in behavior with respect to the environment.

#### **4.5 Sustainable Development and Environment**

Environment is not only a huge area in which we keep on living, but also a huge ecosystem in which millions of creatures live. Environment provides raw material for economy. This raw material gained through the production process turns out to be a consumption product. Then, this raw materials and the energy used in production return to the environment as pollution. Therefore, sustainability of environment is reasonably important in regards to economical development (Kolukisa and Ugurlu, 2010).

Sustainable development is a difficult concept to define. It achieved a new status with the publications of ‘Our Common Future’, the Brundtland report, in 1987 and has gained even greater attention since the United Nations Conferences on Environment and Development (UNCED) held in Rio de Janeiro in June 1992 and said countries have approved of the economic and global issues to be achieved in accordance with the environmental values and sustainable development principles. The Brundtland Commission’s definition of sustainable development satisfying present needs without compromising the ability of future generations to meet their own needs- is still the most widely used starting point of discussion on sustainable development. The concept of sustainable development is an important milestone in environmental theory because it posits how society itself should be organized and not simply why certain environmental protections should be adopted or how they can be best implemented. This ambitious interpretation is widely shared by business leaders, policy activists and academics alike. Sustainable development first came to the prominence in the World Conservation Strategy (WCS) published by the world conservation union (ICUN) in 1980. Three overall objectives for sustainable development were worked out and presented in 1981 in the World Conservation Strategy worked out by the WWFN (World Wide Fund for

Nature), UNEP (United Nations Environment Program) and IUCN. There were three objectives as:

- i) to maintain essential ecological processes and life support system;
- ii) to conserve genetic diversity and wild species;
- iii) to ensure sustainable utilization of species and ecosystems.

Sustainable development is generally thought to have three components: environment, society and economy. The well being of these three areas are intertwined and not separate. For example, a healthy, prosperous society relies on a healthy environment to provide food and resources, safe drinking water and clean air for its citizen. Thus sustainability is considered to be a paradigm for thinking about a future in which environmental, societal and economic consideration are balanced in the pursuit of development and improved quality of life (Chowdhury, 2004). Briefly, the living environment provided by sustainable development means using of water resources so carefully that current and forthcoming generations can benefit adequately, keeping the weather clean in order to breath fresh air, making use of benefaction of nature and living in good health today and in future.

#### **4.6 Environmental Pollution and Poverty Nexus**

The poor are traditionally taken as the agents for causing society's many problems. The most recent allegation directed against them is that they cause environmental pollution. For example, in one of the conclusions of the Bruntland commission report, which incidentally has been accepted as the proposal for environmental conservation, it is explicitly that poverty is a major cause of environmental problems and amelioration of poverty is a necessary and central condition of any effective program to deal with environmental concerns. Both poverty and environmental pollution have been increasing in many developing countries. Ethnic minorities, migrants and refugees are the sources of environmental pollution. Their needs often receive far less attention, and they cannot always be reached through the usual hygienic and welfare channels (Alam, 2010). Jalal (1993), argued that "It is generally accepted that environmental degradation, rapid population growth and stagnant production are closely linked with the fast spread of

acute poverty in many countries of Asia.” This problem is increasing in many developing countries, including Bangladesh.

Poverty is a major determinant of poor environmental quality as well as a big hurdle to achieving sustainable economic development. Whether defined by income, socioeconomic status, living condition or educational level, poverty is the single largest determinant of environmental pollution and poor economic growth. Living in poverty is associated with poor sanitary conditions, unabated sewerage system, lack of clean water resources and increased exposure to environmental risks. Urban poverty is a challenge in all developing countries like Bangladesh, where not only the number of urban poor is increasing, but also the divisions among social groups within cities. In context of Bangladesh for example, the leather processing or tannery industry has long been criticized as one of the most polluting industries. Pollution from tannery industry is also considered responsible for various health hazards. According to one estimate, the amount of waste water discharged by tannery establishment of Hazaribagh in Dhaka is 15,800 cubic meters per day and such waste is contaminating the water of the Buriganga and destroying the aquatic life. As a part of this study, a number of households living in areas adjacent to the Hazaribagh tanneries were interviewed; two third of them could be considered as poor. About 62% of the household heads have primary education or above, while among the non poor household, there is none without basic literacy. According to the entire respondent, the industry has strong detrimental effects on the environment. All of the respondents reported that the leather processing establishments discharged wastes that created bad smell, with 72% of the respondent also complaining about the drainage system being clogged by solid wastes disposed from the tanneries. 70% of the households interviewed expressed concern about the spread of disease by industrial pollution. A number of households living in villages, adjacent to the Savar Export Processing Zone (EPZ) were interviewed to find out people’s perception about the effect of industrial pollution. On the whole, 86% of the respondent in Savar villages considered the problem of industrial pollution to be severe. More than half of the households in the sample are poor. A significant proportion of the household head cannot read and write. Urban Slums where highly congested living with limited access to public utilities characterizes the physical condition. Due to the high density and the lack of basic services or amenities, the conditions in the slum areas are unhygienic. The negative

external impact on the environment of adjacent areas is also very high. About 92% of the entire respondents were found to be poor with quite low level of education at Mirpur in Dhaka. In addition, slums are often turned into a heaven for people engaged in various criminal activities.

#### **4.7 Conclusion**

Actually, education, environmental pollution and sustainable economic development are closely related. Sustainable economic development depends on the indigenized human capital, education and awareness of the people, better health, improved technology, productivity, environmental management system etc. Finally it can be concluded that education, awareness, training and participation of the people in decision making are keys to moving society towards sustainability.

## **Chapter 5: Theoretical Issues**

### **5.1 Introduction**

Environment is the life support system including air, water, soil, noise etc. Environment provides all the basic requirements for the livelihood of living beings. But the civic activities are slowly degrading the quality of the environment. For this reason increasing the global temperature, green house effect, low agricultural productivity, spread of wide range of diseases, various environmental calamities like-tornado, cyclone, deforestation, desertification, salinity, flood, fire in forest, acid rain, earthquake etc. are the common phenomenon. In this chapter, the variables for this study air pollution, water pollution, soil pollution and noise pollution are discussed for better understanding.

### **5.2 Explanation of the Variables**

#### **5.2.1 Air Pollution**

Air is one of the most important constituents of man's environment. It is calculated that a man breathes about 22,000 times a day, inhaling about 16 kg of air by weight. Therefore, clean and pure air is very essential for his health and survival. Air pollution means any solid, liquid or gaseous substance present in the atmosphere in such concentrations that may or trend to be injurious to human beings or other living creatures or plants or property or enjoyment. In a very simple sense, air pollution means the presence of air pollutant in the atmosphere (Meenakshi, 2009).

Sources of air pollution: The sources of air pollution are mainly three types, burning of fossil fuel, industrial discharge and emissions from vehicles. Air pollution mainly occurs due to burning of fossil fuel like coal, petroleum etc. and associated black smoke. Over 99% of brick kilns use fossil fuel but do not comply with the "Brick kiln Ordinance" and pollute enormous air. Industries cause air pollution through smoke emission. Agro based industries like sugar, pulp, paper; tanneries and value added industries like textile, garments, pharmaceuticals, oil refineries, and fertilizer and chemical industries are the major contributors for air pollution in Bangladesh. One of the major sources of air pollution in urban areas of Bangladesh is vehicular air pollution. Dhaka has been rated as

one of the most polluted cities of the world. Bangladesh Atomic Energy Commission (BAEC) reports that automobiles in Dhaka emits 100 kg lead, 3.5 tons SPM, 1.5 tons  $SO_2$ , 14 tons HC and 60 tons CO in every day (Alam, 2009). The polluted air affects the plants, animals, materials or human health. Human health may be affected in various ways by polluted air as irritation, respiratory problem, chronic diseases like bronchitis, asthma etc, increasing mortality and morbidity rates; radioactive air pollution may causes cancer and genetic effects (Chowdhury, 2009).

#### **5.2.1.1 Acid Rain**

Generally rain is acidic and it is wet deposition. When a lot amount of acid deposits in rain water then it is called acid rain. A lot of sulphuric acid and nitric acid, less amount of hydrochloric acid are found in acid rain. This acidic water flows over and through the ground; it affects a variety of plants fishes, animals, destroying the buffering capacity of the soils, reducing the necessary elements like calcium (Ca), magnesium (Mg) for the fertility of soil and results in low production. This acid rain also harmful for human health and sometimes it accelerates the decay of buildings materials and paints, including irreplaceable buildings, status and sculptures that are part of our nation's cultural heritage. Natural and manmade factors are engaged in creating the acid rain. Sulfur dioxide ( $SO_2$ ) and Nitrogen Oxides ( $NO_x$ ) are the primary causes of acid rain. Acid rain occurs when these gases react in the atmosphere with water, oxygen and other chemicals from various acidic compounds like nitric acid and sulphuric acid (Tapon et al., 20012).

#### **5.2.1.2 Green House Effect**

The Earth's surface and lower atmosphere causing warm by water vapor, carbon dioxide, and other trace gases continuously. Visible light from the Sun heats the Earth's surface. Part of this energy is radiated back into the atmosphere in the form of infrared radiation, much of which is absorbed by molecules of carbon dioxide and water vapor in the atmosphere and reradiated toward the surface as more heat. The absorption of infrared radiation causes the Earth's surface and lower atmosphere to warm more than they otherwise would, making the Earth's surface habitable. An increase in atmospheric carbon dioxide caused by widespread combustion of fossil fuels may intensify the

greenhouse effect and cause long-term climatic changes. Likewise, an increase in atmospheric concentrations of other trace greenhouse gases such as chlorofluorocarbons, nitrous oxides, and methane resulting from human activities may also intensify the greenhouse effect. From the beginning of the Industrial Revolution through the end of the 20th century, the amount of carbon dioxide in the atmosphere increased 30% and the amount of methane became more than doubled. It is also estimated that the U.S. is responsible for about one-fifth of all human-produced greenhouse-gas emissions (Merriam, 2013).

### **5.2.1.3 Global Warming**

An increase in the average temperatures of the Earth's atmosphere, especially a sustained increase that cause great enough to change in the global climates. The Earth has experienced numerous episodes of global warming through its history, and currently appears to be undergoing such warming. The present warming is generally attributed to an increase in the greenhouse effect, brought about by increased levels of greenhouse gases, largely due to the effects of human activities. Increase in the global average surface temperature resulting from enhancement of the greenhouse effect, primarily by air pollution. In 2007 the UN Intergovernmental Panel on Climate Change forecasted that by 2100 global average surface temperatures would increase 3.2–7.2 °F (1.8–4.0 °C), depending on a range of scenarios for greenhouse gas emissions, and stated that it was now 90 percent certain that most of the warming observed over the previous half century could be attributed to greenhouse gas emissions produced by human activities (i.e., industrial processes and transportation). Many scientists predict that such an increase in temperature would cause polar ice caps and mountain glaciers to melt rapidly, significantly raising the levels of coastal waters, and would produce new patterns and extremes of drought and rainfall, seriously disrupting food production in certain regions. The 1992 Earth Summit and the 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change attempted to address the issue of global warming, but in both cases the efforts were hindered by conflicting national economic agendas and disputes between developed and developing nations over the cost and consequences of reducing emissions of greenhouse gases (Merriam, 2013).



#### **5.2.1.4 Ozone Layer Depletion**

Ozone is a molecule that contains three atoms of oxygen and thus has the formula,  $O_3$ . This ozone layer is being destroyed by the reactions with chlorine, bromine, nitrogen, hydrogen and oxygen gases through catalytic processes. Ozone has the dramatically different effects; depending on where ozone resides, it can protect or harm life on earth. About 15 miles up in the atmosphere, ozone acts as a shield to protect earth's surface from the Sun's harmful ultraviolet radiation. Without this shield, higher levels of UV radiation reach the surface of the earth. Excessive exposure to UV radiation is linked to several health problems in humans, including eye cataracts, skin cancer and weakened immunity. On the other hand, closer to Earth, in the air we breathe, ozone is a harmful pollutant that causes damage to lung tissue, plants and it is a major constituent of smog. Scientists feel the ozone layer should recover, if ozone depleting substances are eliminated. Under the Montreal Protocol—an international agreement to protect the ozone layer—action has been taken to reduce ozone-depleting substances. The build-up of the most significant CFCs in the lower atmosphere has slowed considerably and one of the key chemicals, CFC-11, is now decreasing (Meenakshi, 2009).

#### **5.2.2 Water Pollution**

Water pollution can be defined as the contamination with a foreign substance, either from natural or anthropogenic sources that cause harmful effects on the biota due to their toxicity. It reduces the oxygen level of water, making it aesthetically unsuitable and spreads epidemic diseases (Meenakshi, 2009). The main sources of water pollution in Bangladesh are as industrial waste and effluents, solid waste and sewage disposal, inadequate sanitary facilities, agricultural chemical, pesticides and arsenic contamination. More than 200 rivers of Bangladesh directly or indirectly receive a large quantity of untreated industrial wastes and effluents. Every day approximately 700 tanneries of Dhaka city are discharging about 16,000 cubic meters of toxic wastes. The indiscriminate discharge of solid waste, domestic and hospital sewage are the major sources of water pollution in Bangladesh. About 4,000 to 4,500 tons of solid wastes are disposed of in low lying areas or into river water. These solid wastes are associated with the problems littering on roads, spilling around the bins, clogging of drains, and

indiscriminate dumping on vacant plots that cause serious environmental pollution. More than 500 hospitals and clinics of Dhaka city generate and release hazardous and toxic wastes without any treatment. Inadequate sanitation facilities pose a serious environmental threat that causes great environmental hazards in Bangladesh. Another source of water pollution in Bangladesh is arsenic in ground water poses a serious environmental hazard for Bangladesh. The acceptable level of arsenic in drinking water is 0.05 mg/L for Bangladesh. But some places it is found more than 70 times higher than that standard. About 80 million people are at risk of arsenic contamination. Agricultural chemical and pesticide is also a major source of water pollution. The movement of rain or irrigation water over land picks up pollutants such as fertilizers, herbicides and insecticides and carries them into rivers, lakes, reservoirs, coastal waters or ground water (Alam, 2009).

### **5.2.3 Soil Pollution**

The root the waste problems in land lie in the leachates and mounting amount of wastes. These leachates which ooze out of the garbage heap are known to move slowly through the layers of the soil beneath and contaminate the soil structure and the water resources deep down the land and reduce the productivity of soil, then that is called soil pollution (Meenakshi, 2009). Among the most significant causes of soil pollution is the enormous volume of industrial waste which is being produced every day but not disposed properly. The mismanagement of house hold wastes, particularly the polythene shopping bags, has caused serious threat to the soil and drainage system. Another cause for soil pollution is the use of agricultural pesticides, fertilizers etc. Sometimes fuel leakages from automobiles washed away by rain and seep into nearly soil. Over use of pesticides and fertilizers has lead to soil pollution (Shams et.al, 2012).

### **5.2.4 Noise Pollution**

When sound becomes loud or disagreeable, results in physiological or psychological harm and damaging human hearing and causes heart diseases that it is called noise pollution. The sources of noise pollution are two categories-manmade and natural. The natural sources of noise pollution are limited like lightning sound and thunder. But

manmade sources may be in many ways such as aircraft, road traffic, railroads, construction, industry, pop music, consumer product etc. The effect of noise pollution classified into two categories as psysiological effect and psychological effects. Physiological effects may result in increase in heart beat, increase in blood pressure, narrowing arteries, impairment of night vision, headache by dilating blood vessels of brain and psychological effect may cause depression and fatigue, insomnia, straining of sense and annoyance, emotional disturbance etc. (Meenakshi, 2009).

### **5.3 Conclusion**

The natural resources interact with each other and with the products of human activities continuously, the environmental conditions are due to the threats posed by the unsustainable development. The consequences of these threats are intensive and mostly irreversible and for this reason a clear understanding is needed for preventing the damages. For the sustainable economic development it is necessary to proper utilization of air, water, soil, energy etc. along with the services such as population control, recycling of materials, climate control, waste management, biodiversity conservation, pest and diseases control etc.

## Chapter 6: Data Description

### 6.1 Introduction

Data from primary survey and secondary sources are used for this research. Data of primary survey are collected from the students of secondary level formal education about their knowledge, attitude and practice regarding environmental pollution. Views of the respective school teacher on the proposed study are also collected. By the observation schedule researcher himself collected data from the allied institutions adopting observation checklist. For the enrichment of the research, secondary data of 37 years (1974-2010) on five series, namely  $CO_2$  emission from various sources, literacy rate of the total population, percentage education share in GDP, industry and transport share in GDP of Bangladesh are used. This chapter has described the nature, trends and sources of data using tables and graphs. Secondary data are collected from the World Development Indicators, Bangladesh Economic Reviews, and Bangladesh Bureau of Statistics.

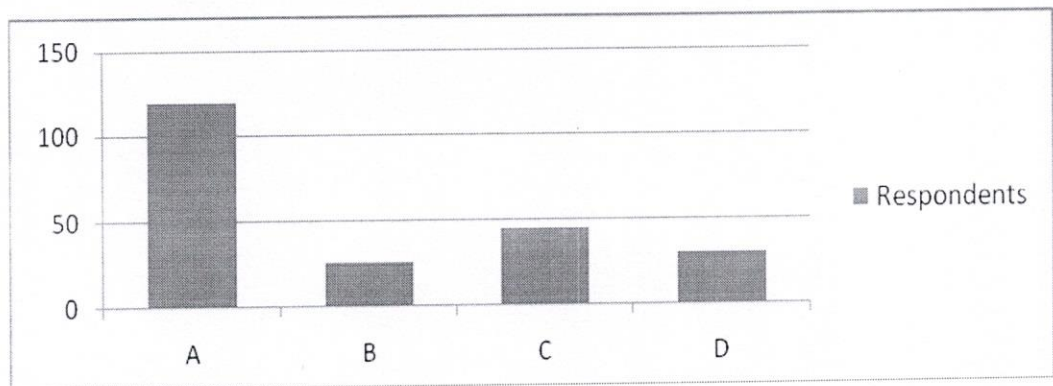
There are many kinds of environmental pollution, such as air pollution, water pollution, soil pollution, noise pollution etc. Following tables and figures reveal the knowledge, practice and attitude of respondents about environmental pollution. There also have the views of 50 teacher respondents about the environmental education and awareness taken from the related institutions. Data are collected by questionnaire survey from secondary level formal educational institution of Dhaka and Rajshahi division, their perceptions are presented in this chapter.

## 6.2 Environmental Knowledge Regarding Air Pollution of the Respondents

**Table 6.1: Students were Asked What they Mean by Air Pollution**

Definition of Air Pollution	Respondents	
	Number	%
A) Atmospheric condition in which various substances are present at concentrations high enough above their normal ambient levels to produce a measurable effect to people, animals, vegetation or materials.	120	54.55 %
B) Atmospheric condition with a foreign substance either from natural anthropogenic sources that cause harmful effects on the biota due to their toxicity.	25	11.36 %
C) Air pollution can be defined as an accumulation of unusable heat from human activities that disrupts ecosystems in the natural environment and described in context to local problems, as on global basis, the change in heat is insignificant.	45	20.45 %
D) Air pollution means any solid, liquid or gaseous substances present in the atmosphere in such concentrations that may or trend to be injurious to human beings or other living creatures or plants or property or enjoyment.	30	13.64 %
	220	100%

**Figure: 6.2.1 Definition of Air Pollution**

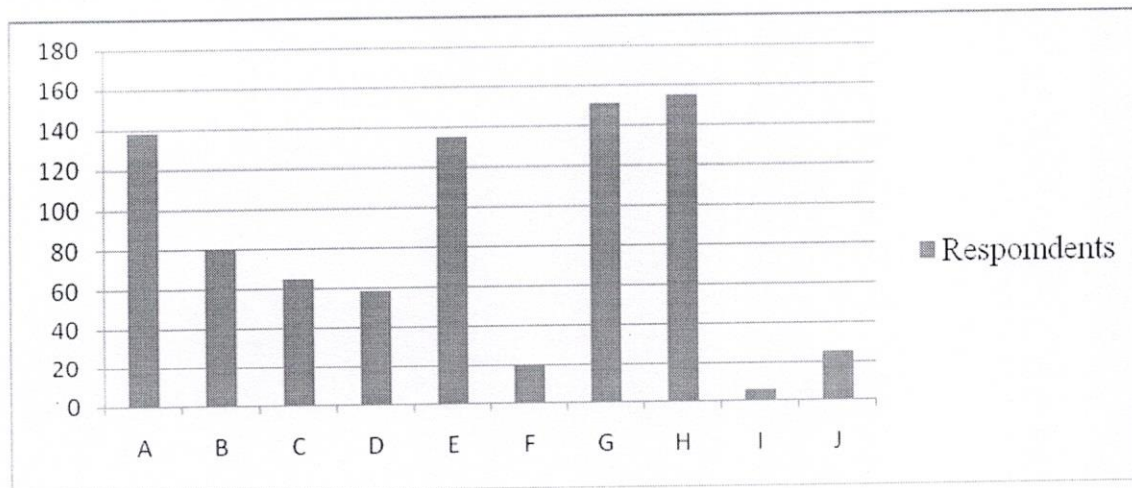


Note: A, B, C, and D are define in Table 6. 1

Respondents were asked what they mean by air pollution. Among them 54.55 % respondents defined air pollution correctly and the rest of 45.45 % of the respondents does not have the clear idea about air pollution. It is shown in Table 6.1 and Figure 6.2.1 that the bar diagram 'A' represents 54.55 % of respondent's correct views.

Factors or sources of air pollution	Total Respondents	Respondents	
		Number	%
A) Industrial and urban wastes	220	138	62.73 %
B) Radioactive pollutants	220	80	36.36 %
C) Agricultural pesticides	220	65	29.55 %
D) Domestic sewages and turn off	220	58	26.36 %
E) Burning of fossil fuel	220	135	61.36 %
F) Industrial plants	220	20	9.09 %
G) Brick kilns	220	151	68.64 %
H) Vehicles	220	155	70.45 %
I) Construction sites	220	5	2.27 %
J) Industrial effluents and sewage	220	25	11.36 %

**Figure 6.2.2: Factors or Sources of Air Pollution**



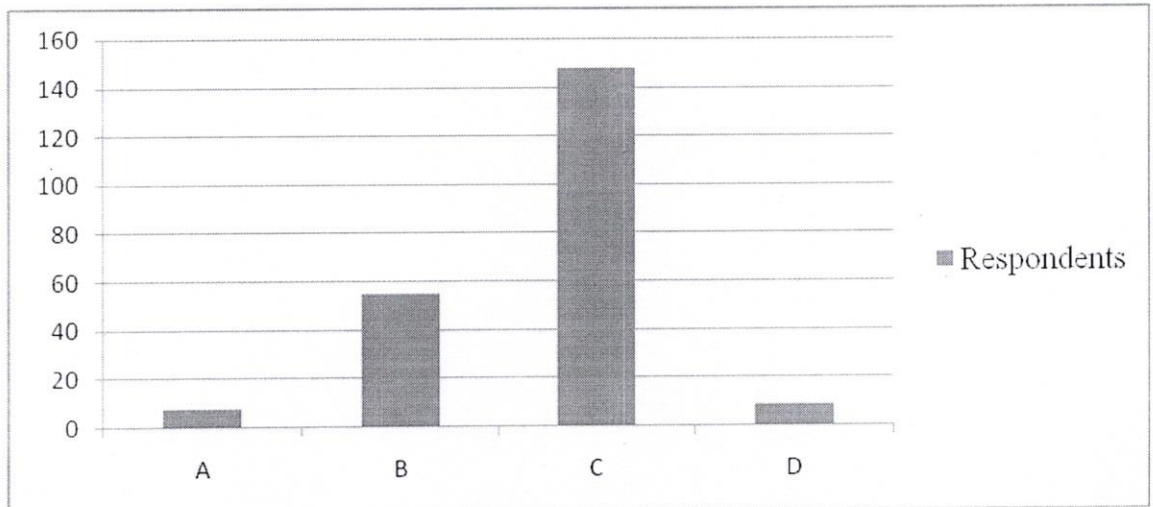
Note: A, B, C, D, E, F, G, H, I and J are defined in Table 6.2

Students were asked about the sources or factors of air pollution. Among them 62.73 % respondents viewed industrial and urban wastes as a source of air pollution, 36.36 % respondents mentioned radioactive pollutants, 61.36 % respondents said that burning of fossil fuel, and 68.64 % respondents mentioned brick kilns and 70.45 % respondents mentioned that vehicles are the most responsible factors of air pollution. From the Table 6.2 and Figure 6.2.2, it is shown that Industrial and urban wastes, burning of fossil fuel, brick kilns and vehicles are the most responsible factors of air pollution.

**Table 6.3: Students were Asked to Identify the Air Pollutants from Vehicles**

Pollutants from Vehicles	Respondents	
	Number	%
A) Particulate matter (PM)	8	3.64 %
B) Volatile Organic Compounds (VOC <sub>x</sub> )	55	25.00 %
C) Carbon monoxide (CO)	148	67.27 %
D) Oxides of Nitrogen (NO <sub>x</sub> )	9	4.09 %
Total	220	100 %

**Figure 6.2.3: Pollutants from Vehicles**

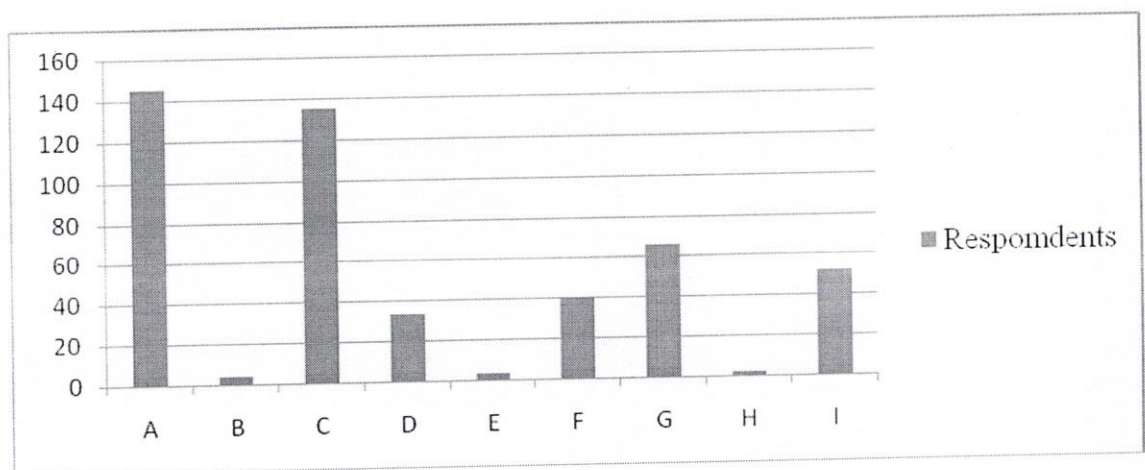


Note: A, B, C and D are defined in Table 6. 3

Respondents were asked to identify the air pollutants from vehicles and their opinions are given in Table 6.3. Among the respondents 3.64 % viewed particulate matter (PM), 25% respondents mentioned volatile organic compounds (VOC<sub>x</sub>), 67.27 % respondents mentioned that carbon monoxide (CO), and 4.09% said that the oxides of nitrogen (NO<sub>x</sub>) are the source of air pollutant from vehicles. Figure 6.2.3 shows that carbon monoxide is the most responsible pollutants from vehicles.

Consequences or Impact	Total Respondents	Respondents	
		Number	%
A) Atmosphere will become extreme hot	220	145	65.91 %
B) Atmosphere will be extreme cold	220	4	1.82 %
C) Many diseases like asthma, skin cancer etc. will increase	220	135	61.36 %
D) Carbon dioxide and carbon monoxide will decrease	220	33	15.00 %
E) Rain fall will increase	220	3	1.36 %
F) Deforestation will increase	220	40	18.18 %
G) Sea level will increase	220	66	30.00 %
H) Growth of Population will increase	220	2	0.91 %
I) Industrial and agricultural productivity will decrease	220	52	23.64 %

**Figure 6.2.4: Impacts of Air Pollution**



Note: A, B, C, D, E, F, G, H, and I are defined in Table 6.4

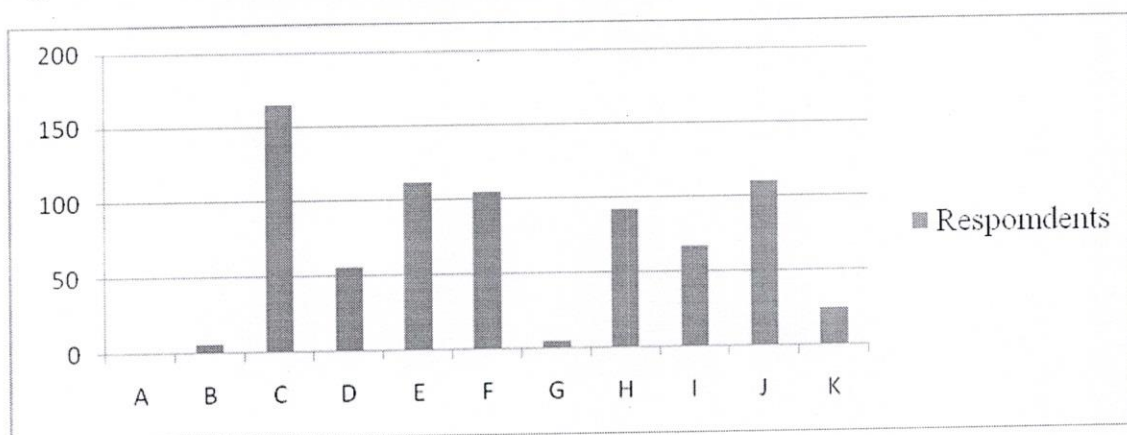
Questions were asked about the consequences of air pollution. In Table 6.4, among them 65.91% respondent viewed atmosphere will extreme hot, 61.36% respondents mentioned that many diseases like asthma, skin cancer etc. will increase, 15% respondents mentioned carbon dioxide and carbon monoxide will decrease, 18.18% mentioned deforestation will increase, 30% students said that sea level will increase, and 23.64 %



mentioned industrial and agricultural productivity will decrease. According to the respondents, the most important impact of air pollution is ‘atmospheres will extreme hot and many diseases like asthma, skin cancer etc. will increase’ shown in diagram A.

Initiatives for reducing air pollution	Total Respondents	Respondents	
		Number	%
A) By political speech	220	00	00 %
B) Avoiding the use of vehicles	220	6	2.73 %
C) Adopting various environmental rules and regulations	220	165	75.00 %
D) Less use of motor vehicles	220	56	25.45 %
E) Avoiding vehicles older than 20 years	220	112	50.91 %
F) Using proper lubricants	220	105	47.73 %
G) Reducing the number of vehicles on streets	220	5	2.27 %
H) Using CNG and LPG	220	92	41.82 %
I) Imposing extensive penalties on polluters	220	67	30.45 %
J) Relocating hazardous industries like brick kilns	220	110	50.00 %
K) Destruction of pathogens by proper treatment	220	25	11.36%

**Figure 6.2.5: Initiatives for Reducing Air Pollution**



Note: A, B, C, D, E, F, G, H, I, J, and K are defined in Table 6.5

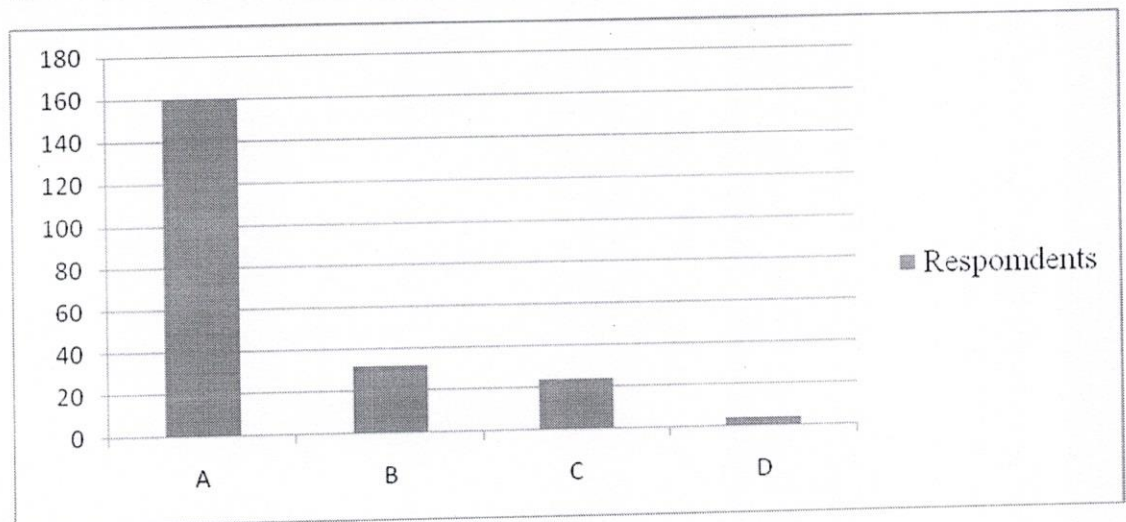
Students were asked how air pollution can be reduced. Table 6.5 and Figure 6.2.5 shows that 75 % respondents mentioned adopting various environmental rules and regulations,

25.45 % respondents mentioned less use of motor vehicles, 50.91 % students told that avoiding vehicles older than 20 years, 41.82 % said that using CNG and LPG, 47.73% students said that using proper lubricants, 30.45% mentioned imposing extensive penalties on polluters and 50% respondents mentioned relocating hazardous industries like brick kilns away from human habitations as the measures for reducing air pollution.

**Table 6.6: Students were Asked to Define Greenhouse Effect**

Definition of Green House Effect	Respondents	
	Number	%
A) Greenhouse effect is a warming of the Earth's surface and lower atmosphere that trends to intensify with an increase in atmospheric carbon dioxide.	160	72.73 %
B) The greenhouse effect means warming inside the house, formed with glassy shed so that man and other animal can live within the house with comfort fully.	32	14.55 %
C) The greenhouse effect is a system by which man make his residence to live in so that he can protect himself from the adverse impact of winter.	24	10.91 %
D) Greenhouse effect means the protection from the wild animal in wintered country, the houses made with hard glass in which man can easily live.	4	1.82 %
Total	220	100 %

**Figure 6.2.6: Definition of Greenhouse effect**

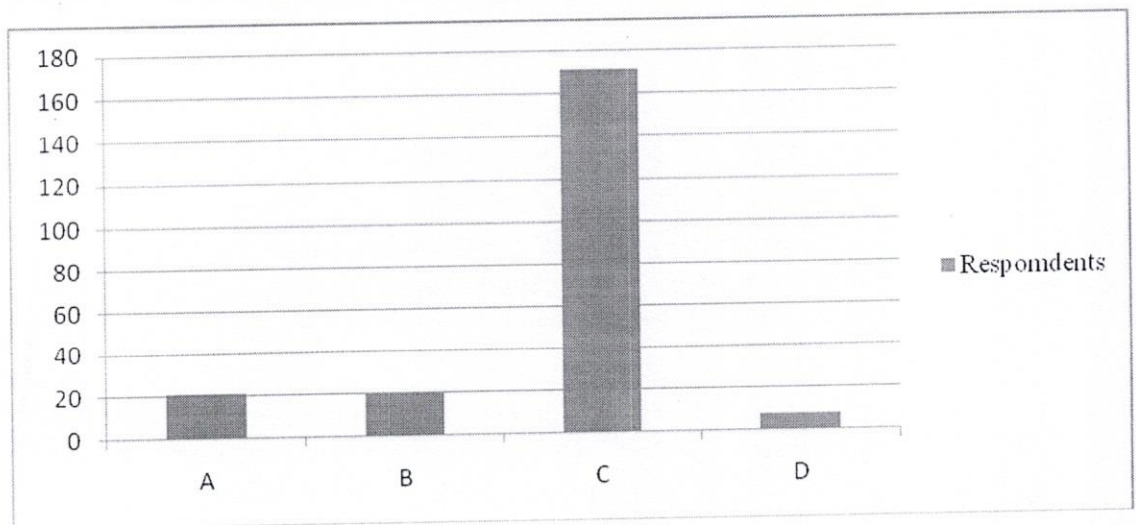


Note: A, B, C and D are defined in Table 6.6

Respondents were asked to define Greenhouse Effect (GHE). Among them 72.73% respondents define green house effect correctly that is represented by bar diagram 'A'. The rests 27.27% respondents do not have the clear concept about green house effect.

<b>Table 6.7: Consequences of Green House effect</b>		
Consequences or Impact	Respondents	
	Number	%
A) Atmosphere will be extreme cold and sea level will decrease	21	9.55 %
B) Biodiversity will increase in atmosphere	20	9.09 %
C) Atmosphere will be extreme hot and low land will submerge by sea	171	77.73 %
D) There will be no change in atmosphere	8	3.64 %
Total	220	100 %

**Figure 6.2.7: Consequences of Greenhouse effect**



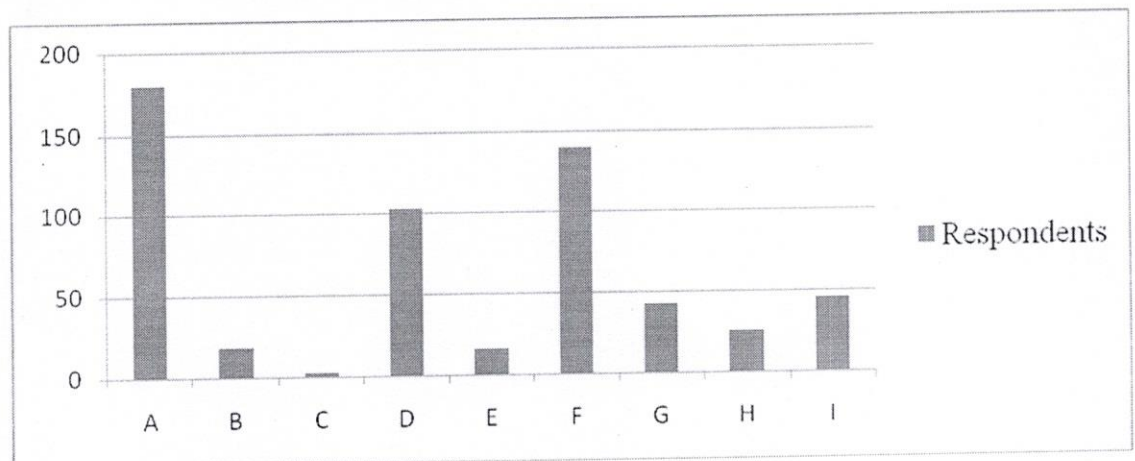
Note: A, B, C and D are defined in Table 6.7

Question was asked to the respondents about the consequences of green house effect. Among them, 9.55 % respondents said that atmosphere will be extreme cold and sea level will decrease, 9.09 % mentioned that biodiversity will increase in atmosphere, 77.73 % respondent told that atmosphere will be extreme hot and low land will submerge by sea and 3.64 % said that there will be no change in atmosphere. Figure 6.2.7 shows

the bar diagram C representing 77.73 % respondents' perception for the green house effect that atmosphere will be extreme hot and low land will be submerged by sea.

Green House Gases	Total Respondents	Respondents	
		Number	%
A) Carbon dioxide ( $CO_2$ )	220	180	81.82 %
B) Water Vapor	220	18	8.18 %
C) Oxygen( $O_2$ )	220	2	0.91 %
D) Methane ( $CH_4$ )	220	102	46.36 %
E) Hydrogen ( $H_2$ )	220	16	7.27 %
F) C. F. C (Chloroflouro carbon)	220	140	63.64 %
G) Nitrous Oxide (NOx)	220	42	19.09 %
H) Particulate matter (PM)	220	25	11.36 %
I) Ozone ( $O_3$ )	220	45	20.45 %

**Figure 6.2.8: Green House Gases**



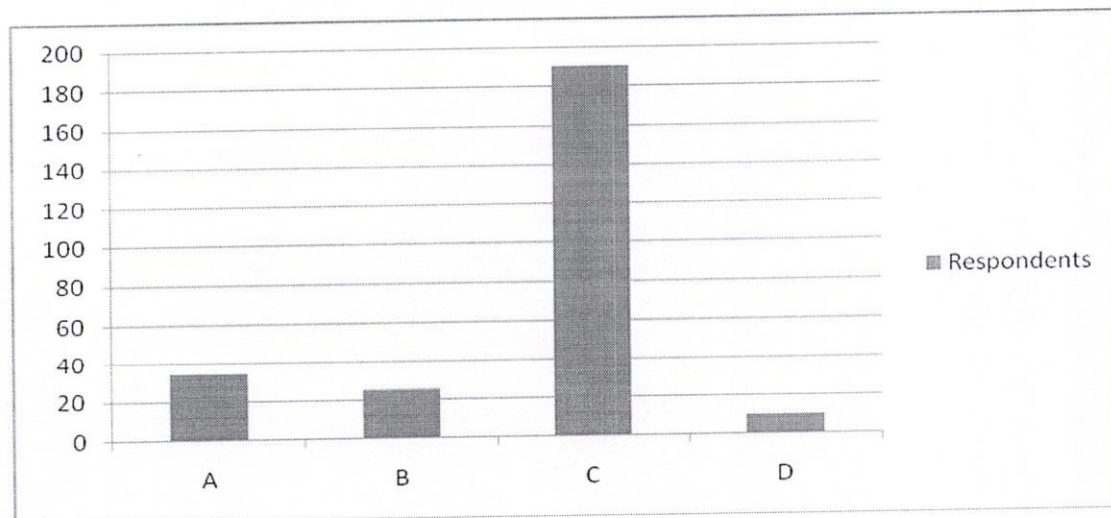
Note: A, B, C, D, E, F, G, H, and I are defined in Table 6.8

Students were asked which are green house gases and responsible for heating atmosphere. Table 6.8 shows that 81.82 % respondents mentioned Carbon Dioxide ( $CO_2$ ), 46.36% students said that Methane ( $CH_4$ ), 63.64% respondents mentioned C. F.

C (Chloroflouro carbon), 19.09 % said that Nitrous Oxide ( $NO_x$ ), 11.36% mentioned Particulate Matter (PM), and 20.45 % respondents mentioned that Ozone ( $O_3$ ) are responsible for heating atmosphere. This is shown in Figure 6.2.8 that A, D and F diagrams represent the most responsible gases for green house effect.

Initiatives	Number of respondents	%
A) Establishment of Oxygen plant	34	15.45 %
B) By deforestation	5	2.27 %
C) By forestation	190	86.36 %
D) By increasing the use of $CO_2$	9	4.09 %
Total	220	100 %

**Figure: 6.2.9 Measures for Preventing Carbon Dioxide**

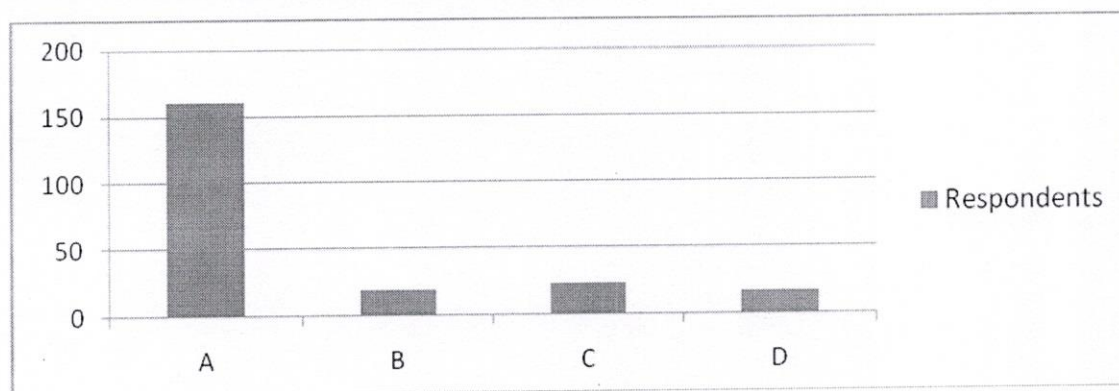


Note: A, B, C and D are defined in Table 6.9

Table 6.9 shows the initiatives for preventing  $CO_2$  increase mentioned by the respondents. Among them 15.45% said Establishment of Oxygen Plant, 2.27 % mentioned deforestation, 86.36% respondents told a forestation and the rest of 4.09 % respondents said increase the use of  $CO_2$  as the measure for preventing  $CO_2$  increase. According to their suggestions in Figure 6.2.9, we find that forestation is the best way to prevent  $CO_2$  increase.

<b>Table 6.10: Students were Asked what they mean by Water Pollution</b>		
Definition of Water Pollution	Respondents	
	Number	%
A) Water pollution is the contamination with a foreign substance, either from natural or anthropogenic sources that cause harmful effects on the biota due to their toxicity, reduces oxygen level in water, making it aesthetically unsuitable and spreads epidemic diseases	160	72.73 %
B) Water pollution can be defined as the problems in land lies in the leach and mounting amount of wastes that ooze out of the garbage heap are known to move slowly through the layers of soil beneath and contaminate the water resources deep down the land	19	8.64 %
C) Water pollution means any solid, liquid or gaseous substances present in the atmosphere in such concentrations that may or trend to be injurious to human beings or other living creatures or plants or property or enjoyment	24	10.91 %
D) It can be defined as an accumulation of unusable heat from human activities that disrupt ecosystem in the natural environmental and described in context to local problems, and on the global basis, the change in heat is insignificant	17	7.73 %
Total	220	100 %

**Figure 6.2.10: Definition of Water Pollution**

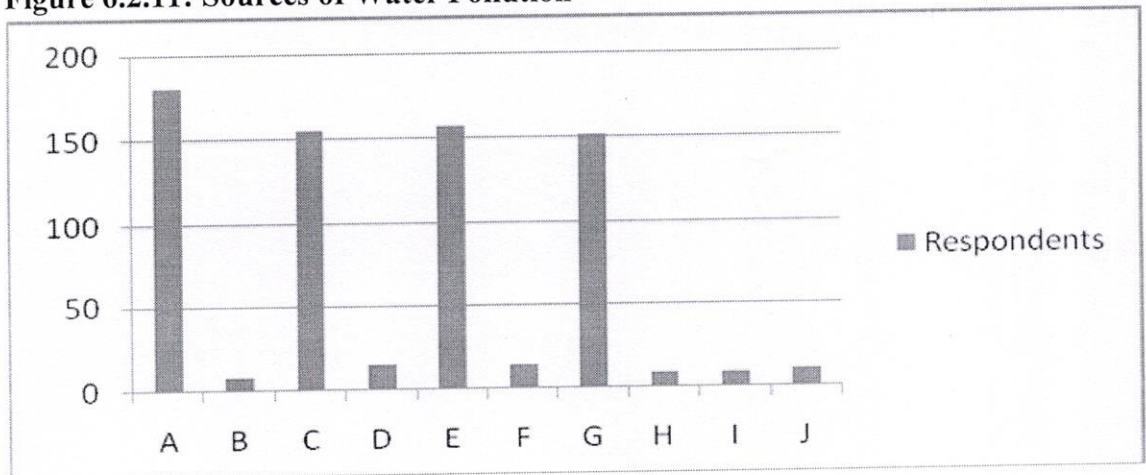


Note: A, B, C and D are defined in Table 6.10

Table 6.10 shows that 72.73% respondents define water pollution correctly that is mentioned in diagram A and the rest 27.27% students do not have the clear idea about water pollution.

Factors or Sources	Total Respondents	Number of Respondents	%
A) Industrial garbage	220	180	81.82 %
B) Vehicles and suspended particulate matter (SPM)	220	8	3.64 %
C) Unsanitary latrines	220	155	70.45 %
D) Burning of fossil fuels	220	15	6.82 %
E) Littering and dumping of rubbish in water	220	157	71.36 %
F) Brick kilns	220	14	6.36 %
G) Agricultural Chemical and Pesticides	220	152	69.09 %
H) Volatile Organic Compounds (VOCx)	220	9	4.09 %
I) Dust and Construction sites	220	9	4.09 %
J) Oxide of Sulfur and Nitrogen	220	11	5.00 %

**Figure 6.2.11: Sources of Water Pollution**

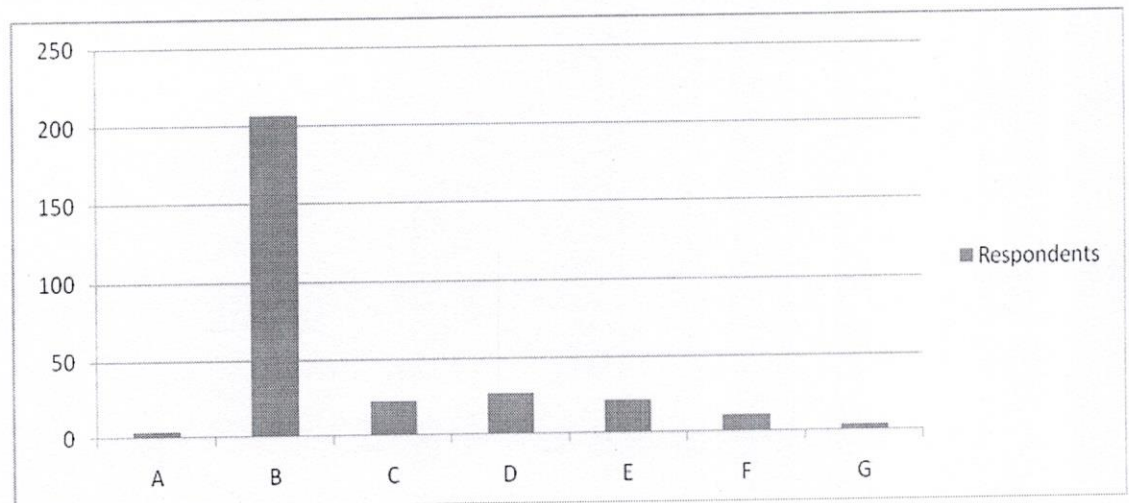


Note: A, B, C, D, E, F, G, H, I and J are defined in Table 6.11

Table 6.11 shows that 81.82 % students mentioned industrial garbage as a sources of water pollution, 70.45 % respondents said unsanitary latrines are responsible for water pollution. Among them 71.36 % mentioned littering and dumping of rubbish in water and 69.09 % of them mentioned agricultural chemical are the cause of water pollution. They mentioned correctly in Figure 6.2.11 that the diagram A, C, E and G are most responsible for polluting water.

Consequences or Impact	Total Respondents	Number of Respondent	%
A) Atmosphere will become extreme hot	220	4	1.82 %
B) Many diseases like diarrhea, dysentery, arsenicosis etc. will increase	220	207	94.09 %
C) Sea level will increase and agricultural productivity will decrease	220	22	10.00 %
D) Deforestation and soil erosion will increase	220	26	11.82 %
E) Many diseases like asthma, cancer will increase	220	21	9.55 %
F) Cyclone and tidal waves will increase	220	11	5.00 %
G) Biodiversity will increase	220	4	1.82 %

**Figure 6.2.12: Consequences or Impact of Water Pollution**



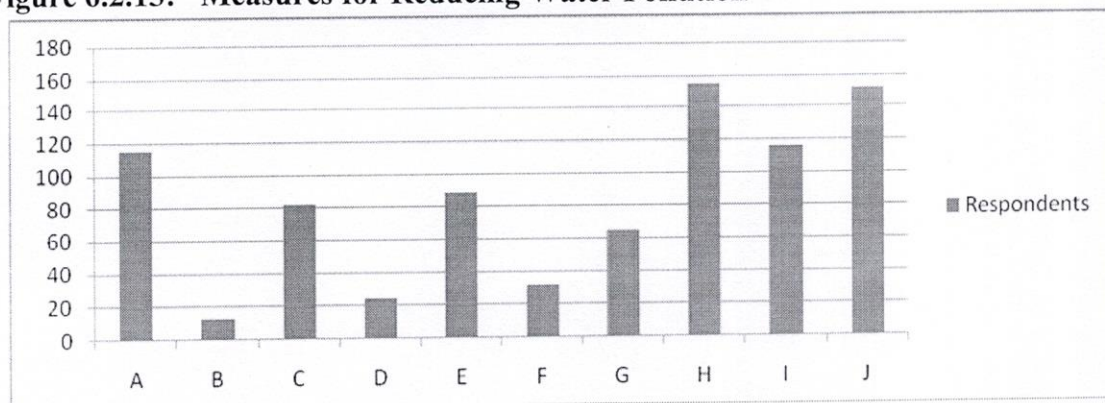
Note: A, B, C, D, E, F, and G are defined in Table 6.12

Table 6.12 shows that the most of 94.09 % respondents viewed as many diseases like diarrhea, dysentery, arsenicosis etc. will increase for water pollution. Among the respondents 10 % told that sea level will increase and agricultural productivity will decrease, 11.82 % respondents said deforestation and soil erosion will increase for water pollution and 9.55 % students mentioned that many diseases like asthma, cancer will increase due to water pollution. It is shown in Figure 6.2.12 that the bar-diagram B represents the most impact of water pollution.



Initiatives or Measures	Total Respondents	Respondents No.	%
A) Proper planning of industrial areas like zoning	220	115	52.27 %
B) Reducing the number of vehicles on streets	220	12	5.45 %
C) Creating high boundaries of water bodies	220	82	37.27 %
D) Relocating of hazardous industries like brick kilns to areas away from human habitations	220	24	10.91 %
E) Using Organic fertilizers	220	88	40.00 %
F) Destruction of pathogens by proper treatment	220	31	14.09 %
G) Imposing extensive penalties on polluters	220	64	29.09 %
H) Industrial and house hold wastes must not be disposed in river or lack	220	155	70.45 %
I) Integrated pest management and not using of harmful chemical and pesticides	220	116	52.73 %
J) Establishing Effluent Treatment Plant (ETP) in industry	220	152	69.09 %

**Figure 6.2.13: Measures for Reducing Water Pollution**



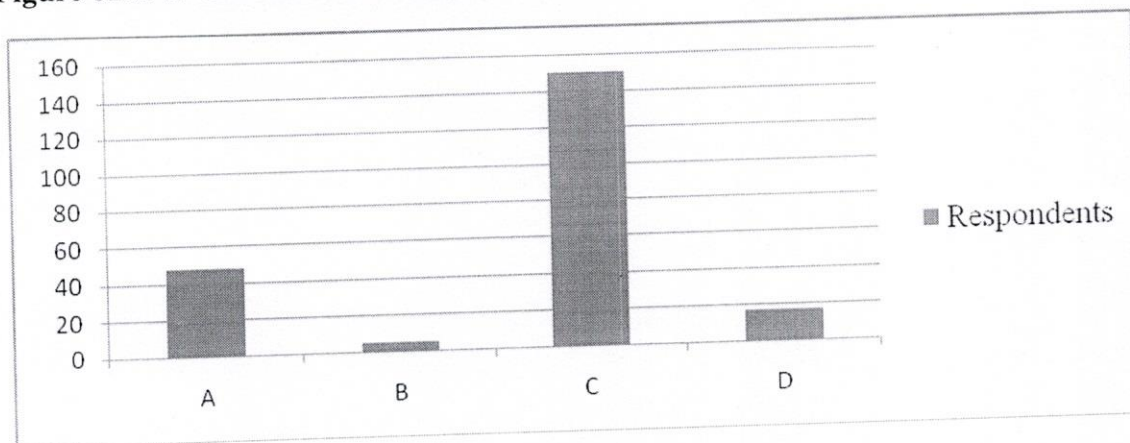
Note: A, B, C, D, E, F, G, H, I and J are defined in Table 6.13

Table 6.13 describes that 52.27 % students viewed measures for reducing water pollution as proper planning of industrial areas like zoning, 70.45 % respondents mentioned industrial and house hold wastes must not be disposed in river or lack, 52.73 % students said integrated pest management and not using of harmful chemical and pesticides as a measure of reducing water

pollution and 69.09 % respondents told that establishing effluent treatment plant (ETP) in industry is an another measures for reducing water pollution. This is shown in Figure 6.2.13 that the diagram A, H, I and J are the more effective way to reduce water pollution mentioned by the students.

Definition of Soil Pollution	Number of Respondents	%
A) It means any solid, liquid or gaseous substances present in the soil in such concentrations that may or trend to be injurious to human beings or other living creatures	48	21.82%
B) It means as metallic and radioactive pollutant, construction sites, dumping of rubbish mixing with soil	5	2.27 %
C) Enormous volume of industrial and household wastes, polythene shopping bags, paper plastic that are threat to soil and drainage system, over use of agricultural pesticides, fertilizers that reduces the fertility of top soil is called soil pollution	150	68.18%
D) It consists of highly heterogenous mass of discarded material from the urban community as well as more homogeneous accumulation of agricultural, industrial and mining wastes in soil	17	7.73 %
Total	220	100 %

**Figure 6.2.14: Definition of Soil pollution**

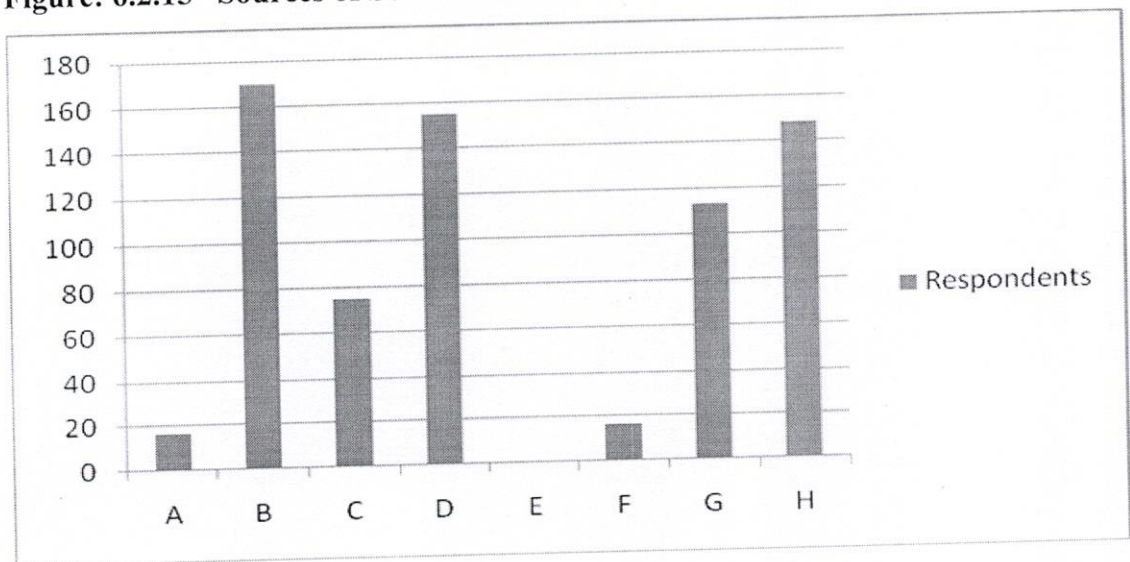


Note: A, B, C and D are defined in Table 6.14

Table 6.14 shows that 68.18% students defined soil pollution correctly and rest 31.82% has not the clear idea about soil pollution that is shown in bar diagram C.

Sources	Total Respondents	Number of Respondents	%
A) Burning of fossil fuel	220	16	7.27 %
B) Polythene bags	220	170	77.27 %
C) Domestic sewages	220	75	34.09 %
D) Agricultural pesticides	220	155	70.45 %
E) Road traffic congestion	220	00	00 %
F) Vehicular emissions	220	16	7.27 %
G) Industrial and house hold garbage	220	113	51.36 %
H) Chemical fertilizers	220	148	67.27 %

**Figure: 6.2.15 Sources of Soil Pollution**

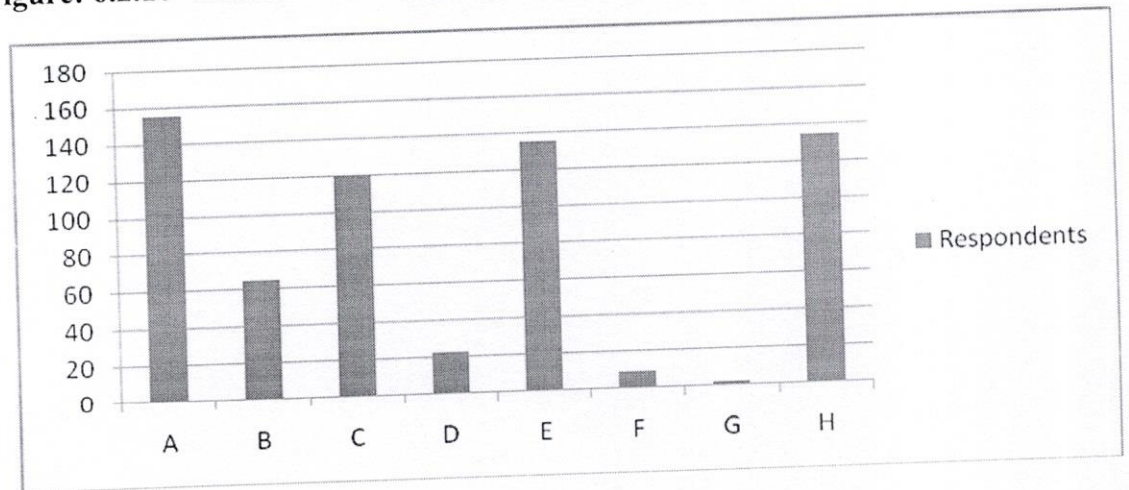


Note: A, B, C, D, E, F, G, and H are defined in Table 6.15

Table 6.15 shows that 77.27 % students identified the polythene bags are responsible sources of soil pollution, 70.45 % respondents mentioned agricultural pesticides, 51.36% respondents said that industrial and house hold garbage and 67.27% students mentioned chemical fertilizers as the sources of soil pollution. It is shown in Figure 6.2.15 by the diagram A, D, G and H.

Initiatives	Total Respondents	Respondents No.	%
A) Recycling papers, plastics and other materials	220	155	70.45 %
B) Imposing extensive penalties on polluters	220	65	29.55 %
C) Using natural fertilizers	220	120	54.55 %
D) Destruction of pathogens by proper treatment	220	23	10.45 %
E) By planting trees and reforestation	220	135	61.36 %
F) Using proper lubricants in vehicles	220	9	4.09
G) By political speech	220	2	0.91
H) By adopting various environmental laws	220	134	60.91%

**Figure: 6.2.16 Initiatives for Reducing Soil Pollution**

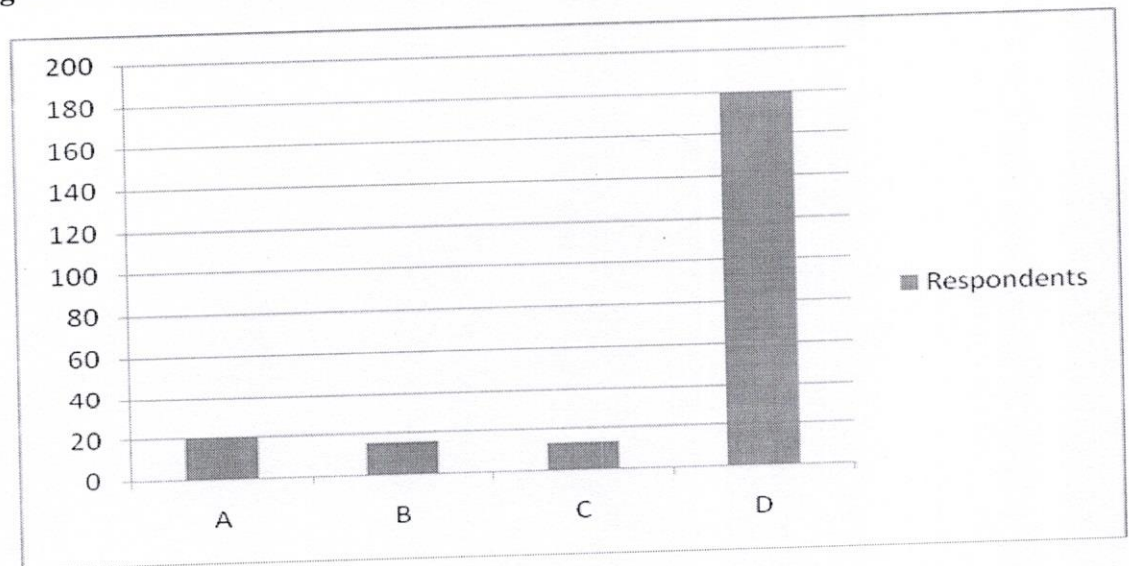


Note: A, B, C, D, E, F, G, and H are defined in Table 6.16

Respondents were asked for the initiatives of reducing soil pollution and their opinions are given in Table 6.16. Results indicate that 70.45 % respondents mentioned recycling paper, plastics and other materials, 29.55% students said that imposing extensive penalties on polluters, 54.55% respondents mentioned that using natural fertilizers, 61.36% told that by planting trees and reforestation, and 60.91% respondent said that by adopting various environmental laws as the measures for reducing soil pollution. Bar diagrams A, C, E, and H show the more important measures for reducing soil pollution mentioned by the respondents.

Table 6.17: Respondents were Asked to Know the Roles of Forest to Keep the Balance of Environment		
Roles	Number of Respondent	%
A) Forest controls the direction of wind	20	9.09 %
B) Forest protects from green house effects	15	6.82 %
C) Forest helps to keep environment cool	13	5.91 %
D) All the above	180	81.82 %
Total	220	100 %

**Figure 6.2.17: Role of Forest for keeping the Balance of Environment**

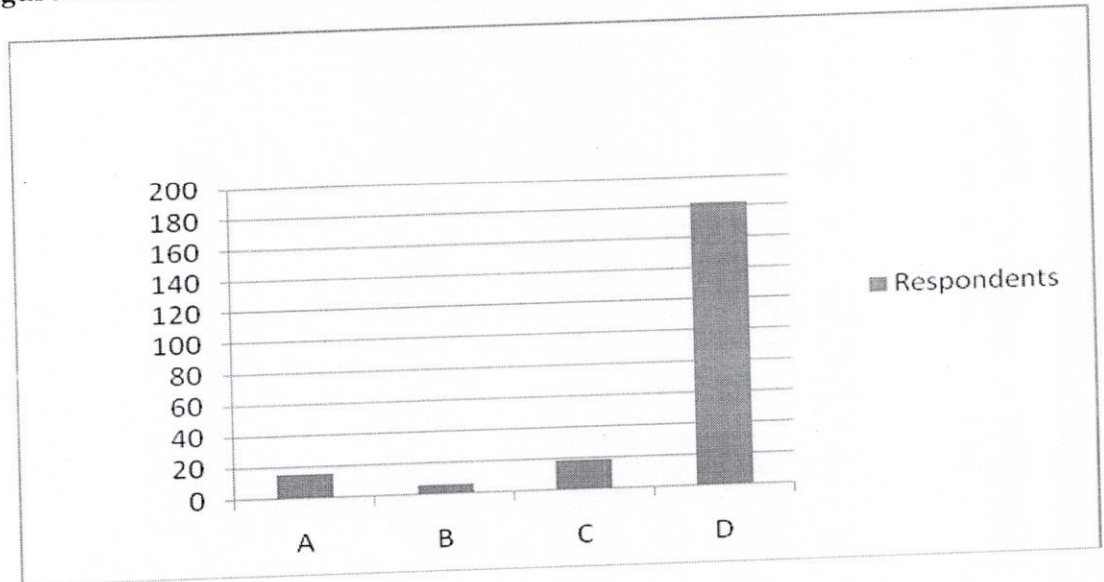


Note: A, B, C and D are defined in Table 6.17

Table 6.17 and Figure 6.2.17 show the views of respondents about the role of forest for keeping the balance of environment. About 9.09 % respondents think that forest controls the direction of wind; 6.82% mentioned forest protects from green house effects, 5.91 % respondents mentioned that forest helps to keep environment cool and the rest 81.82% think that forest plays the entire role mentioned in Table 6.17 for keeping the balance of environment.

Definition of Noise Pollution	Number of Respondents	%
A) Traffic congestion, volatile organic compounds (VOCx), Industrial and vehicular pollution are known as noise pollution	15	6.82 %
B) Metallic and radioactive pollutant, construction sites, dumping of rubbish etc. are known as noise pollution	5	2.27 %
C) Sound of road traffic, construction, industry, coal-fired power plants, consumer products are known as noise pollution	18	8.18 %
D) When sound becomes loud or disagreeable, resulting in physiological or psychological harm and damaging human hearing and causes heart diseases is called noise pollution	182	82.73 %
Total	220	100 %

**Figure 6.2.18: Definition of Noise Pollution**

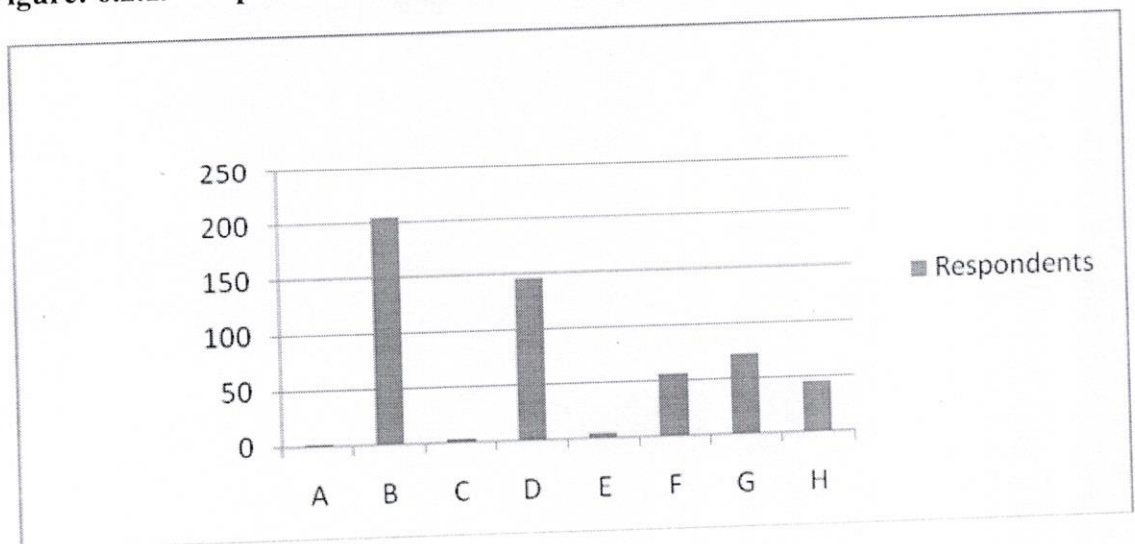


Note: A, B, C and D are defined in Table 6.18

Respondents were asked to define noise pollution in Table 6.18. Among them 82.73% respondents defined it correctly that is demonstrated by bar diagram D and the rests 17.27 % respondents do not have the clear idea about noise pollution.

Responsible Elements	Total Respondents	Number of Respondents	%
A) Sound of cyclone	220	2	0.91 %
B) High volume music	220	205	93.18 %
C) Sound of birds and animals	220	3	1.36 %
D) Hydraulic motor horn	220	146	66.36 %
E) Sound of tidal and tornado	220	4	1.82 %
F) Sound of air craft	220	55	25.0 %
G) Sound of brick kilns	220	71	32.27 %
H) Sound of rocket engine	220	45	20.45 %

**Figure: 6.2.19 Responsible Elements for Noise Pollution**



Note: A, B, C, D, E, F, G, and H are defined in Table 6.19

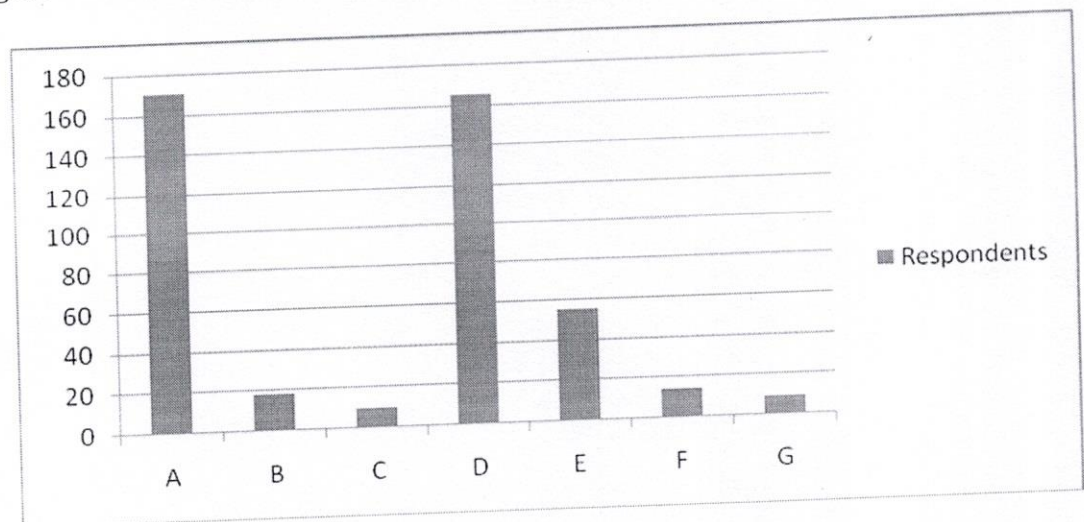
Respondents were asked to mention the sources of noise pollution. Table 6.19, shows that 93.18% respondents mentioned high volume music, 66.36% said that hydraulic

motor horn, 25% students mentioned the sound of air craft, 32.27 % told that sound of brick kilns and 20.45% mentioned sound of rocket engine are the more responsible elements for noise pollution. So, according to them in Figure 6.2.19, high volume music and hydraulic motor horn are most responsible for creating noise pollution.

**Table 6.20: Diseases That are Created from Noise Pollution**

Diseases	Total Respondents	Number of Respondents	%
A) Impairment of hearing	220	170	77.27
B) Respiratory problem	220	18	8.18
C) Cancer and genetic effects	220	10	4.45
D) High blood pressure and heart diseases	220	165	75.0 %
E) Headache and fever	220	55	25.0 %
F) Stomach pain	220	14	6.36
G) Bronchitis, asthma, throat irritation	220	9	4.09 %

**Figure 6.2.20: Diseases Created from Noise Pollution**



Note: A, B, C, D, E, F, and G are defined in Table 6.20

Table 6.20 and Figure 6.2.20 show the views of respondents regarding the diseases which are created from noise pollution. Among them 77.27 % respondents mentioned that the impairment of hearing, 75 % said that high blood pressure and heart diseases, 25

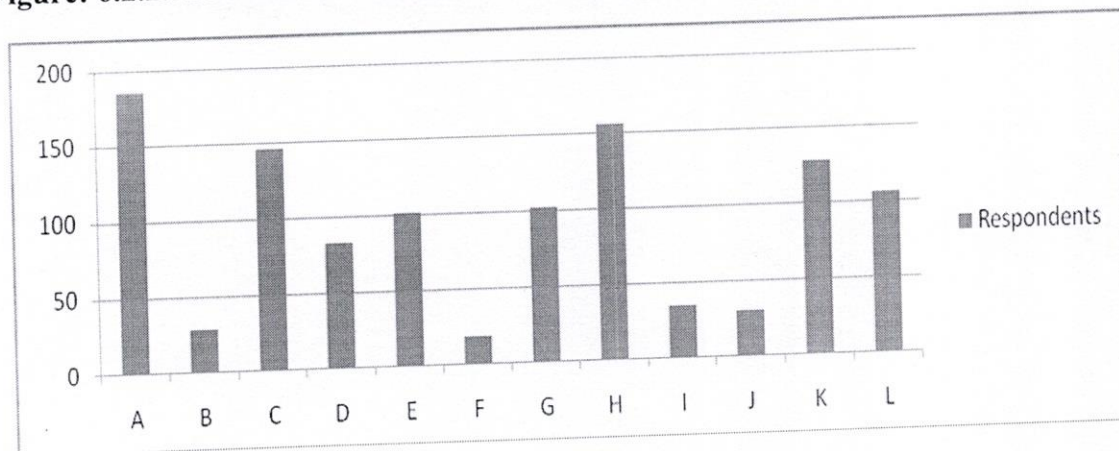


% said that headache and fever, 6.36 % said the stomach pain, 4.09 % mentioned that bronchitis, asthma, throat irritation causes from noise pollution. So, impairment of hearing, high blood pressure and heart diseases are the most important effects of noise pollution.

**Table 6.21: Students were Asked to Mention some Natural Hazards Related to Our Environments**

Hazards	Total Respondents	Number of Respondents	%
A) Flood	220	185	84.09 %
B) Fire in forest	220	28	12.73 %
C) Drought	220	145	65.91 %
D) Tsunami	220	83	37.73 %
E) Deforestation	220	101	45.91 %
F) Ice falling	220	18	8.18 %
G) Tornado	220	102	46.36 %
H) River erosion	220	155	70.45 %
I) Salinity	220	35	15.91 %
J) Acid rain	220	30	13.64 %
K) Earthquake	220	127	57.73 %
L) Cyclone	220	105	47.73 %

**Figure: 6.2.21 Some Natural Hazards in Our Environment**

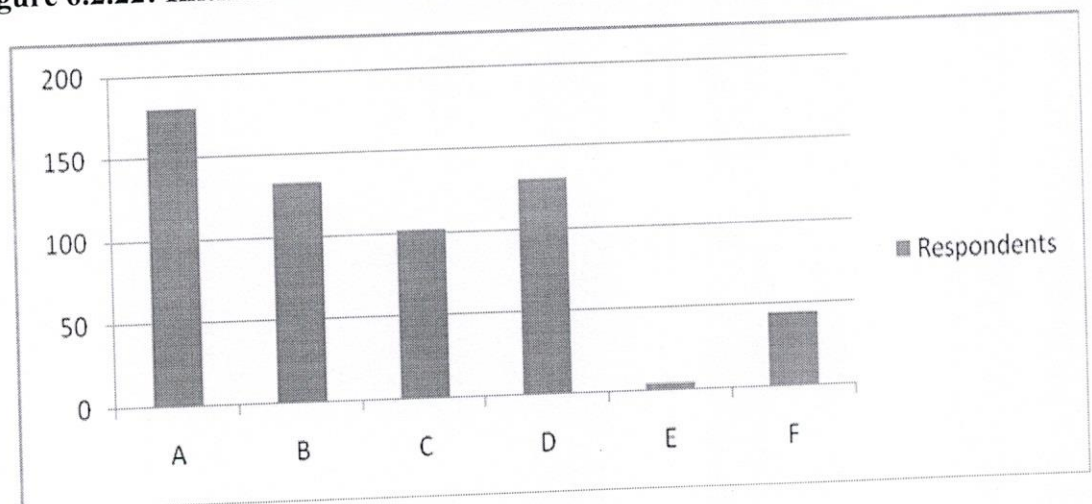


Note: A, B, C, D, E, F, G, H, I, J, K and L are defined in Table 6.21.

Respondents were asked to mention the natural hazards related to our environments. Table 6.21 and Figure 6.2.21 show that 84.09% mentioned flood, 12.73% mentioned fire in forest, 65.91% said drought, 37.73% mentioned Tsunami, 45.91% respondents said deforestation, 8.18% said ice falling, 46.36% told the tornado, 70.45% mentioned river erosion, 15.91% said salinity, 13.64% said acid rain, 57.73% told earthquake and 47.73 % respondents mentioned cyclone that are related to our environment. In some context, fire in forest, ice falling, earth quake, mentioned the remarkable portion of respondents, although this hazards are not more active in our country. But flood, drought, river erosion, deforestation, tornado and cyclone are common hazards in our environment.

Initiatives	Number of Respondents	%
A) Creating awareness through education	180	81.82 %
B) By reducing the growth of population	133	60.45 %
C) By recycling of the materials	102	46.36 %
D) By implementation of environmental laws	130	59.09 %
E) By political speech	4	1.82 %
F) Threatening among people not to pollute the environment	45	20.45 %
Total	220	100 %

**Figure 6.2.22: Initiatives for Environmental Protection from Pollution**

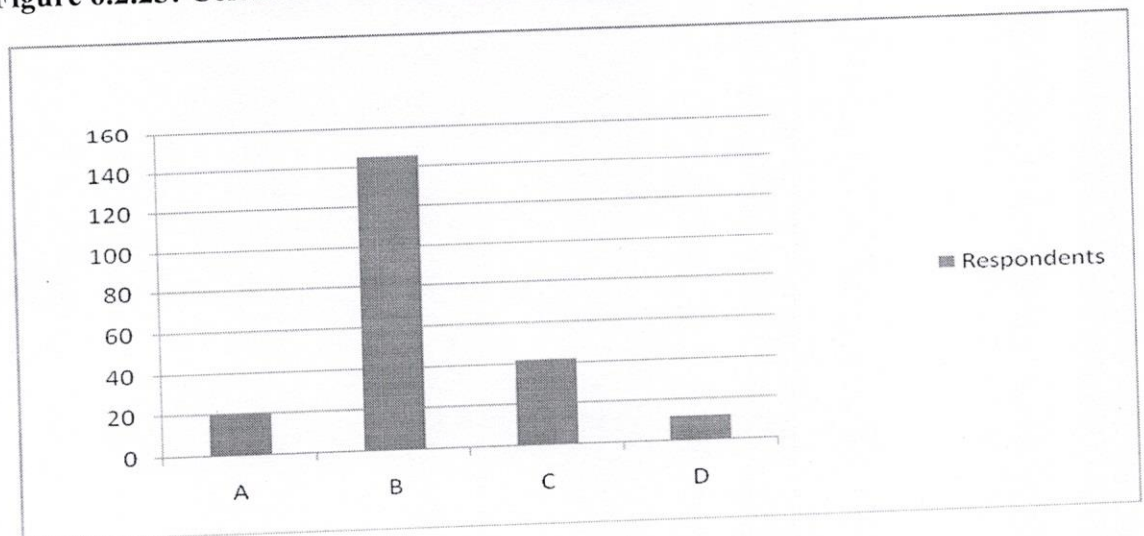


Note: A, B, C, D, E, and F are defined in Table 6.22.

The students were asked for the initiatives of environmental protection from pollution. Table 6.22 and Figure 6.2.22 show that 81.82 % respondents mentioned creating awareness through education, 60.45 % respondents said by reducing the growth of population, 46.36 % said by recycling of the materials, 59.09 % students said by implementation of environmental laws and 20.45 % respondents mentioned that threatening among people not to pollute the environment for the protection of environment. Their views are rational.

Date of World Environment Day	Number of Respondents	%
A) 5, April	21	9.55 %
B) 5, June	145	65.91 %
C) 5, May	42	19.09 %
D) 5, July	12	5.45 %

**Figure 6.2.23: Celebration of World Environment Day**



Note: A, B, C and D are defined in Table 6.23

They were asked to identify the celebration of World Environment Day. Table 6.23 and Figure 6.2.23 show that 9.55 % mentioned 5, April; 65.91 % respondents mentioned 5,

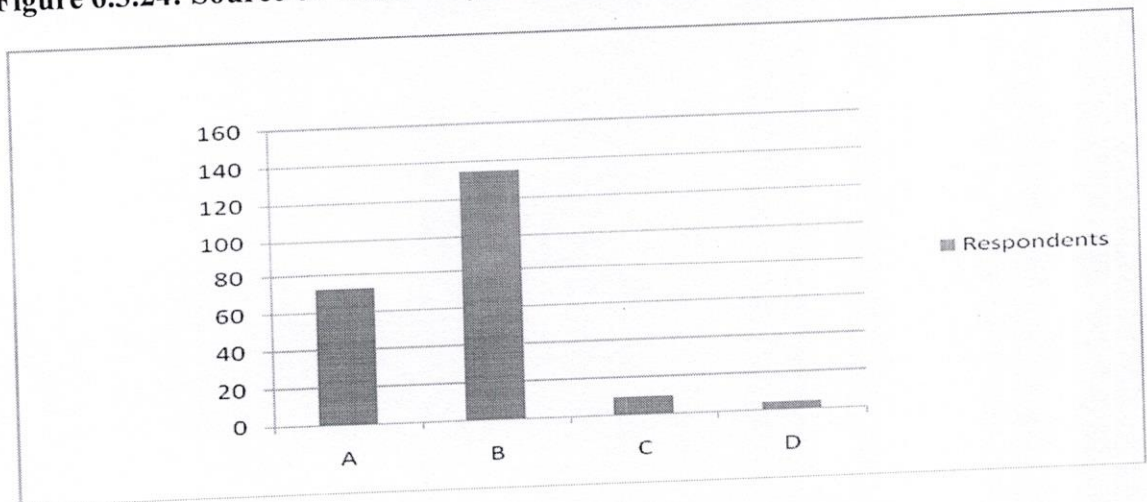
June; 19.09 % said 5, May and 5.45 % told 5, July, the world environment day. So, about 65.91% respondents mentioned the 'World Environment Day' correctly.

### 6.3 Environmental Practice of the Respondents

**Table 6.24: Students were Asked which Source of Water do they Use for Drinking and other Works at Home**

Source of water	Number of Respondents	%
A) Tap water	72	32.73 %
B) Tube well water	135	61.36 %
C) Pond and River water	9	4.09 %
D) From other sources (for example rain)	4	1.82 %
Total	220	100 %

**Figure 6.3.24: Source of Water they use for Drinking and others Work at Home**



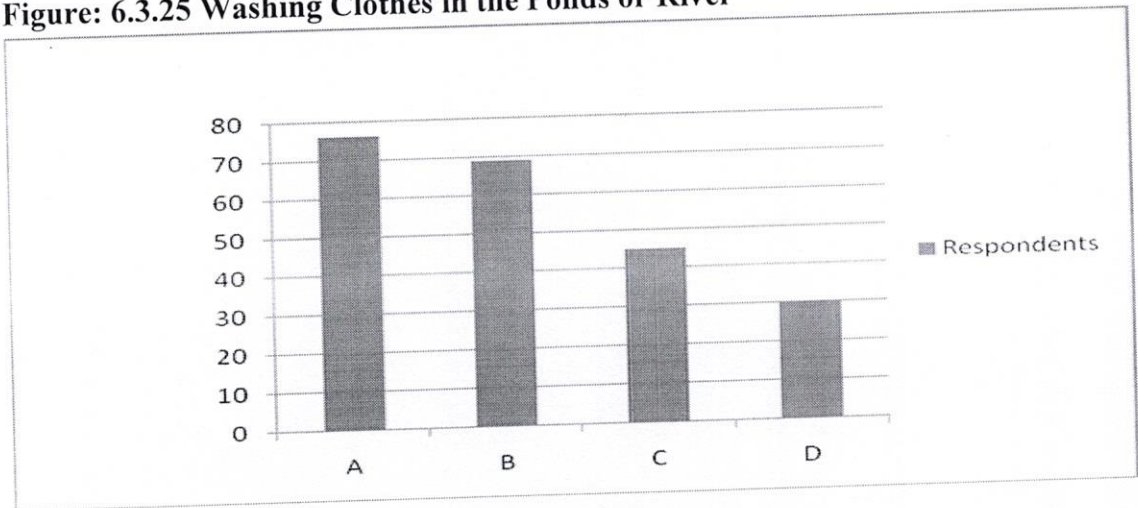
Note: A, B, C and D are defined in Table 6.24

Students were asked which sources of water they use for drinking and other works at home. Table 6.3 and Figure 6.3.24 illustrate, 33.18% respondents said that they use water tap water, 61.36% mentioned tube well water, and 4.09% respondents mentioned pond and river water and the rests 1.82% respondents use water for drinking and other household works from other (rain) sources of water.

**Table 6.25: Students were Asked do they Wash their Clothes in the Pond or River**

Activities	Number of Respondents	%
A) Don't wash in the pond/river water	76	34.55 %
B) Never wash in the pond/river water	69	31.36 %
C) Sometimes wash in the pond/river	45	20.45 %
D) Not applicable	30	13.64 %

**Figure: 6.3.25 Washing Clothes in the Ponds or River**



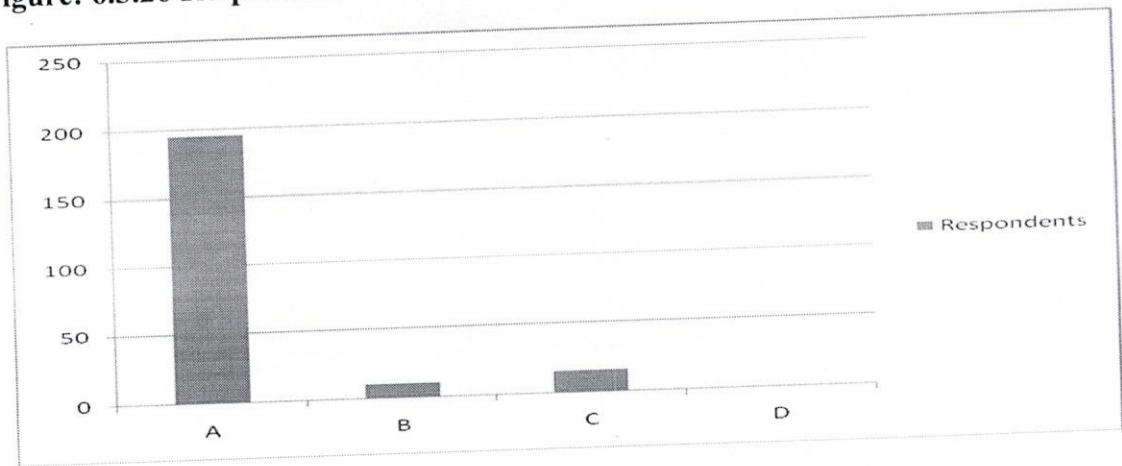
Note: A, B, C and D are defined in Table 6. 25

In Table 6.25, they were asked do they wash their clothes in pond or river. About 34.54% respondents mentioned that they don't wash in the pond/river water, 31.36% mentioned that they never wash in the pond/river water, 20.45% respondents sometimes wash in the pond/river and 13.63% think it is not applicable for them.

**Table 6.26: Students were Asked What they do if a Water Tap is Open (Running) Unnecessarily**

Activities	Number of Respondents	%
A) Off the tap	195	88.64
B) Don't off the tap	10	4.55
C) Don't take it under consideration	15	6.82
D) If others (please write).....	0	0 %

**Figure: 6.3.26 Respondent's Activities when Water Tap is Open Unnecessary**



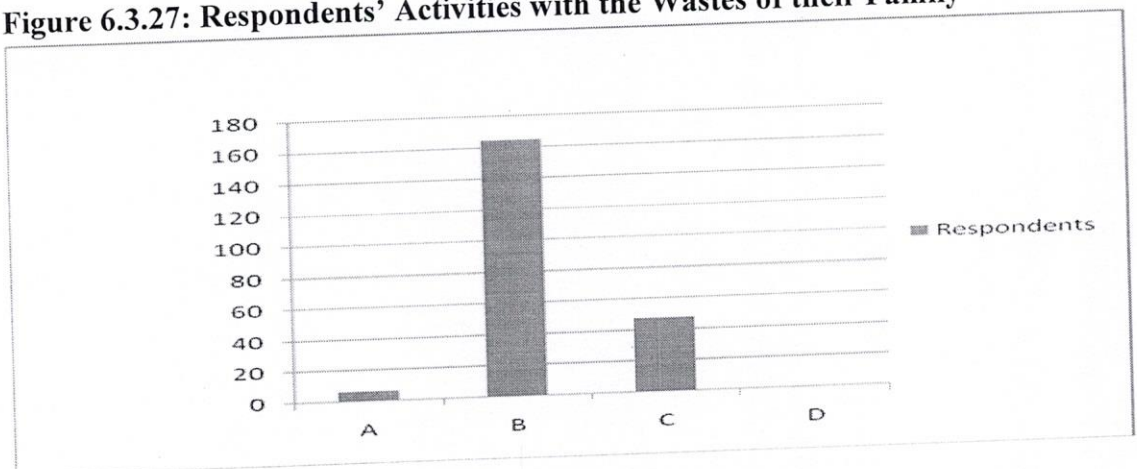
Note: A, B, C and D are defined in Table 6.26

In Table 6.26, students were asked what they do if water tap is open unnecessarily. Among them, 88.63% respondents stop the tap, 4.55% don't stop the tap and 6.82% don't take it under consideration.

**Table 6.27: Students were Asked what they do With Wastes of their Family**

Initiatives mentioned by the respondents	Number of Respondents	%
A) Throwing it here and there	7	3.18 %
B) Put it at the fixed place	165	75.00 %
C) Bury in the ground	48	21.82 %
D) Others (please write).....	0	0 %

**Figure 6.3.27: Respondents' Activities with the Wastes of their Family**



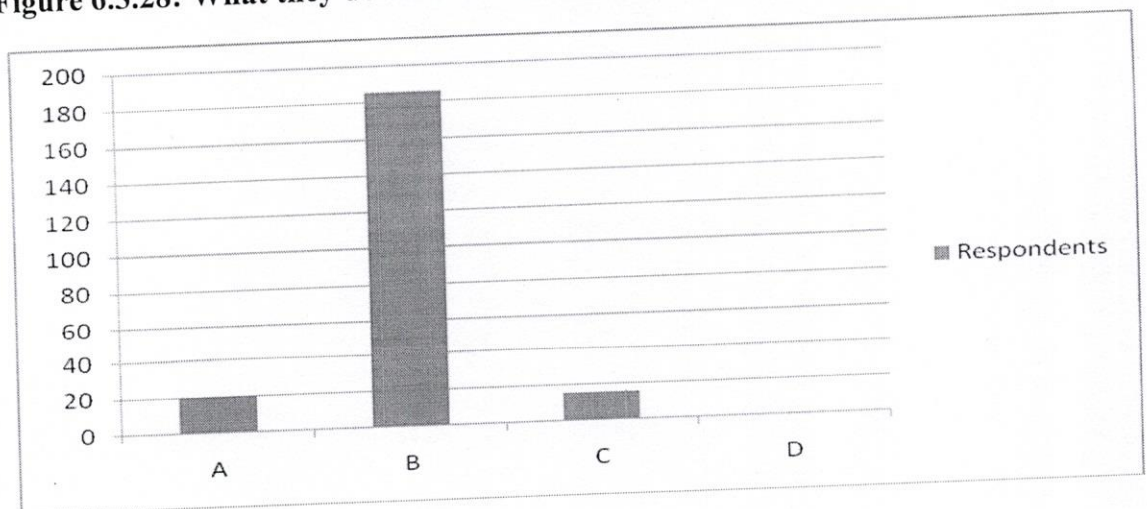
Note: A, B, C and D are defined in Table 6. 27

Respondents were asked what they do with the waste of their family. About 3.18 % respondents mentioned that they through it here and there, 75 % respondents put it at the fixed place and 21.82 % said that they bury it in the ground.

**Table 6.28: They were Asked what they do When the Switch of Light is on or Running Unnecessarily**

Activities	Number of Respondents	%
A) Don't off the switch	20	9.09 %
B) Off the switch	185	84.09 %
C) Don't take it under consideration	15	6.82 %
D) Others (please write).....	0	0.00 %
Total	220	100 %

**Figure 6.3.28: What they do when Switch of Light is on or Running Unnecessarily**



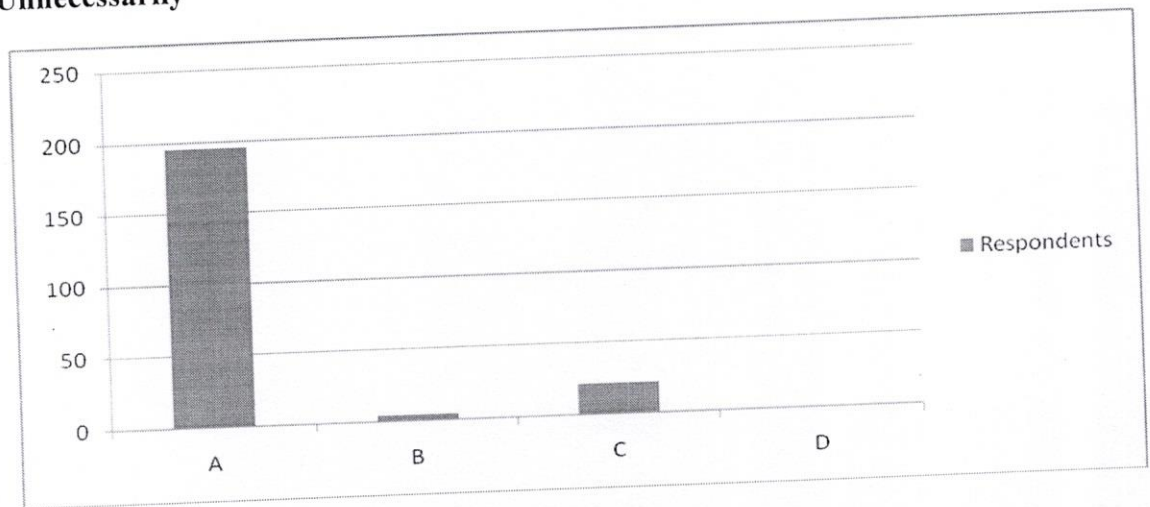
Note: A, B, C and D are defined in Table 6.28

Students were asked what they do if switch of light is on or running unnecessarily. Table 6.28 and Figure 6.3.28 show that, 9.09 % respondents don't stop the switch, 84.09 % stop the switch and 9.55 % respondents don't take it under consideration. It can be mentioned that 84.09 % respondent (shown by bar diagram B) are conscious and stop the switch while it is not required.

**Table 6.29: Students were Asked What they do when their T.V/Computer is Open (Running) Unnecessarily**

Activities	Number of Respondents	%
A) Off the computer/T.V	195	88.64 %
B) Don't off the computer/T.V	4	1.82 %
C) Don't take it under consideration	21	9.55 %
D) Others.....	0	0 %

**Figure 6.3.29: What they do when T.V./Computer is Open or Running Unnecessarily**



Note: A, B, C and D are defined in Table 6. 29

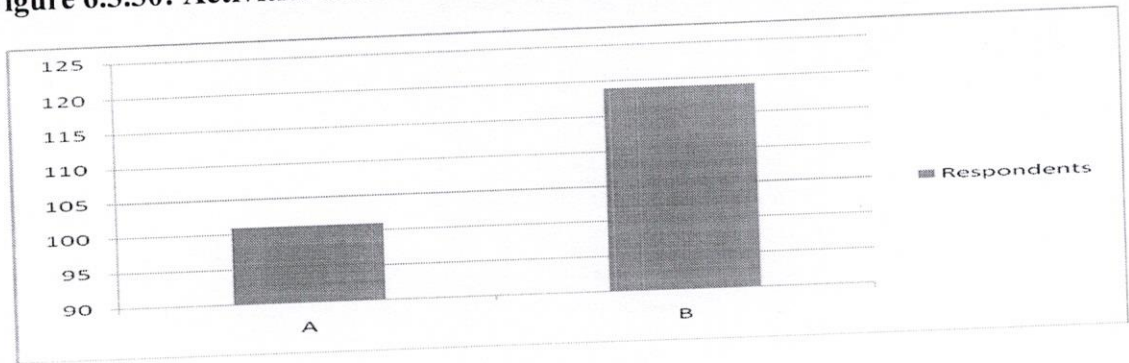
Students were what they do when T.V. or computer is open (running) unnecessarily. About 88.64 % of the respondents stop the computer/T.V consciously, 1.82 % doesn't stop the computer/T.V and the rest 9.55 % students don't take it under consideration.

**Table 6.30: Knowledge about the Activities of Science club, Nature Study Club etc. in their School**

Total number of Respondents	Yes (A)		No (B)	
	Number	%	Number	%
220	101	45.91 %	119	54.09 %



**Figure 6.3.30: Activities of Science or Nature Study Club in their School**



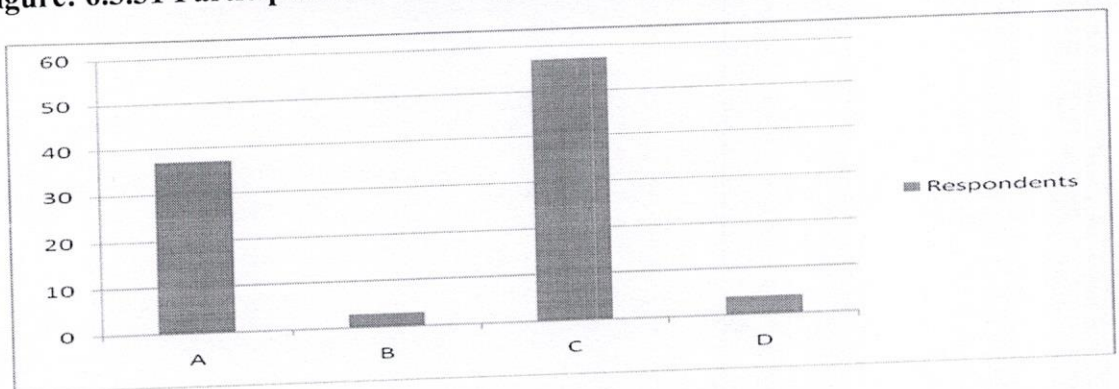
Note: A and B are defined in Table 6.30

Respondents were asked about the activities of Science Club, Nature Study Club etc. in their school. Among them, 45.91 % said 'yes' and 54.09 % said there are 'no' activities of any Science or Nature Study Club in their school.

**Table 6.31: Participation of Respondents in Science Club and Nature study Club**

Initiatives	Number of Respondents	%
A) Always	37	16.82 %
B) Randomly	3	1.36 %
C) Sometimes	57	25.91 %
C) Never	4	1.82 %

**Figure: 6.3.31 Participation of the Respondents in Science or Nature Study Club**



Note: A, B, C and D are defined in Table 6. 31

Table 6.31 and Figure 6.3.31 show that 16.82% respondents always take part in Club activities, 25.91 % respondents sometimes take participation in that organization, 1.36% randomly and 1.82% never takes participation in it.

Respondents' Activities	Always		Randomly		Sometimes		Never	
	Resp onde nts	%	Resp onde nts	%	Resp onde nts	%	Resp onde nts	%
Keep the switches when it is not required	185	84.09 %	8	3.64 %	22	10.00 %	5	2.27 %
Listen to music or T.V with high volume	12	5.45 %	6	2.73 %	50	22.73 %	152	69.09 %
Write on the opposite side of used paper	145	65.91 %	7	3.18 %	55	25.00 %	13	5.91 %
Take care of the plants	125	56.82 %	5	2.27 %	82	37.27 %	8	3.64 %
Smoke	2	0.91 %	0	0 %	6	2.73 %	212	96.36 %
Advise others not to smoke	130	59.09 %	6	2.73 %	60	27.27 %	24	10.91 %
Think about the environment deeply	91	41.36 %	17	7.73 %	105	47.73 %	7	3.18 %

Execution of some activities done by the respondents related to their daily life. Table 6.32 shows that 5.45% respondents always, 2.73% randomly, 22.73% sometimes and 69.09% never listen to music or T.V. with high volume. In other activities, 65.91% of the respondents write on the opposite side of the used papers always, 3.18% do it randomly, 25% sometimes do it and 5.91% never do these activities. With the activities of taking care of plants, 56.82% respondents do always, 2.27% randomly, 37.27% sometimes do the activity and 3.64% never do that. Among them, 96.36% respondents do not smoke and 1.82% sometimes smokes. Of the respondents, 59.09% always advise others not to smoke and 27.27% sometimes advise others not to smoke. Moreover, 41.36 % respondents think deeply about the environment, 7.735 randomly, 47.73% sometimes and 3.18 % never think about the environment.

#### 6.4 Respondents' Environmental Attitude Scale

Environmental attitude scale is important to judge the respondents' outlook regarding the environment and it will help to understand their feeling towards the environment.

Statements regarding Air pollution	Fully agreed		Mostly agreed		Moderately agreed		Less agreed		Not agreed	
	Res pon dent s	%	Res pon dent s	%	Res pon dent s	%	Res pon dent s	%	Res pon dent s	%
Increase of carbon dioxide in the air may bring danger for the environment	195 Total =220	88.64 %	7	3.18 %	9	4.09 %	4	1.82 %	5	2.27 %
Nature will conserve air automatically because it is a part of the nature	85 Total =220	38.64 %	30	13.64 %	25	11.36 %	16	7.27 %	64	29.09 %
Forestation prevents carbon dioxide increase	185 Total =220	84.09 %	18	8.18 %	6	2.73 %	3	1.36 %	8	3.64 %
Green house gases are responsible for heating atmosphere	170 Total =220	77.27 %	25	11.36 %	12	5.45 %	5	2.27 %	8	3.64 %

With respect to environmental attitude scale Table 6.33 shows that 88.64% respondents are fully agreed that increase of carbon dioxide in the air may bring danger for the environment. About 38.64% fully agreed, 13.64% mostly agreed, 11.36% moderately agreed, 7.27% less agreed and 29.09% not agreed with the statement that nature will conserve air automatically because it is a part of the nature. In addition 84.09% respondents are fully agreed regarding forestation prevents carbon dioxide increase.

Moreover, 77.27% respondents fully agreed with the statement that green house gases are responsible for heating atmosphere.

**Table 6.34: Statement Regarding Water Pollution**

Statements regarding water pollution	Fully agreed		Mostly agreed		Moderately agreed		Less agreed		Not agreed	
	Res pon dent s	%	Res pon dent s	%	Res pon dent s	%	Res pon dent s	%	Res pon dent s	%
Drinking polluted water is responsible for many stomach diseases	195	88.64 %	9	4.09 %	8	3.64 %	2	0.91 %	6	2.73 %
It is necessary to use water economically	175	79.55 %	20	9.09 %	13	5.91 %	3	1.36 %	9	4.09 %
Nature will conserve water automaticall y because it is a part of the nature	70	31.82 %	38	17.2 7%	20	9.09 %	16	7.27 %	76	34.5 5%

Table 6.34 shows that, 88.64% respondent fully agreed that drinking polluted water is responsible for many stomach diseases. About 79.55 % fully agreed, 9.09 % mostly agreed, 5.91% moderately agreed and 4.09 % not agreed about the necessity to use water economically. About 31.82 % fully agreed, 17.27 % mostly agreed, 9.09 % moderately agreed, 7.27 % less agreed and 34.55 % not agreed that nature will conserve water automatically because it is a part of the nature.

Statements about Soil Pollution	Fully Agreed		Mostly Agreed		Moderately Agreed		Less Agreed		Not Agreed	
	Res pon dent s	%	Res pon dent s	%	Res pon dent s	%	Res pon dent s	%	Res pon dent s	%
Polythene and Plastic reduces the fertility of soil	186 Total =220	84.55%	20	9.09%	6	2.73%	0	0%	8	3.64%
Industrial and Urban wastes responsible for soil pollution	172 Total =220	78.18%	20	9.09%	16	7.27%	5	2.27%	7	3.18%
Fertility of soil does not decrease if a crop is grown on the same field every year	47 Total =220	21.36%	9	4.09%	22	10.00%	6	2.73%	136	61.82%
Thinking of soil pollution is unnecessary rather than other elements of environmental pollution	22 Total =220	10.00%	5	2.27%	14	6.36%	16	7.27%	163	74.09%

Table 6.35 shows that, 84.55% fully agreed, 9.09% mostly agreed, 2.73% moderately agreed and 3.64% not agreed regarding the statement that polythene and plastic reduces the fertility of Soil. About the statement 'industrial and urban wastes responsible for Soil pollution', 78.18 % fully agreed, 9.09% mostly agreed, 7.27% moderately agreed, 2.27 % less agreed and 3.18% not agreed. In addition, 21.36 % fully agreed, 4.09% mostly agreed, 10% moderately agreed, 2.73% less agreed and 61.82% not agreed about the

speech 'the fertility of Soil does not decrease if a crop is grown on the same field every year'. Moreover, 10% fully agreed, 2.27% mostly agreed, 6.36% moderately agreed, 7.27% less agreed and 74.09% not agreed with the statement of thinking of soil pollution is unnecessary rather than other elements of environmental pollution.

**Table 6.36: Statement Regarding Noise Pollution**

Statements Regarding Noise Pollution	Fully Agreed		Mostly Agreed		Moderately Agreed		Less Agreed		Not Agreed	
	Res pondent s	%	Re spo ndent s	%	Re spo ndent s	%	Re spo ndent s	%	Re spo ndent s	%
Everybody should aware of noise pollution like high volume music, motor horn etc.	195	88.64%	18	8.18%	5	2.27%	2	0.91%	0	0%
Noise pollution is responsible for high blood pressure and heart diseases	185	84.09%	12	5.45%	14	6.36%	2	0.91%	7	3.18%

In Table 6.36, among the respondent 88.64 fully agreed, 8.18 % mostly agreed, 2.27 % moderately agreed with the statement of 'everybody should aware of noise pollution like high volume music, motor horn etc'. Besides 84.09 % fully agreed, 5.45 % mostly agreed, 6.36 % moderately agreed and 3.18 % not agreed with the statement 'noise pollution is responsible for high blood pressure and heart diseases.'

**Table 6.37: Statement Regarding Overall Environment**

Statements of Overall Environmental pollution.	Fully Agreed		Mostly Agreed		Moderately Agreed		Less Agreed		Not Agreed	
	Res pondent s	%	Res pondent s	%	Res pondent s	%	Res pondent s	%	Res pondent s	%
Since man has prospered highly in science, he does not need to depend on environment	14 Total =220	6.3 6%	7	3.1 8%	12	5.4 5%	12	5.4 5%	175	79.5 5%
Balance of environment is not dependent on human activities	18 Total =220	8.1 8%	6	2.7 3%	10	4.5 5%	6	2.7 3%	180	81.8 2%
In order to keep the environment fresh and beautiful, its air, water and land must remain pollution free	199 Total =220	90. 45 %	5	2.2 7%	12	5.4 5%	4	1.8 2%	0	0%
Mosquitoes, flies, insects etc. should be destroyed because they are harmful	110 Total =220	50. 00 %	27	12. 27 %	32	14. 55 %	16	7.2 7%	35	15.9 1%
Everybody should obey the law of 'ban of polythene'	188 Total =220	85. 45 %	22	10. 00 %	5	2.2 7%	0	0%	5	2.27 %
It is not a matter if we, the younger, do not think about environmental pollution	10 Total =220	4.5 5%	12	5.4 5%	8	3.6 4%	14	6.3 6%	176	80.0 0%
The environment near our homes can be kept beautiful if we try a little	195 Total =220	88. 64 %	13	5.9 1%	8	3.6 4%	0	0%	4	1.82 %

Table 6.37 shows that, 6.36% fully agreed, 3.18% mostly agreed, 5.45% moderately agreed, 5.45% less agreed and 79.55% not agreed with the statement 'since man has prospered highly in science, he does not need to depend on environment.' In addition 8.18% respondents fully agreed, 2.73% mostly agreed, 4.55% moderately agreed, 2.73% less agreed and 81.82% not agreed with the statement of 'balance of environment is not dependent on human activities'. Regarding the statement 'in order to keep the environment fresh and beautiful, its air, water and land must remain pollution free', 90.45% fully agreed, 2.27% mostly agreed, 5.45% moderately agreed. Besides, 50 % respondents fully agreed, 12.27 % mostly agreed, 14.55 % moderately agreed, 7.27 % less agreed and 15.91 % not agreed about the statements of 'mosquitoes, flies, insects etc. should be destroyed because they are harmful.' Regarding the statement, everybody should obey the law of 'ban of polythene, 85.45% fully agreed, 10% moderately agreed, 2.27% moderately agreed and 2.27% not agreed. Moreover, among the respondents 4.55% fully agreed, 5.45 % mostly agreed, 3.64 % moderately agreed, 6.36 % less agreed and 80 % not agreed about the statement 'it is not a matter if the younger; do not think about environmental pollution'. Finally, 88.64 % respondents fully agreed, 5.91 % mostly agreed, 3.64 % moderately agreed and 1.82 % not agreed with the statement of the environment near our homes can be kept beautiful if we try a little.

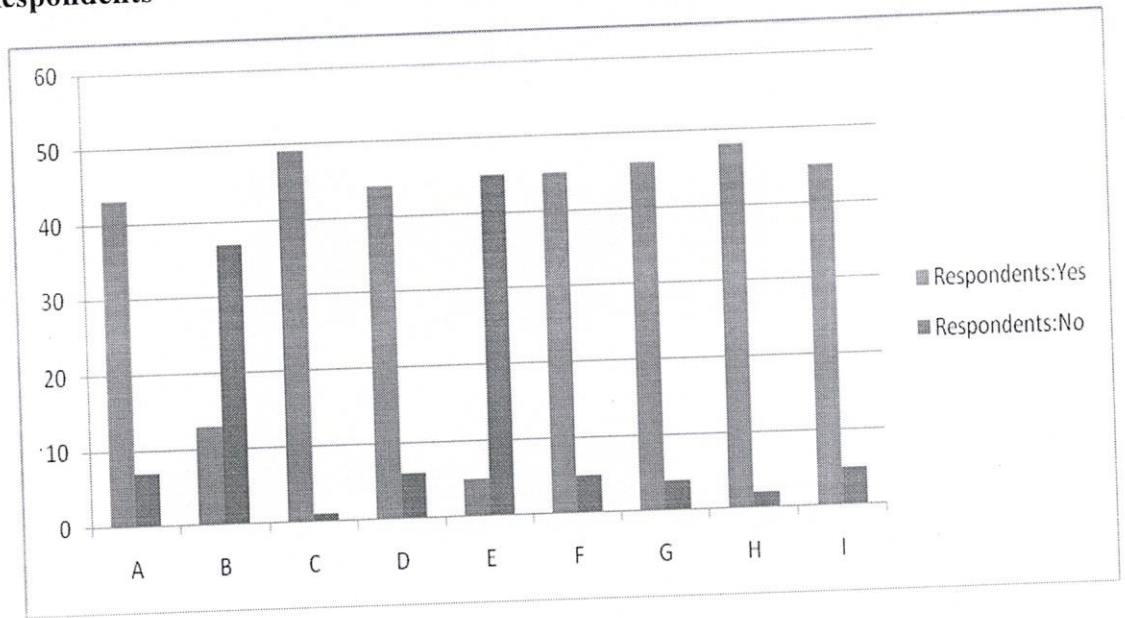


## 6.5 Environmental Literacy, Education and Awareness for Teacher Respondents

**Table 6.38: Environmental Literacy and Awareness of the Teacher Respondents at Secondary Level**

Factors	Yes		No	
	No. of Respondents	%	No. of Respondents	%
A) Studied Environmental pollution education at your educational curriculum	43 Total=50	86 %	7	14 %
B) Attended courses or training in environmental pollution education	13 Total=50	26 %	37	74 %
C) Environmental pollution is one of the biggest problems in Bangladesh	49 Total=50	98 %	1	2 %
D) Need to spend more time teaching students about the environmental pollution	44 Total=50	88 %	6	12 %
E) There are numerous opportunities provided regularly to learn about environmental pollution in Bangladesh	5 Total=50	10 %	45	90 %
F) Need for a separate course at secondary level about environmental pollution education	45 Total=50	90 %	5	10 %
G) Environmental education should be mandatory at Primary, Secondary and Tertiary level	46 Total=50	92 %	4	8 %
H) Every teacher to receive environmental education (EE) training	48 Total=50	96 %	2	4 %
I) 'World Environment Day', 'World Health Day', 'World Aids day', 'Heritage Day' should be celebrated for creating awareness in school	45 Total=50	90 %	5	10 %

**Figure 6.5.32: Environmental Literacy, Education and Awareness of the Teacher Respondents**



Note: A, B, C, D, E, F, G, H and I are defined in Table 6.38

Table 6.38 and Figure 6.5.32, shows that 86% respondents said yes and 14% respondents said no when the teachers were asked about their study regarding environmental pollution education in their education curriculum. Attending any course or training in respect of environmental pollution education, they reply that 26% have taken their training and 74% have not any training on the issues. Among them, 96% mentioned environmental pollution is one of the biggest problems and 4% did not think so. They were asked about necessarily to spend more time teaching students about the environmental pollution. Among them, 88 % respondents said yes and the rest 12 % said not necessary. About 90 % respondents think that there have not numerous opportunities provided regularly to learn about environmental pollution and 10% says that there have more opportunity in Bangladesh. About 90% of them think that there is need a separate course at secondary level about environmental pollution education and 10 % respondents think that it is not necessary. Moreover, 92 % respondents mentioned that environmental education should be mandatory at primary, secondary and tertiary level and the rest 8 % do not think so. Among the respondents, 100 % think that every teacher should receive environmental education training. Finally, 90 % respondents mentioned that World Environment Day, World Health Day, World Aids Day, World Heritage Day should be celebrated for creating awareness in school and 10% of them think that it is not necessary to celebrate in school for creating awareness among students.

**Table 6.39: Teachers' Views about Air, Water, Soil, Noise and Other Pollution According to Importance of their Ranking**

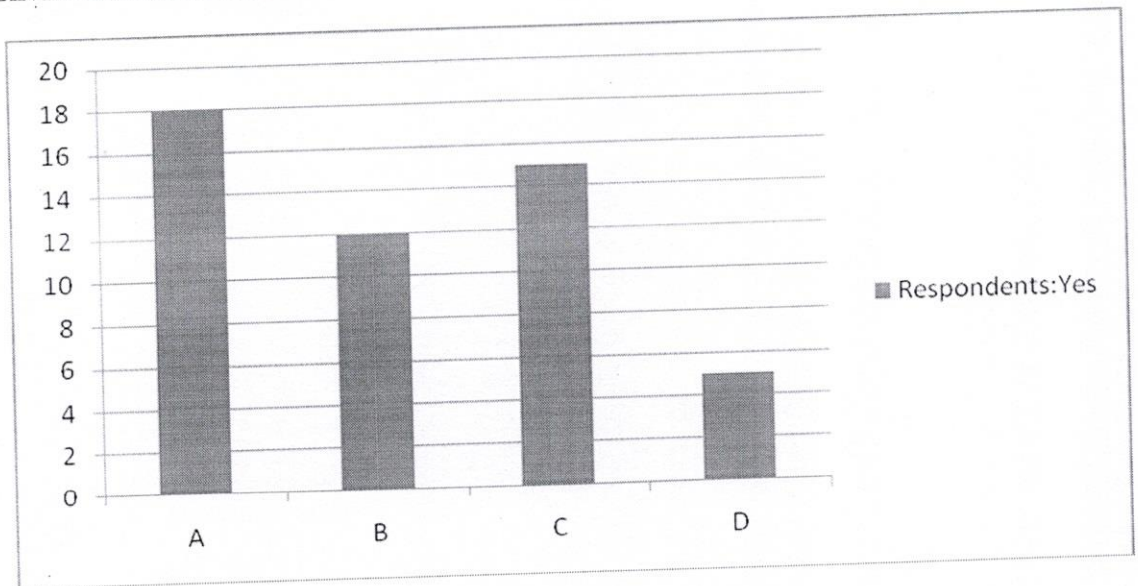
Factors	Rank-1		Rank-2		Rank-3		Rank-4		Rank-5	
	Res pon dent s	%	Res pon dent s	%	Res pon dent s	%	Res pon dent s	%	Res pon dent s	%
Air pollution	32	64%	12	24%	4	8%	1	2%	0	0%
Water pollution	21	42%	23	46%	5	10 %	1	2%	0	0%
Soil pollution	0	0%	5	10%	30	60 %	14	28%	0	0%
Noise pollution	2	4%	5	10%	10	20 %	33	66%	0	0%
Others pollution	0	0%	0	0%	0	0%	0	0%	21	42%

In Table 6.39, teachers' views about ranking according to importance, air, water, soil and noise are mentioned. Among them, 60 % respondents think that the air pollution is the Rank-1 problem, 42 % respondents think water pollution is the Rank -1 problem, 46 % teachers mentioned that water pollution is the Rank-2 problem, 60 % respondents said that soil pollution is the Rank-3 problem and 76 % mentioned that noise pollution is the rank -4 problem. Besides they mentioned category of other pollution as Rank-5 problem in Bangladesh.

**Table 6.40: Elements that are Needed to Teach Students Significantly Regarding Environmental Pollution**

Necessary Elements	Number of Respondents	%
A) Audio visual system	18	36 %
B) Posturing	12	24 %
C) Exhibition	15	30 %
D) Campaigning	5	10 %
Total Respondents	50	100 %

**Figure 6.5.33: Elements Needed to Teach Students More Significantly Regarding Environmental Pollution**



Note: A, B, C and D are defined in Table 6.40

In Table 6.40 and Figure 6.5.32, for creating awareness more and significantly, 36 % teacher respondents mentioned that the audio visual system is necessary, 24 % mentioned that posturing, 30 % said that exhibition and the rest 10 % said that campaigning for rising awareness among the students regarding environmental pollution.

## 6.6 Data from School Observation

For avoiding false information the observation method is used to collect data from the schools of selected areas. By using the observation checklists, the cleanliness of the school ground, classroom facilities of air and light, use of waste basket, sufficiency of latrines and their cleanliness, environment related topics in the bulletin board etc. are observed.

Observable Features	Total Schools	Satisfactory	Moderate	Unsatisfactory
1. Cleanliness of the class room	10	7	2	1
2. Facilities of fresh air and light in the class room	10	6	4	
3. Use of waste basket	10	3	5	2
4. Cleanliness of School ground	10	6	3	1
5. Amount of trees in School compound	10	5	3	2
6. Sufficiency of latrines	10	6	2	2
7. Sufficiency of Environment related topic in bulletin board	10	0	3	7
8. Books related to environment in School library	10	2	3	5
9. Psychological environment of the school	10	4	4	2
10. Cleanliness of latrines	10	1	2	7

Researcher himself found by the observation schedule that 70% classroom has the satisfactory cleanliness, 20% moderate and 10% classrooms' cleanliness are unsatisfactory. 70% classroom's has the satisfactory facilities of fresh air and light where 30% class room's condition is unsatisfactory in this respect. Among them 30% school satisfactory, 50% moderate and the rest 20% unsatisfactory about the use of waste basket in their school. By observing it is found that 60% satisfactory and 40% are moderate of the cleanliness of school ground. In respect of amount of trees in school campus, 60% school has the satisfactory amount of trees, 20% moderate and the rest 20% school has

unsatisfactory condition of trees. 70% school has the sufficiency of latrines, 20% moderate and 10% has unsatisfactory condition of latrine. Among them, 50% moderate and rest of 50% school have unsatisfactory condition of the sufficiency of environment related topic in their bulletin board. In respect of environment related book in their library, 30% schools are moderate and 70% schools are unsatisfactory. Of the school, 50% satisfactory and the rest 50% moderate in respect of psychological environment. About the cleanliness of the school latrines 10% are found satisfactory, 30% moderate and 60% are unsatisfactory.

### 6.7 Data from Interview Schedule

To find out the opinions and suggestions of the intellectuals the Scheduled interviews have been arranged. So their experiences and opinions in respect of environmental pollution and its sustainable improvement are critically important.

Policy Makers (Intellectual Level) Regarding Curriculum at Secondary Level Education	Yes		No	
	Number of Respondent	%	Number of Respondent	%
A) Do you think that the present educational curriculum is quite appropriate for creating awareness among the secondary level students about environmental pollution?	3	60%	2	40%
B) Do you think that there is needed a separate environmental pollution education course at secondary level?	2	40%	3	60%
C) Do you think that the environmental pollution education course should be mandatory for each group of students at secondary level?	4	80%	1	20%
C) Do you think that there is needed to involve the environmental rules at secondary level education curriculum for creating awareness?	3	60%	1	20%

In Table 6.42, from the view of policy makers (intellectual level) regarding curriculum at secondary level education, it is found that 80% respondent mentioned that environmental pollution education course should be mandatory for each group of students at secondary level. They said that the separate course is not needed. But all the concepts about environmental pollution should be included in different relevant subjects. They also argued that only awareness might not be enough to reduce pollution. Implementation of rules is needed so that people can see the consequences of not complying with the related rules. Finally they comments about the rules and awareness needed to go hand in hand.

**Table 6.43: Data Description of Interview Schedule from Policy Makers, Taken by Using Semi-Structured Interview Schedule**

Policy Makers (Intellectual Level) Perspective to Environment Related Rules	Yes		No	
	Number of Respondents	%	Number of Respondents	%
A) Do you think that motivation and peoples' support is stronger than the laws and regulations for sustainable improvement of environmental pollution quality?	4	80%	1	20%
B) Do you think when people will be educated then the environmental laws will be more activated?	5	100%	00	0%
C) Do you agree that if one violets the environmental laws and regulations then penalties should be implemented?	5	100%	00	0%
C) Please, identify the causes of non-enforcing of laws and regulations at present situation: i) Lack of coordination among concerned agencies, ii) Complicated system, iii) Negligence and corruption of law enforcing agencies. iv) Local pressure, e) Illiteracy v) Others.....	i)=5 ii)=1 iii)=3 iv)=1 v)=1 (Lack of proper law enforcement)	100% 20% 60% 20% 20%	00	0%

According to policy makers (intellectual level) perspective to environment related rules and activities, all of them agree with the statement of when people will be educated and conscious then the environmental laws will be more activated and if one violets this

laws, penalties should be implemented effectively. Most of them think that lack of coordination among concerned agencies, negligence and corruption of law enforcing agencies also are the causes of non-enforcing of laws and regulations. Several of them think that establishment of pollution pay principle by enforcing environmental regulation is important. They suggest that it needed to set up a judicial system where expert juries in various field of environment will help to find out the possible best way of a verdict regarding environmental pollution.

### 6.8 Data for Carbon Dioxide ( $CO_2$ ) Emission of Bangladesh

Carbon dioxide ( $CO_2$ ) is one of the important element for environmental pollution and global warming. This element is emits from various sources, like fossil fuel, gas fuels, solid fuels, cement fuels etc. and the volume of  $CO_2$  emission is increasing with production and economic activities gradually.

**Table 6.44: Carbon Dioxide ( $CO_2$ ) Emissions from Fossil-fuel; Gas Fuels, Liquid Fuels, Solid Fuels, Cement Manufacture and Bunker Fuels (in metric ton) from 1974-2010 in Bangladesh**

Year	Total Fossil Fuel Emissions	Emissions from Gas Fuels	Emissions from Liquid Fuels	Emissions from Solid Fuels	Emission from Cement Manufacture	Per capita Emission	% Share of $CO_2$ Emission
	(metric tons)	(metric tons)	(metric tons)	(metric tons)	(metric tons)	(metric tons)	(metric tons)
1974	1271000	377000	769000	112000	12	0.02	58%
1975	1328000	263000	913000	129000	23	0.02	60%
1976	1519000	385000	990000	122000	21	0.02	69%
1977	1585000	431000	975000	137000	42	0.02	72%
1978	1641000	457000	1023000	115000	46	0.02	75%
1979	1813000	523000	1148000	98000	44	0.02	83%
1980	2083000	605000	1311000	122000	46	0.02	95%
1981	2163000	666000	1323000	127000	47	0.02	98%
1982	2345000	864000	1283000	155000	44	0.03	107%
1983	2246000	961000	1160000	83000	42	0.03	102%
1984	2488000	1219000	1200000	32000	37	0.03	113%
1985	2791000	1388000	1320000	51000	33	0.03	127%
1986	3126000	1565000	1444000	77000	40	0.03	142%

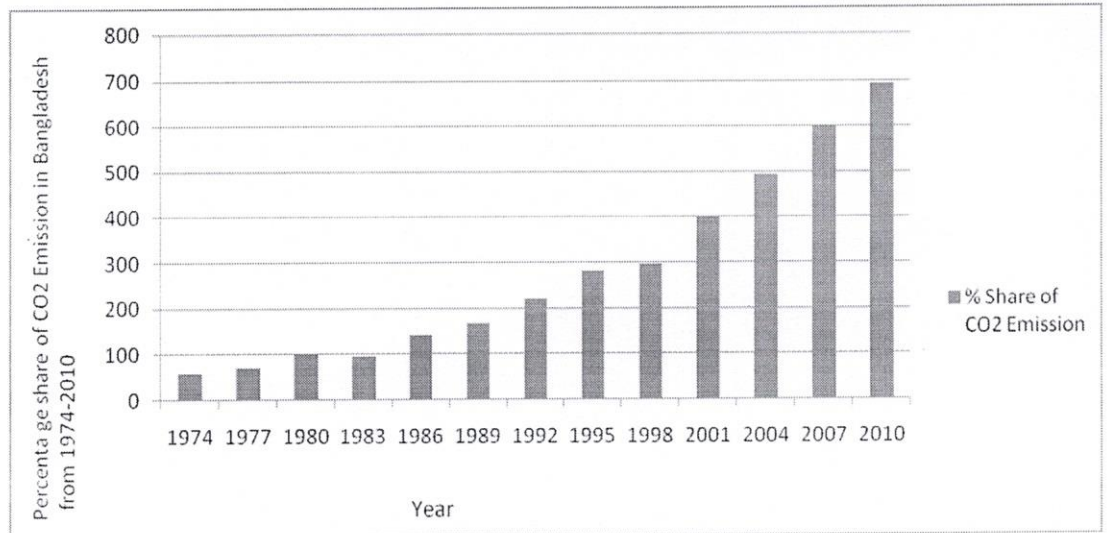


1987	3235000	1618000	1454000	121000	42	0.03	147%
1988	3694000	1910000	1638000	104000	42	0.04	168%
1989	3669000	2024000	1574000	28000	43	0.04	167%
1990	4236000	2068000	1830000	292000	46	0.04	193%
1991	4347000	2472000	1745000	93000	37	0.04	198%
1992	4840000	2622000	2093000	88000	37	0.04	220%
1993	4747000	2836000	1841000	33000	37	0.05	216%
1994	5173000	3131000	1977000	27000	38	0.05	235%
1995	6222000	3556000	2296000	333000	38	0.05	283%
1996	6553000	3684000	2596000	185000	88	0.05	298%
1997	6835000	3620000	2743000	335000	138	0.05	311%
1998	6556000	3909000	2381000	96000	169	0.06	298%
1999	6881000	4262000	2287000	48000	284	0.07	313%
2000	7599000	4607000	2163000	342000	487	0.07	346%
2001	8849000	5159000	2647000	363000	681	0.07	403%
2002	9190000	5428000	2720000	363000	680	0.07	418%
2003	9678000	5838000	2693000	12000	680	0.08	421%
2004	1011500	6280000	3842000	34000	680	0.08	494%
2005	1093900	6751000	2778000	45000	694	0.08	467%
2006	1134800	7292000	4577000	157000	694	0.08	598%
2007	1183700	7791000	4113000	201000	694	0.09	602%
2008	1238800	8796000	2863000	350000	680	0.09	576%
2009	1391800	9572000	3223000	444000	680	0.09	634%
2010	1544800	1044800	3683000	638000	680	0.1	691%

**Source:** All data are collected from Carbon Dioxide Information Analysis Center (CDIAC) at the Oak Ridge National Laboratory. Data excludes emissions from land use and agriculture (Including Deforestation).

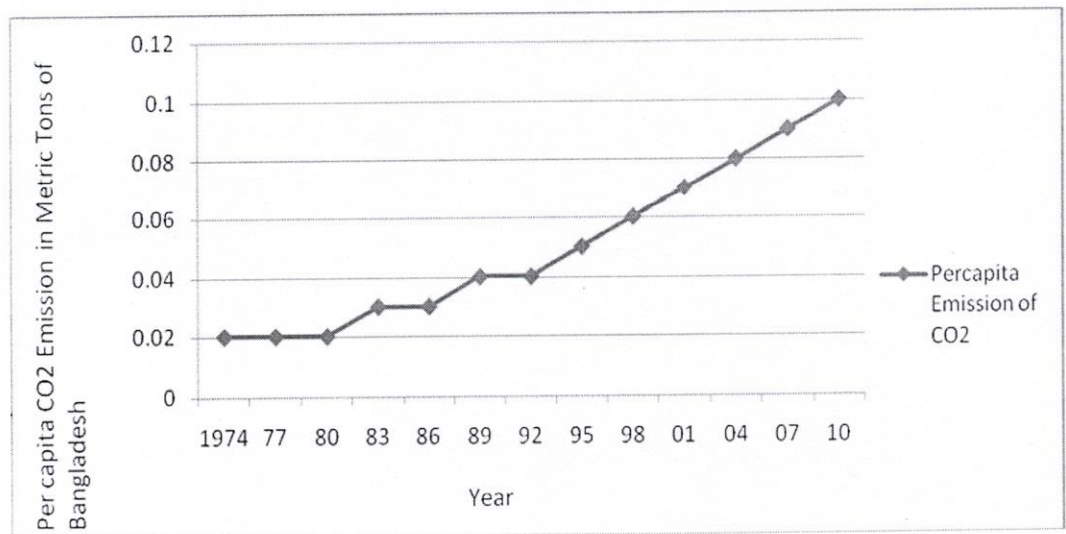
Table 6.44 indicates that the Carbon dioxide ( $CO_2$ ) emissions from fossil-fuel; gas fuels, liquid fuels, solid fuels, cement manufacture and bunker fuels are increasing gradually from the beginning of the independence of Bangladesh in 1972. From the very beginning per capita emission and % share of  $CO_2$  emission were low. But with the passing of time these emissions increase with the increase of production in various sectors of the economy and gradually it is going towards an alarming situation.

**Figure 6.7.34: Percentage (%) Share of  $CO_2$  Emission of Bangladesh (1974-2010)**



In Figure 6.7.34, the bar diagram presents the increasing trend of carbon dioxide ( $CO_2$ ). In 1974 it was only 58%. From 1995 to 1998 it was almost same. But after 1998 this emission is increasing at a faster rate and in 2010 it has increased about 691%. It indicates that the economic activities have increased that is why the emission has increased.

**Figure 6.7.35: Per capita Carbon Dioxide ( $CO_2$ ) Emission increasing in Bangladesh from 1974-2010**



In Figure 6.7.2 the per capita carbon dioxide is same from 1974 to 1981. This line chart indicates that after 1981 this per capita emission is increasing gradually. After 1993 it increases at a faster rate and the line chart goes upwards sloping.

## 6.9 Education Share in GDP

For the statistical analysis gross domestic product (GDP), real education expenditure, GDP share in education are used. It is observed from data that GDP share in education did not increase with the pace of total GDP.

Year	GDP at Constant Price	Real Education Expenditure	(%) share of GDP	Year	GDP at Constant Price	Real Education Expenditure	Percent age (%) share of GDP
1974	678490.8	5835.02	0.86	1993	1424569.6	30485.79	2.14
1975	716920.8	4731.68	0.66	1994	1487887.6	31245.64	2.10
1976	736074.8	1692.97	0.23	1995	1567553.6	32448.36	2.07
1977	788144.4	2285.62	0.29	1996	1659712.4	34522.02	2.08
1978	825988.8	9911.87	1.20	1997	1752850.0	34706.43	1.98
1979	832772.0	8744.11	1.05	1998	1844480	37442.94	2.03
1980	861027.2	11193.35	1.30	1999	1934290	40233.23	2.08
1981	871616.8	12289.80	1.41	2000	2049280	43444.74	2.12
1982	914268.0	12159.76	1.33	2001	2157350	46598.76	2.16
1983	1036829.2	13789.83	1.33	2002	2252610	50007.94	2.22
1984	992909.2	13602.86	1.37	2003	2371010	53821.93	2.27
1985	1035999.6	13053.59	1.26	2004	2519680	57952.64	2.3
1986	1079309.6	17268.95	1.60	2005	2669740	62471.92	2.34
1987	1110517.2	17657.22	1.59	2006	2846730	68321.52	2.4
1988	1138528.4	21518.19	1.89	2007	3032070	74285.72	2.45
1989	1213973.2	21851.52	1.80	2008	3217260	80109.77	2.49
1990	1255233.6	23221.82	1.85	2009	3401970	86410.04	2.54
1991	1308303.6	27343.55	2.09	2010	3608450	94541.39	2.62
1992	1366961.2	29116.27	2.13				

Source: (1) Bangladesh Economic Review 1997, 2007, and 2012. (2) Bangladesh Bureau of Statistics, BANBEIS, 2010. (3) World Development Indicators, 2011. (Adjusted base year 1984-85 to 1995-96)

Table 6.45 indicates that the GDP increases over time in Bangladesh but share of education to GDP did not increase with the same direction. Educational expenditure increases with a slow speed as the GDP increases.

**Figure 6.7.36: GDP at Constant Price and Real Education Expenditure of GDP (in Million Tk.) from 1974 – 2010 of Bangladesh**

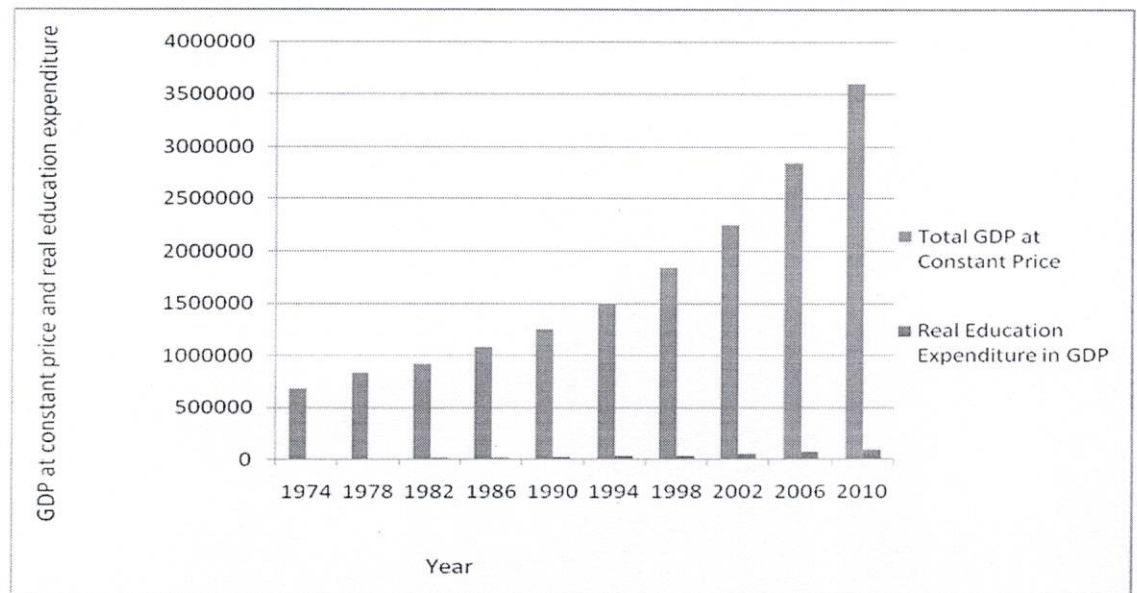


Fig 6.7.36 shows the bar diagram of total GDP increasing rapidly, but educational expenditure in GDP increasing over time very slowly. This was below 2 percent up to 1990 and after that it is increasing gradually with slow speed and now it is about 2.76 percent of GDP.

### 6.10 Data of Industry Share in GDP

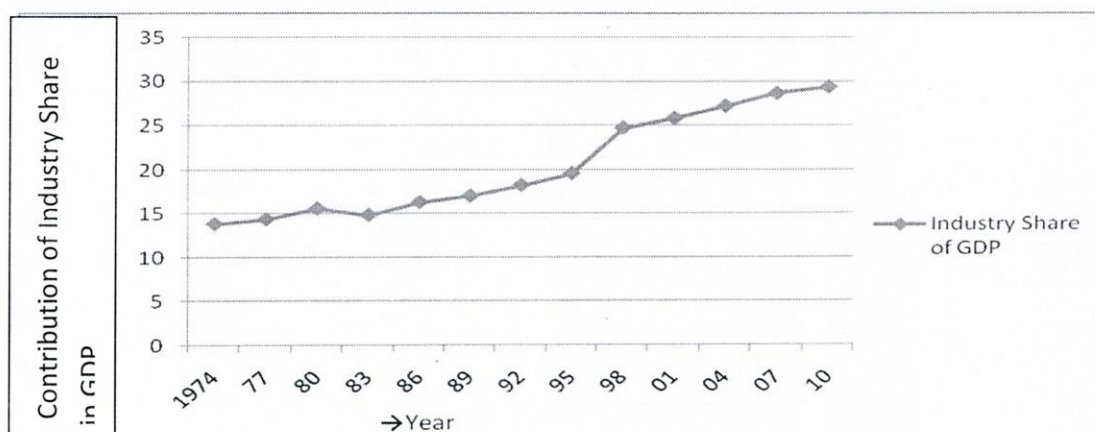
Table 6.46 shows the percentage contribution of industry share in GDP. It was below 20 percent of GDP up to 1995. But after that time this contribution is increasing and now this contribution is about 30% of our GDP. Figure 6.7.37 shows that the line chart is going upward slopping after 1995.

**Table: 6.46: Contribution of Industry Share in GDP of Government, from 1974-2010 (at constant prices, base year 1995-96, in million Tk.)**

Year	Industry Share of GDP	year	Industry Share of GDP
1974	13.82	1993	18.85
1975	12.88	1994	19.55
1976	14.69	1995	19.55
1977	14.35	1996	23.96
1978	16.58	1997	24.67
1979	15.6	1998	24.68
1980	15.57	1999	24.73
1981	15.63	2000	25.24
1982	15.12	2001	25.75
1983	14.83	2002	26.24
1984	15.97	2003	26.57
1985	15.71	2004	27.15
1986	16.3	2005	27.96
1987	16.68	2006	28.76
1988	17.05	2007	28.62
1989	17.01	2008	28.81
1990	17.16	2009	28.92
1991	17.64	2010	29.33
1992	18.22		

Source: (i) Bangladesh Economic Review, 1999, (ii) Bangladesh Economic Review, 2012; Ministry of Finance, GOB.

**Figure: 6.7.37 Bangladesh Industry Share of GDP (in Million Tk.) from 1974-2010**



## 6.11 Data for Literacy Rate in Education

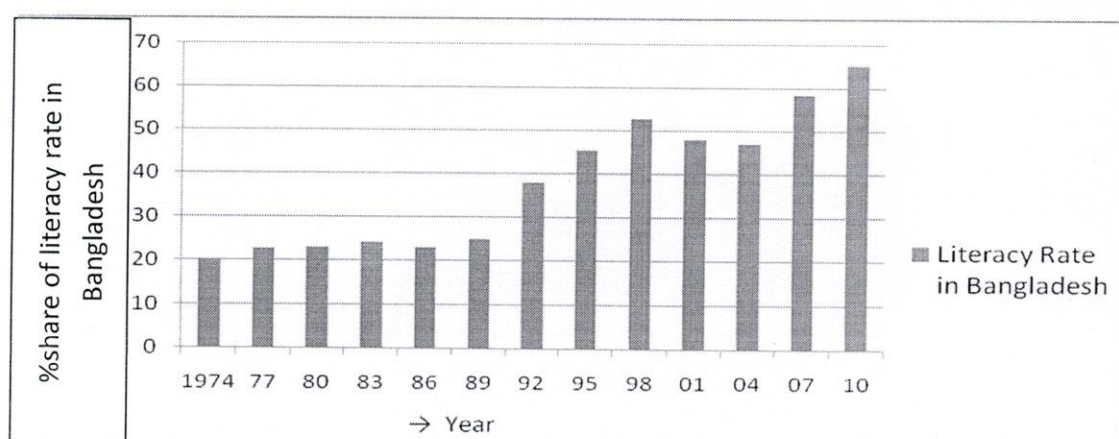
**Table: 6.47 Literacy Rate of Bangladesh, from 1974-2010. Literate Population is the Portion of Total Population of 14 years and Above Age Group**

Year	Literacy Rate	Year	Literacy Rate
1974	20.2	1993	39.1
1975	21.5	1994	42.3
1976	23.8	1995	45.3
1977	22.8	1996	47.2
1978	23.7	1997	51.2
1979	23.0	1998	52.6
1980	23.0	1999	52.7
1981	24.1	2000	52.8
1982	24.3	2001	47.9
1983	24.1	2002	41.4
1984	24.2	2003	54.8
1985	24.0	2004	47.0
1986	23.0	2005	52.0
1987	24.6	2006	52.0
1988	24.4	2007	58.3
1989	25.0	2008	59.0
1990	25.0	2009	56.3
1991	37.2	2010	65.0
1992	38.0		

Source: (1) Bangladesh Bureau of Statistics, BANBEIS, 2010, (2) Bangladesh Economic Review 1997, 2007, and 2012.

Table 6.47 shows that the literacy rates were very low after liberation period. This literacy rate was about 25% till 1990. By increasing over the period this rate reached at about 52.8% by 2000. After that this trend was decreasing in several periods and from 2006 this rate was again begun to increase upwardly which is shown in Figure 6.7.38

**Figure 6.7.38: Literacy Rate of total population, 14 years and Above Age Group from 1974-2010 in Bangladesh.**



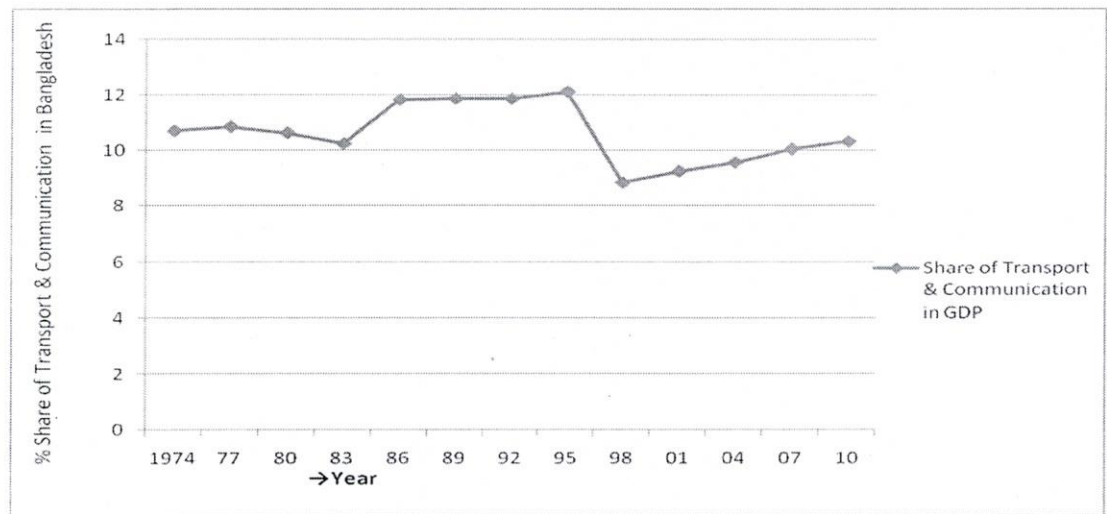
### 6.12 Transport and Communication Share in GDP

**Table 6.48: Contribution of Transport & Communication Share in GDP of Government, from 1974-2010 (at constant prices, base year 1995-96, in million Tk.)**

Year	Share of Transport and Communication	Year	Share of Transport and Communication
1974	10.7	1993	12.01
1975	10.62	1994	12.17
1976	11.17	1995	12.12
1977	10.85	1996	8.72
1978	10.78	1997	8.76
1979	10.76	1998	8.84
1980	10.63	1999	8.85
1981	10.9	2000	9.08
1982	11.14	2001	9.26
1983	10.24	2002	9.4
1984	11.22	2003	9.4
1985	11.1	2004	9.57
1986	11.83	2005	9.69
1987	11.93	2006	9.85
1988	12.13	2007	10.06
1989	11.86	2008	10.27
1990	11.83	2009	10.43
1991	11.81	2010	10.33
1992	11.86		

Source: Bangladesh Economic Review, 1999, 2011 and 2012, Ministry of Finance, GOB

**Figure 6.7.39: Share of Transport and Communication in GDP in million Tk. from 1974-2010 in Bangladesh**



From the Table 6.48, it is found that the contribution of transport and communication is about 12% in GDP till 1995. But after that time contribution of this sector is found to be decreasing and after several periods, it was again begun to increase with slow speed which is shown in Figure 6.7.7

### 6.13 Conclusion

In this chapter data of primary survey and secondary sources are analyzed using both tabulation and graphical ways. By the Graphs and Tables one can easily realize the trend and relationship among the variables. Primary data have collected by questionnaire survey and interview technique from students, teachers and intellectuals. Data have collected by questionnaire survey from students on their knowledge, attitude and practice regarding environmental pollution. In several cases, found from the primary survey that the students have the misconceptions regarding environmental pollution. Views and opinions of the teachers and intellectuals have collected through interview survey and have described for strengthen the research work. Data from observation schedule has described for avoiding false information. In order to show long run causal relationship, the time series data on  $CO_2$  emission, GDP growth, literacy rate, GDP share in education, industry share in GDP and transport share in GDP covering the period 1974 to 2010 are shown in grand Tables.



## Chapter 7: Empirical Econometric Methodology

### 7.1 Introduction

Global warming and climate change attracted considerable attention worldwide. The intergovernmental panel on climate change (IPCC) reported that the global temperatures will increase from 1.1 to 6.4 C and the sea level will rise from about 16.5 to 53.8 cm by 2100 (IPCC, 2007). This would have tremendous negative impact on the half of the population of the world lives in coastal areas (Lau et al., 2009). In this circumstances many countries like Bangladesh will totally submersed by sea water.

On the other hand, higher economic growth causes environmental degradation which threatens the sustainability of the environment because economic growth is closely related to energy consumption which is responsible for higher levels of  $CO_2$  emissions. It became the general consensus that higher economic growth should not be pursued at the expense of the environment and this issue raised the question of how economic growth can be made more sustainable. Sustainable development defined by Brundtland (1987) as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Some of international organizations around the world continuously attempt to reduce the adverse impacts of global warming. One such attempt is the Kyoto Protocol agreement, made in 1997 as an attempt to reduce the adverse impact of global warming. Among the variety of polluting substances, Carbon Dioxide ( $CO_2$ ) is a major one and represents 60 percent of greenhouse gas emission (World Bank, 2007).

Grossman and Krueger (1991) and Simon Kuznets (1955) states that in the early stages of economic growth, environmental quality decreases with an increase in per capita income, but after a certain level it starts decreasing with the increase in the level of per capita income, thus resulting in an inverted U-shaped curve (i.e. Environmental Kuznets Curve, EKC).

This study seeks to empirically examine the long run causal relationship among environmental pollution (i.e.,  $CO_2$  emission), education (i.e. literacy rate), economic growth (i.e., industry and transport share in GDP) and the share of GDP in education in a

multivariate framework for Bangladesh during the 1974-2010 periods. The study employed the Vector Error Correction Model (VECM) technique to establish the long run and short run relationships among the variables in the model. The study applied a unit root test (Augmented Dickey-Fuller Test and Phillips-Perron Test) to overcome the non stationary problem in data. Cointegration and error correction model based Granger Causality Test are applied to evaluate the possible causal relationship among the variables in the model.

## 7.2 Model Specification and Variables

The study applied multivariate model analysis techniques to examine the relationships among environmental pollution i.e.  $CO_2$  emission, education i.e. literacy rate, percentage share of GDP in education, percentage share of industry and transport in GDP of Bangladesh. The study based on the assumption that production in industry and transport communication driven by high energy consumption that is likely to produce  $CO_2$ , i.e., it is likely to cause environmental pollution, and literacy rate as well as GDP in education is driven to create awareness among people about environmental pollution. The basic form of the relationship among the variables can be expressed as

$$Ep_t = \alpha + \alpha_1 Lit_t + \alpha_2 GDP_t + \alpha_3 Ind_t + \alpha_4 Trans_t + \varepsilon_t \quad (7.1)$$

Where,  $Ep_t$ = Environmental pollution, i.e.,  $CO_2$  emission,  $Lit_t$ = Literacy Rate, i.e., education,  $GDP_t$ = Share of Gross Domestic Production in education,  $Ind_t$  = Contribution of Industry Share in GDP,  $Trans_t$  =Contribution of Transport and Communication share in GDP,  $\varepsilon_t$  = Error terms.

## 7.3 Empirical Study

The empirical study consists of unit root test, the cointegration test, error correction mechanism and Granger causality test. These are discussed below.

### 7.3.1 Spurious Regression

If we run the regression in time series data and the probability value of  $R^2$  looks good superficially but for the further probing it looks suspected, in this respect there may act as a spurious sense. If the regression of a non stationary time series data runs on a non stationary time series data then the estimated regression suffers from spurious results. In this respect there have not the validity of standard 't' and 'F' testing procedures.

Considering the following two random walk models as

$$y_t = y_{t-1} + u_t \quad u_t \sim N(0, 1) \quad (7.2)$$

$$x_t = x_{t-1} + u_t \quad u_t \sim N(0, 1) \quad (7.3)$$

Where  $y_t$  and  $x_t$  are uncorrelated non stationary variables, that are I (1), such that if the following regression model is estimated as

$$y_t = \beta_0 + \beta_1 x_t + \varepsilon_t \quad (7.4)$$

Here, for the non stationary nature of data,  $\varepsilon_t$  have also the non stationary tendency in the series.  $R^2$ , the coefficient of determination, is most commonly used criteria for the adequacy of the estimated models. It should remember that  $R^2$  do not necessary reflect any causal relationship between dependent and independent variables. According to Granger and Newbold, an  $R^2 > d$  is a good rule of thumb to suspect that the estimated regression is spurious, where 'd' means the Durbin Watson statistic. Although  $y_t$  and  $x_t$  are non-stationary, their regression from the first difference of  $y_t$  ( $=y_t$ ) on the first difference of  $x_t$  ( $=x_t$ ) are stationary. In such a regression it will find that  $R^2$  is practically zero and the Durbin Watson 'd' is about 2.

### 7.3.2 Stationarity and Non-stationarity

In this study the Vector Error Correction Model (VECM) technique is employed to examine the long run relationship among  $CO_2$  emission, education, GDP share in education, GDP contribution in Industry and Transport in Bangladesh. Econometric

theory suggests that if the variables are cointegrated, there will be at least's one linear combination of variables in the model. One implication is that most of the time series data are non stationary in nature and the application of OLS techniques will results in spurious outcomes. This data requires that before the application of ordinary least squares (OLS) to estimate the relationship, it is necessary to establish the order of their integration; 1(0) or 1(1). For this purpose, the study applied a unit root test based on the Augmented Dickey-Fuller tests to examine the time series properties of the data.

Any time series data is said to be stationary if its mean and variance are constant over time and the value of the covariance between two time series does not depend on the actual time at which the covariance is computed (Gujarati, 2011). Any series is said to be stationary if the following conditions are satisfied:

$$\text{Mean: } E(y_t) = \mu \quad (7.5)$$

$$\text{Variance: } \text{Var}(y_t) = E(y_t - \mu)^2 = \sigma^2 \quad (7.6)$$

$$\text{Covariance: } \text{Cov}(y_t, y_{t+k}) = E[(y_t - \mu)(y_{t+k} - \mu)] \quad (7.7)$$

Equation (7.5) and (7.6) imply that the series contain a constant mean, variance while equation (7.7) imply that the covariance between any two values of  $y$  from the series depends only on the difference apart in time between those two values ( $k$ ), not on the actual time ( $t$ ) at which the covariance is computed. On the other hand a series is non stationary if it fails to satisfy the above any conditions. A stationary series always moves around its mean value with constant range but non stationary series moves at different points in time with changing its mean and variance.

Another process of explaining the stationarity considering the following autoregressive model as:

$$y_t = \rho y_{t-1} + u_t \quad t=1, 2, 3, \dots, T \quad (7.8)$$

Where,  $u_t$  is the stochastic error term. If the absolute value of  $\rho$  is less than one, then the series  $y_t$  will be stationary and if  $\rho=1$ , then the series is non stationary. Any non stationary time series can be converted into stationary by differencing in order. In this

context how many numbers of differences are needed depend on the number of unit roots the series contain. Say, a series becomes stationary after differencing 'd' times then it contains d unit roots and is said to be integrated of order d, denoted by I(d). If differenced the series  $\Delta y_t = (y_t - y_{t-1})$ , shows that  $\Delta y_t$  moving arounds its mean value and has a finite variance, it is stationary. In equation (7.8), if  $\rho=1$ ,  $y_t$  has a unit root and  $y_t \approx I(1)$ , then the series is non stationary.

## 7.4 Testing Methods of Unit Roots

Testing for the unit root problem, the Augmented Dickey-Fuller test and Phillips-Perron test are discussed as below:

### 7.4.1 Augmented Dickey-Fuller (ADF) Test

The Augmented Dickey-Fuller (ADF) test is used to test for the existence of unit roots and determine the order of integration of the variables; the test we do both with and without a time trend. Akaike method is used to choose the optimal lag length. It can be seen in Table (8.1) of chapter 8, that the presence of a unit root which indicates non-stationarity, cannot be rejected at 5% significance level. But in difference form and in lag length 2, the non stationarity problem is vanished.

### 7.4.2 Phillips-Perron (P.P.) Test

Phillips-Perron (1988) test deals with serial correlation and heteroscedasticity. Phillips and Perron (1988) use non parametric statistical methods to take care of serial correlation in the terms with adding lagged difference terms. Phillips-Perron test detects the presence of a unit root in a series. Suppose,  $y_t$  is estimating as:

$$\Delta y_t = \alpha + \beta t + \rho^* y_{t-1} + u_t \quad (7.9)$$

Where, the PP test is the t value associated with the estimated coefficient of  $\rho^*$ . The series is stationary if  $\rho^*$  is negative and significant. The test is performed for all the variables where both the original series and the difference of the series are tested for stationary.

## 7.5 Cointegration Testing Methods

The concept of cointegration was introduced by Granger (1983) and the statistical analysis of cointegrated process was organized by Engle and Granger (1987). Cointegration means that despite being individually non-stationary, a linear combination of two or more time series can be stationary (Gujarati, 2011). When a linear combination of non stationary variables is stationary, the variables are said to be cointegrated and the vector that is quite possible for a linear combination of integrated variables to be stationary. In this case the variables are said to be cointegrated. The key point of cointegration is:

- (i) Cointegration refers to a linear combination of non stationary variables,
- (ii) All the variables must be integrated of the same order.

Suppose the cointegrated regression equation is:

$$y_t = \alpha + \beta x_t + u_t \quad (7.10)$$

In this series  $y_t$  and  $x_t$  are I (1) and the error term  $u_t$  is I (0). Then the coefficient measures the equilibrium relationship between the series  $y$  and  $x$ . The term  $u_t$ , indicates the deviation from the long run equilibrium path of  $y_t$  and  $x_t$ . A time series data ( $y_t$ ) is said to be integrated of order one and that can be denoted as I (1). If the original non stationary series has to be differenced 'd' times for stationary process, the original series is integrated of order 'd' that can be denoted by I (d). Consistency in ECM requires all of terms to be integrated of order zero, I (0). This is possible only if  $y$  and  $x$  are cointegrated in a linear form, that is  $X_t = \alpha y_t + u_t$  which is stationary.

There are several methods for testing cointegration. Trace Statistics and Maximum Eigen value test are used to find cointegration among the variables.

### 7.5.1 Trace Statistics and Maximum Eigen Test

Johansen and Juselius (1990) method employs VAR system to test for the numbers of cointegration vectors and that test provides two Likelihood Ratio (LR) test statistics to

identify cointegration vector. First test is named trace ( $\lambda_{trace}$ ) statistics and the second is maximum eigenvalue ( $\lambda_{max}$ ) statistics. These tests are given as follows.

Trace Statistic:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^k \ln(1 - \hat{\lambda}_i) \quad (7.11)$$

Maximum eigenvalue Statistic:

$$\lambda_{max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (7.12)$$

Where  $r$  is the number of cointegrating vectors under the null hypothesis and  $\hat{\lambda}_i$  is the estimated value for the  $i$ th ordered eigenvalue from the matrix  $\Pi$ . The trace statistics tests the null hypothesis that the number of cointegrating relations is  $r$  against  $k$  cointegration relations, where  $k$  is the number of endogenous variables. The maximum eigenvalue test examines the null hypothesis that there are  $r$ -cointegrating vectors against an alternative of  $r+1$  cointegrating vectors. To determine the rank of matrix  $\Pi$ , the test values obtained from the two test statistics are compared with the critical value from Mackinnon-Haug-Michelis (1999). For both tests, if the test statistic value is greater than the critical value, the null hypothesis of  $r$  cointegrating vectors is rejected in favor of the corresponding alternative hypothesis.

### 7.5.2 Granger Causality Test

The Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another. Ordinarily, regressions reflect "mere" correlations, but Clive Granger, who won a Nobel Prize in Economics, argued that certain set of tests reveal something about causality. Granger causality examines to what extent a change from past values of a variable affect the subsequent changes of the other variables. A time series  $x$  is said to Granger-cause  $y$  if it can be shown, usually through a series of t-tests and F-tests on lagged values of  $x$  (and with lagged values of  $y$  also included), that those  $x$  values provide statistically significant information about future values of  $y$ . If a time series is stationary, the test is performed using the level values of

two (or more) variables. If the variables are non-stationary, then the test is done using first (or higher) differences. The number of lags to be included is usually chosen using an information criterion, such as the Akaike information criterion or the Schwarz information criterion. Any particular lagged value of one of the variables is retained in the regression if (i) it is significant according to a t-test, and (ii) the other lagged values of the variable jointly add explanatory power to the model according to an F-test. Then the null hypothesis of no Granger causality is not rejected if and only if no lagged values of an explanatory variable have been retained in the regression. The cause and effect relationship among the variables can be determining the following equation:

$$\begin{aligned} \Delta EP_t = & \alpha_{10} + \sum_{i=1}^k \alpha_{11i} \Delta EP_{t-i} + \sum_{j=1}^k \alpha_{12j} \Delta GDP_{t-j} + \sum_{m=1}^k \alpha_{13m} \Delta IND_{t-m} \\ & + \sum_{n=1}^k \alpha_{14n} \Delta TRANS_{t-n} + \alpha_{15} ECT_{t-1} + \mu_{1t} \end{aligned} \quad (7.13)$$

$$\begin{aligned} \Delta GDP_t = & \alpha_{20} + \sum_{i=1}^k \alpha_{21i} \Delta GDP_{t-i} + \sum_{j=1}^k \alpha_{22j} \Delta EP_{t-j} + \sum_{m=1}^k \alpha_{23m} \Delta IND_{t-m} \\ & + \sum_{n=1}^k \alpha_{24n} \Delta TRANS_{t-n} + \alpha_{25} ECT_{t-1} + \mu_{2t} \end{aligned} \quad (7.14)$$

$$\begin{aligned} \Delta IND_t = & \alpha_{30} + \sum_{i=1}^k \alpha_{31i} \Delta IND_{t-i} + \sum_{j=1}^k \alpha_{32j} \Delta EP_{t-j} + \sum_{m=1}^k \alpha_{33m} \Delta TRANS_{t-m} \\ & + \sum_{n=1}^k \alpha_{34n} \Delta GDP_{t-n} + \alpha_{35} ECT_{t-1} + \mu_{3t} \end{aligned} \quad (7.15)$$

$$\begin{aligned} TRANS_t = & \alpha_{40} + \sum_{i=1}^k \alpha_{41i} \Delta TRANS_{t-i} + \sum_{j=1}^k \alpha_{42j} \Delta EP_{t-j} + \sum_{m=1}^k \alpha_{43m} \Delta GDP_{t-m} \\ & + \sum_{n=1}^k \alpha_{44n} \Delta IND_{t-n} + \alpha_{45} ECT_{t-1} + \mu_{4t} \end{aligned} \quad (7.16)$$

$$\begin{aligned} \Delta LIT_t = & \alpha_{50} + \sum_{i=1}^k \alpha_{51i} \Delta LIT_{t-i} + \sum_{j=1}^k \alpha_{52j} \Delta EP_{t-j} + \sum_{m=1}^k \alpha_{53m} \Delta GDP_{t-m} \\ & + \sum_{n=1}^k \alpha_{54n} \Delta TRANS_{t-n} + \alpha_{55} ECT_{t-1} + \mu_{4t} \end{aligned} \quad (7.17)$$



Where  $\Delta$  is difference operator,  $EP_t$  = environmental pollution,  $GDP_t$  = gross domestic product, i.e., economic growth,  $IND$  = industry share in GDP,  $TRANS_t$  = transport share in GDP,  $LIT_t$  = literacy rate of total population,  $\mu_{1t}$ ,  $\mu_{2t}$ ,  $\mu_{3t}$ ,  $\mu_{4t}$ , and  $\mu_{5t}$  are white noise terms and  $ECT_{t-1}$  gives the lagged error correction term derived from the long run effect. The existence of short run causality meaning that the dependent variable responds only to short-term shocks can be determined by testing the null hypothesis of  $\alpha_{12} = \alpha_{13} = \alpha_{14} = 0$  in the equation (7.13);  $\alpha_{22} = \alpha_{23} = \alpha_{24} = 0$  in equation (7.14);  $\alpha_{32} = \alpha_{33} = \alpha_{34} = 0$  in the equation (7.15);  $\alpha_{42} = \alpha_{43} = \alpha_{44} = 0$  in the equation (7.16) and  $\alpha_{52} = \alpha_{53} = \alpha_{54} = 0$  in the equation (7.17). Coefficients of error correction terms (ECT) measure the speed of adjustment. We can also check whether these sources of causality are jointly significant by testing the joint hypothesis of  $\alpha_{12} = \alpha_{13} = \alpha_{14} = \alpha_{15} = 0$  in the equation (7.13);  $\alpha_{22} = \alpha_{23} = \alpha_{24} = \alpha_{25} = 0$  in the equation (7.14);  $\alpha_{32} = \alpha_{33} = \alpha_{34} = \alpha_{35} = 0$  in the equation (7.15);  $\alpha_{42} = \alpha_{43} = \alpha_{44} = \alpha_{45} = 0$  in the equation (7.16) and  $\alpha_{52} = \alpha_{53} = \alpha_{54} = \alpha_{55} = 0$  in the equation (7.17). The rejection of joint hypothesis indicates that after a shock to the system, these sources of causality are responsible for the re-establishment of long-run equilibrium.

## 7.6 Error Correction Modeling (ECM)

Granger (1983) and Engle (1987) analyzed that if the variables are integrated of order one and cointegrated, then there exists the Error Correction Term (ECT) and these variables bears the steady state situation or in equilibrium situation.

Considering the following equation which exist each other relationship as:

$$\Delta y_t = \beta_1 + \sum_{i=1}^n \beta_2 \Delta y_{t-1} + \sum_{i=1}^n \beta_3 \Delta x_{t-1} + \alpha_1 \Delta ETC_{t-1} + \varepsilon_{1t} \quad (7.18)$$

$$\Delta x_t = \gamma_1 + \sum_{i=1}^m \gamma_2 \Delta x_{t-1} + \sum_{i=1}^m \gamma_3 \Delta y_{t-1} + \alpha_2 \Delta ECT_{t-1} + \varepsilon_{2t} \quad (7.19)$$

Where  $x_t$  and  $y_t$  denotes the variables,  $ECT_{t-1}$  is the error correction term which is the lagged residual series of the cointegrating vector, denotes the first difference and the error correction term. Here the error correction term capturing the disequilibrium situation. The negative and significant coefficient of error terms suggests that there is a short run adjustment process working behind the long run equilibrium relationship among the variables. Coefficient parameters of error correction term are the speed of adjustment for the short run imbalances. In fact in the vector error correction model all the variables are endogenously determined within the model. When the variables are cointegrated, there is a systematic and general tendency of the series of return to their equilibrium situation. This means that the dynamics of adjustment is intrinsically embodied in the theory of cointegration.

The error correction model states that dependence on both  $x_t$  and error correction term. If the error correction term is not zero, then the model is out of equilibrium. That is  $y_t$  lies it's equilibrium values and it starts falling in the next period to correct the disequilibrium error.

### **7.7 Conclusion**

In this chapter short run and long run equilibrium among the variables are explained. While dealing with non stationary data, equilibrium in synonymous with the concept of cointegration. Failure to establish cointegration often leads to spurious regressions, which do not neglect long run economic relationship. Cointegration is very closely related to the use of short run error correction models. Thus providing a useful and meaningful link between the long and short run econometric approach, the error correction model (ECM) can be based on with the variables. In this study the error correction term is also used to examine the long run equilibrium relationship among education, environmental pollution and sustainable economic development. Granger causality approach tests both the short run causality through the lagged differenced explanatory variables and long run causality through the error correction term. Granger et al. (2000) suggests that a significant error correction term implies long run causality from the explanatory variables to the dependent variables in a model. However in this chapter we have applied empirical methodologies are used to testing the unit root, Granger causality, cointegration and error correction modeling.

## Chapter 8: Empirical Results

### 8.1 Introduction

The aims of this chapter to analyze the results of unit root test to detect the characteristics of the data series regarding  $CO_2$  emission, literacy rate, GDP in education, percentage share of industry and transport in GDP. Coingration test is used to find the long run relationship and Granger Causality test used to find the causal relationship among the variables. In this respect, Augmented Dickey-Fuller (ADF) Test, Phillips-Perron (P.P) test, cointegration, Granger Causality test, Error Correction Modeling are applied.

### 8.2 Results of Unit Root Test

#### 8.2.1 Augmented Dickey-Fuller Test

We first perform unit root tests on all five series in levels and first difference in order to determine the univariate properties of the data in the analysis. To investigate the stationary properties of the variables we run the regression analysis with an intercept term and with intercept term with trend for testing the presence of a unit root. Results are presented in Table 8.1 and 8.2.

At 5% significance level, it is found that the data series are non-stationary at their level form because the ADF test statistics are less than their respective critical values (in absolute terms). Table 8.1 indicates that the non-stationarity problems vanished after first difference of the data series, because the ADF statistics are greater than their critical values at 5% level and the null hypothesis of non stationarity is rejected.

**Table 8.1: Results of Augmented Dickey-Fuller Unit Root Test**

<b>Level Form</b>		
<b>Variable</b>	<b>ADF</b>	
	<b>With intercept</b>	<b>With trend and intercept</b>
<b>CO2 emission</b>	2.951125(2)	3.540328(2)
Literacy Rate	2.951125(2)	3.540328(2)
Edu. Share in GDP	2.951125(2)	3.540328(2)
Ind. Share in GDP	2.951125(2)	3.540328(2)
Transport Share in GDP	2.951125(2)	3.540328(2)
<b>First Difference Form</b>		
<b>Variable</b>	<b>ADF</b>	
	<b>With intercept</b>	<b>With trend and intercept</b>
<b>CO2 emission</b>	2.954021(2) ***	3.544284(2)
Literacy Rate	2.954021(2) **	3.544284(2)**
Edu. Share in GDP	2.954021(2) **	3.548490(1) **
Ind. Share in GDP	2.954021(2) **	3.544284(2) **
Transport Share in GDP	2.954021(2) **	3.544284(2) **

**Note:** On the base of critical value, \*\*denotes the rejection of null hypothesis of unit root at 5% and \*\*\* denotes that the rejection of null hypothesis of unit root at 10% level of significance. Here we consider the variables with intercept and with trend and intercept in level and first difference form. Number in the bracket denotes lag length.

### 8.2.2 Phillips Perron Test

Phillips Perron Test is also used as a non parametric statistical method to take care of the serial correlation in the terms without adding lagged difference terms. In the level form the statistics value is less than the critical value in both with constant and with constant and time trend. So there is a unit root problem in level form. But in first difference form, for both with constant and with constant and trend, the test statistics value is greater than that of critical value at 1%, 5% or 10% level of significance. So, the null hypothesis of non-stationarity are rejected i.e., the data series are stationary at first difference form. Results of Phillips Perron test is shown in the Table 8.2.

**Table 8.2: Results of Phillips-Perron (P.P) Test**

Variable	Statistics	Critical Values			Statistics	Critical Values		
	With Constant	1%	5%	10%	With Constant and trend	1%	5%	10%
<b>Level Form</b>								
CO2 Emission	3.571060	-3.626784	-2.945842	-2.611531	-1.932346	-4.234972	-3.54032	-3.202445
GDP in Education	-0.901992	-3.626784	-2.945842	-2.611531	-2.759501	-4.234972	-3.540328	-3.202445
Literacy Rate	0.184795	-3.626784	-2.945842	-2.611531	-2.468220	-4.234972	-3.540328	-3.202445
Industry Share	0.168464	-3.626784	-2.945842	-2.611531	-2.128264	-4.234972	-3.540328	-3.202445
Transport Share in GDP	-1.835964	-3.626784	-2.945842	-2.611531	-2.145808	-4.234972	-3.540328	-3.202445
<b>First Difference form</b>								
CO2 Emission	-6.640706	-3.632900	-2.948404	-2.612874	-12.35874	-4.243644	-3.544284	-3.204699
GDP in Education	-6.887097	-3.632900	-2.948404	-2.612874	-6.876830	-4.243644	-3.544284	-3.204699
Literacy Rate	-8.359425	-3.632900	-2.948404	-2.612874	-8.393353	-4.243644	-3.544284	-3.204699
Industry Share	-7.292705	-3.632900	-2.948404	-2.612874	-7.207645	-4.243644	-3.544284	-3.204699
Transport Share in GDP	-6.207344	-3.632900	-2.948404	-2.612874	-6.114559	-4.243644	-3.544284	-3.204699

Note: The test is conducted using Eviews 7.1.

### 8.3 Cointegration Results

Cointegration test clarifies the existence of long run equilibrium relationship among the variables. The estimated results, particularly Maximum Eigen value and Trace statistics are presented in Table 8.3 which indicates that the statistics values are greater than their critical values. This means that the hypothesis of no cointegration is rejected and hence the variables are cointegrated. The Trace statistics and Maximum Eigen value tests indicate that there is one cointegration equation at 5% level. This means that the variables- environmental pollution (i.e.  $CO_2$  emission), education (i.e. literacy rate), share of GDP in education, industry and transport share in GDP have the long run relationships.

**Table: 8.3 Cointegration among Education Share in GDP, CO<sub>2</sub> Emission Education, Industry and Transport Share in GDP**

H0	H1	Trace Statistics	5% Critical value	Max. Eigen value	5% critical value	Hypothesis
H <sub>0</sub> : r=0	H <sub>1</sub> : r=1	105.4033	88.8.380	54.93443	38.33101	None**
H <sub>1</sub> : r=1	H <sub>1</sub> : r=2	50.46890	63.87610	26.51069	32.11832	

Note: The test is performed using Eviews 7.1.

#### 8.4 Results of Granger Causality Test

Granger (1988) analyzed that if the variables are cointegrated then there should be at least one direction of causality between the variables and this causality has been tested by F-statistics. Table 4 shows the results of sector wise Granger causality between the variables. Result shows that literacy rate does not Granger causes education share in GDP but education share in GDP Granger causes literacy rate. That is causation goes from education share in GDP to literacy rate. Industry and CO<sub>2</sub> emission Granger cause each other, that is, emission causes industrial production. Literacy rate does not granger cause emission but emission i.e. environmental pollution Granger cause literacy rate. Literacy rate and industry share in GDP Granger cause each other. Transport share in GDP does not granger cause literacy rate but literacy rate Granger causes transport share in GDP. Industry share in GDP and Education share in GDP Granger cause each other. In lag 4, education share in GDP does not Granger cause emission i.e. environmental pollution but emission i.e. environmental pollution Granger causes education share in GDP.

**Table 8.4: Granger Causality between the Variables (ED, EM, IND, L, T)**

Null Hypothesis	Lag	Obs.	F-Statistics	Probability	Decision
L does not Granger cause ED ED does not Granger cause L	1	36	0.67023 3.62511	0.4188 0.0657	Accepted Rejected**
IND does not Granger cause EM EM does not Granger cause IND	1	36	3.40932 3.03221	0.0738 0.0909	Rejected** Rejected***
L does not Granger cause EM EM does not Granger cause L	1	36	2.09907 3.42968	0.1568 0.0730	Accepted Rejected**
L does not Granger cause IND IND does not Granger cause L	1	36	6.51994 4.10823	0.0155 0.0508	Rejected* Rejected**
T does not Granger cause L L does not Granger cause T	1	36	0.47354 3.41835	0.4962 0.0735	Accepted Rejected**
T does not Granger cause IND IND does not Granger cause T	2	35	3.77709 0.77103	0.0344 0.4715	Rejected** Accepted
IND does not Granger cause ED ED does not Granger cause IND	3	34	5.73793 2.37397	0.0036 0.0923	Rejected* Rejected***
EM does not Granger cause ED ED does not Granger cause EM	4	33	3.38635 0.36868	0.0248 0.8285	Rejected** Accepted

Note: The test is performed using Eviews 7.1. Here, L=Literacy rate, ED=Education Share in GDP, IND=Industry Share in GDP, EM=Carbon Dioxide ( $CO_2$ ) Emission, T=Transport and communication Share in GDP, GDP=Gross Domestic Product; \*, \*\*and \*\*\* denote 1%, 5% and 10% levels of significance respectively.

From the results it can be said that more education share in GDP strengthen the literacy rate and increase in literacy rate creates awareness among the people that reduces emission i.e. environmental pollution. The educational attainments lead to reduction of environmental pollution and it also leads to GDP growth.

### 8.5 Results of Error Correction Modeling (ECM)

After checking unit root tests, Johansen maximum likelihood procedures are used to test for cointegration among the variables. Since cointegrating relationship is found among the variables, an error correction model (ECM) could be constructed to determine the direction of causality. The significant lagged ECT coefficient indicates that the current outcomes are affect by the past equilibrium errors.

The long term effects of the variables can be represented by the estimated cointegration vector. The adjusted coefficient of error correction term shows the long term effect and the estimated coefficient of lagged variables shows the short term effect. Table 8.5 shows the auto regression among the variables. The (\*\*) values are statistically significant and shows the estimated coefficient of lagged variables.

**Table 8.5: Causality Test from Estimates of Vector Error Correction Model for (EM, ED, IND, L and T)**

Error Correction:	D(ED)	D(EM)	D(IND)	D(L)	D(T)
CointEq1	-0.197192 [-4.01956]	0.003250 [ 1.46041]	0.648185 [ 1.55042]	4.404343 [ 2.00416]	-0.271871 [-0.67358]
D(ED(-1))	0.021097 [ 0.23703]	-0.001941 [-0.48061]	-0.669111 [-0.88216]	-2.511329 [-0.62987]	0.481522 [ 0.65757]
D(ED(-2))	-0.291701** [-3.36686]	0.001162 [ 0.29571]	-2.146998** [-2.90791]	-4.042221 [-1.04153]	0.308227 [ 0.43241]
D(EM(-1))	-11.13698** [-2.54031]	-0.121469 [-0.61071]	-64.33423 [-1.72196]	-135.1425 [-0.68814]	9.226587 [ 0.25580]
D(EM(-2))	-2.803119 [-0.61565]	-0.305933 [-1.48103]	-24.32887 [-0.62701]	-341.4481 [-1.67409]	46.26570 [ 1.23506]
D(IND(-1))	-0.076944** [-2.79737]	2.16E-05 [ 0.01733]	-0.377184 [-1.60913]	-0.683500 [-0.55472]	0.048155 [ 0.21279]
D(IND(-2))	0.117927** [ 4.61832]	0.000708 [ 0.61086]	0.250479 [ 1.15108]	-0.430977 [-0.37678]	0.028585 [ 0.13606]
D(L(-1))	0.002945 [ 0.63228]	-0.000168 [-0.79476]	0.022310 [ 0.56212]	-0.558650** [-2.67780]	-0.011108 [-0.28990]
D(L(-2))	0.003093 [ 0.66774]	0.000168 [ 0.79811]	0.023133 [ 0.58601]	-0.065717 [-0.31670]	-0.027110 [-0.71134]
D(T(-1))	-0.047682 [-1.45567]	0.000876 [ 0.58964]	-0.382443 [-1.37004]	-1.165117 [-0.79403]	-0.073694 [-0.27345]
D(T(-2))	0.138108** [ 4.01137]	-0.000462 [-0.29573]	0.471253 [ 1.60616]	-0.799860 [-0.51862]	-0.028214 [-0.09960]
C	0.092694 [ 2.68091]	0.002960 [ 1.88678]	0.784618 [ 2.66288]	3.688128 [ 2.38122]	-0.175496 [-0.61693]

Note: \*\* denotes the rejection of the hypothesis at 5% level of significance. Values in the third brackets show the standard t-statistics.



Table 8.5 shows that the error correction term is significant for carbon dioxide ( $CO_2$ ) emission (EM), industry share in GDP (IND) and transport share in GDP (T) indicating the short run and long run relation of economic growth and environmental pollution. The error correction term is significant for education share in GDP (ED) and literacy rate (L). This indicates that literacy rate is influenced by the education share in GDP.

## 8.6 Conclusion

This chapter uses secondary data to examine the causal relationship among education, environmental pollution and sustainable economic development for Bangladesh over the period 1974-2010 using a multivariate approach. Johansen cointegration results reveal that  $CO_2$  emission, literacy rate, education share in GDP, industry and transport share in GDP are cointegrated and indicate the long run relationship among the variables.

Granger causality approach within an error correction frame work confirms the unidirectional causality between emission and education share in GDP. The findings suggest strong evidence of unidirectional causality between  $CO_2$  emission i.e. environmental pollution and education share in GDP as well as environmental pollution (i.e., emission) and literacy rates. This implies that more education share in GDP intensifies the literacy rate and literacy rates create the awareness among the people. This awareness among the people reduces the environmental pollution.

## **Chapter 9: Summary, Conclusions and Recommendations**

### **9.1 Introduction**

Education is the vital element to create awareness among the people. It is also considered as a fundamental tool for conscious and organizing a society towards a specific goal. In twenty first century economic and social development of Bangladesh cannot be attained without educational development because the present world is more competitive rather than ago. For the sustainable development it will be a challenged for the nation to prepare its human capital with sound health and good quality of education for probable and productive purpose. For sustaining the trend of development it is also needed to keep the balance of environment mainly depends on the various human activities.

The objectives of this study is to examine the knowledge, practice and attitude of the respondents through primary data regarding environmental pollution and analyze the causal relationship among education, environmental pollution using the secondary data covering the period of 1974-2010.

### **9.2 Summary of the Major Findings**

The study has arranged empirical evidence concerning the relationship among environmental pollution, education and sustainable economic development in Bangladesh. This study has used both the primary survey and secondary data for the enrichment of the research work. The collected primary data has analyzed with various Tables and charts. On the other hand, for the secondary data, empirical econometric methodologies, such as, unit root test, cointegration test, Granger causality test, error correction methods are applied.

The primary survey on environmental knowledge, attitude and practice reveals that they have the positive and expected trend of awareness of the respondent regarding environmental pollution. But in several cases, they have the misconception relating to the environmental pollution.

With the secondary data, after testing of unit root, we examine the cointegration test without a trend and with a trend. We find one cointegration relationship at 0.05 percent level of significance among the variables. Johansen cointegration results reveal that  $CO_2$  emission (i. e. environmental pollution), literacy rate (i. e. education), education share in GDP, industry and transport share in GDP are cointegrated. This indicates the existence of long run equilibrium relationship among the variables. Short run equilibrium relationships among the variables are also shown by error correction modeling.

Granger causality test ensures that the presence of unidirectional causality between education and environmental pollution. The findings suggest the strong evidence for unidirectional causality from  $CO_2$  emission (i. e. environmental pollution), literacy rate (i.e. education). Running the regression of environmental pollution on literacy rate, it is found that the standardized coefficient (beta) of literacy rate is negative which implies that if the literacy rate increases then the  $CO_2$  emission i.e. environmental pollution will be reduced.

It is also observed from the error correction model that there remains a difference between short and long run values of the variables. This error will be eliminated in the long run through the reducing of environmental pollution. This indicates that the environmental pollution is likely converging to the long run equilibrium growing the awareness of the people through education and gain the sustainable development.

The core messages of this thesis convey the fact that there exist long run relationship among education, environmental pollution and sustainable economic growth. To establish this relationship time series annual secondary data from 1974 to 2010 have been used in this study.

### **9.3 Policy Implications**

Education is the vital elements in terms of its impact on health, poverty alleviation, sustainable improvement of the environment etc. But there are many problems in education system of Bangladesh that are *inter alias* poor educational background of the tutors, very high pupil-tutor ratio, weak physical facilities of the institutions, lack of proper training of the tutors, complexity of the administrative and other works related to

the issue, insufficiency of government budget and low salary package etc. For eradicating illiteracy and creating widespread mass awareness regarding protection of the environment and utilization of all national resources in a sustainable and environmentally sound manner, the government needs to take initiatives and proper training in education. But for improving the quality of education, share of GDP in education is very low and this amount is around 2.35 percent of total GDP, over the past 20 years that indicates the poor scenario in education sector of Bangladesh. Total GDP volume has been increased many fold but educational expenditures did not increase with the same direction.

#### **9.4 Policy Analysis**

Above findings suggest that there are short and long run relationship between education and environmental pollution in Bangladesh. However, the policies in this field should be under taken for ensuring quality education and cooperation among the various organizations. These are as follows:

##### **9.4.1 Probable Cooperation among the Environment Related Organizations**

At present, the education sector in Bangladesh is seriously under resourced lacking the threshold of per capita expenditure needed at different levels. In respect of this reality the following organization can help to achieve sustainability through reducing environmental pollution.

##### **Non Government Organizations (NGOs)**

It can play the role in creating environmental awareness among the people and organizing various appropriate training programs among concern groups. NGOs can raise awareness about health and nutrition, hygiene, safe drinking water, sustainable farming, primary health care, sanitation, population control and family planning through group and community action. NGOs also can give the people training with group discussion, non formal schooling etc. for the conservation of environment.

## **Civil Society Organization**

Various organization of civil society can come up with different activities aiming at the protection and conservation of environment. These are as:

- Bangladesh Poribesh Andolon (BAPA) aiming to promote public awareness and action for the prevention of environmental degradation, mitigation of pollution and the safe protection environment in Bangladesh and influencing protection of the global environment. With the campaigns including demonstrations, rallies and boat processions to protest against pollution of the rivers Buriganga, Turag and Balu, Gulshan-Baridhara Lake, Baragram and Ashulia water bodies, it can play the role for protecting from pollution scatter all over Bangladesh.
- Bangladesh Environmental Lawyer Association (BELA), whose mission is to ensure sound and sustainable ecological order in the country using legal mechanism, proper observation and make people aware of their environmental right and duties, BELA can conduct its activities through workshops, various training and dissemination of information on environmental regulation through the media, legislative activities, documentation, publications etc. throughout the country. It can cooperate with other organizations related to environmental protection, for increasing awareness among the people.

## **Mass Media**

The electronic media like Bangladesh Radio and Bangladesh Television and the print media such as newspapers, periodicals and journals can play very significant role in environmental pollution education programs. For creating awareness in marginal level of the society about air pollution, water pollution, deforestation, industrial effluents, soil pollution, greenhouse effect etc. mass media can play the vital role for protecting them from pollution.

## **Local Communities**

Local communities can play an important role for protecting from desertification, forest destruction to commercial logging industrial pollution, population growth, changing life

styles or structures, ecological imbalances etc. in positive way. Lack of coordination amongst respective organization is common problem in Bangladesh. Many ministries or departments adopt their individual policies and program to pursue their own mandate without any collective efforts and because of this duplication exists between the actors. Unavailability of data and information on environmental education related issues also hamper the activities of environmental educators and facilitators.

#### **9.4.2 Educational Expenditure should be increased**

Investment in education is the best investment. If we want to drive the nation with a view to specific goal, it will not possible without proper education and technology. In the present competitive world, we have no opportunity to develop of our nation without developing the education sector of Bangladesh. So, budgetary allocation as well as in various environmental training for creating awareness for the implementation of rules and regulations regarding the issues of environmental pollution should be increased.

#### **9.5 Conclusion**

This study designed with both the primary and secondary data. Primary data are collected from the students and teachers respondents by close and open ended questionnaire on their knowledge, practice and attitude about environmental pollution. The collected primary data are mainly regarding on air, water, soil and noise pollution. Observation method was conducted to collect the data through observation checklist for avoiding the false information. Data are also collected from intellectual level related to curriculum and policy making through interview schedule. The collected primary data has been analyzed by Tables, Graphs and percentage of their views. Results suggest that in several cases the students' respondents have the misconceptions regarding environmental pollution. For example 50% students' respondents are fully agreed with the statement that 'Mosquitoes, flies, insects etc. should be destroyed because they are harmful'. In this case they do not know the importance of mosquitoes, flies, insects etc. for the ecological balances. Another factor is that although fire in forest, acid rain, ice

falling are not so related to our local environment but also a remarkable portion (about 15%) student respondents have mentioned that that are related to our environment.

The main objectives of this study are to know the impact of formal education in reducing environmental pollution in Bangladesh. For the enrichment of this study, secondary data are also used to examine the causal relationship among education and environmental pollution for Bangladesh over the period 1974-2010 using a multivariate approach. With secondary data, the study examines the short run and long run relationship among the variables. Granger causality approach within an error correction frame work confirms that there is a unidirectional causality between emission and literacy rate and between emission and education share in GDP. Results of Granger causality indicates that the value of F-statistics is 3.42968 which reject the hypothesis that emission (EM) does not Granger cause literacy rate (L). Moreover F-statistics value 3.38635 indicates that emission (EM) ganger cause education share in GDP. In addition ECM results indicate that the standard t-statistics is significant both in short and long term viewpoint in respect of causality among the variables. The findings suggests that evidence for unidirectional causality from  $CO_2$  emission (i.e. environmental pollution), to literacy rate (i.e. education). Johansen cointegration results reveal that  $CO_2$  emission, literacy rate, education share in GDP, industry and transport share in GDP are cointegrated and indicate the long run causal relationship among the variables where Trace Statistics 105.4033 is greater than 5% critical value 88.8380 and Max-Eigen value 54.93443 is greater than 5% critical value 38.33101. This indicates that the economy is likely to converge to equilibrium in the long run with reducing the pollution of environment through education. As a developing country like Bangladesh, these results provide a bench mark to take decision regarding environmental pollution for sustainable development and for further research work.

## 9.6 Policy Recommendations

From the primary survey it is found that there have the misconceptions of the respondent about environmental knowledge, attitude and practice. For the fortification of the research work with the secondary data, there found the short run and long run causality among environmental pollution (i.e.  $CO_2$  emission), education (i.e. literacy rate) and sustainable development (i.e. industry and transport share in GDP). Therefore the following policies may be suggested:

- a. Creating awareness through education in entire level of the education system and society.
- b. Awareness regarding environmental pollution should be increased through exhibition, posturing, campaigns, audio-visual materials etc. both in urban and rural areas.
- c. Training system should be mandatory regarding environmental pollution for awareness and efficiency of the teachers and other managerial body related to education.
- d. Share of education expenditure in GDP should be increased immediately.
- e. Development expenditure on education should be increased, so that it can help to improve the infrastructures of educational institutions.
- f. Establishment of polluter's pay principle, enforcing by the environment regulatory body of the government.
- g. Effluent Treatment Plant (ETP) must be established in industry, especially for red category industry.
- h. Need to improve traffic system and new technology should be applied for brick making process to reduce air pollution.
- i. Environmental laws and ordinance should be updated in accordance with the present need and proper implementation.



- j. Education for sustainability should be included in the national curriculum and higher education.
- k. Mass communication media should be adopted for information related to pollution problems.
- l. Recycling plants for municipal waste and sewages should be established.
- m. Scientific Societies, Associations and Academies should raise voice against environmental pollution in both rural and urban areas.
- n. In agriculture, biological control of pests should be applied to replace wide use of insecticides, pesticides and fungicides. Biological nitrogen fixation should be adopted reducing chemical fertilizers.
- o. Establishment of the environmental judiciary with the expert judges in various field of environment.

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## Appendix

### Questionnaire for M.Phil Projected Research

**Title: Role of Education in Reducing Environmental Pollution in Bangladesh**

Researcher: Mirza Md. Moyen Uddin  
M.Phil Fellow  
Institute of Education and Research  
University of Rajshahi, Rajshahi

Supervisor: Dr. Md. Abdul Wadud  
Ph. D (Newcastle, UK)  
Professor, Department of Economics  
University of Rajshahi, Rajshahi

Special Information:

[Collected data will be used only for the research work. Privacy of the respondent will be kept.]

#### Question on socio-economic aspects

Questionnaire

No.....

Date: .....

#### Respondent's Information

Name of Respondent: ..... Student: Male / Female

Name of Institution: .....

Class: ..... Age: .....

Address: .....

Questionnaire for Data Collection from Student Respondents

**(Knowledge About Air Pollution)**

**01. What do you mean by Air pollution?**

a) Atmospheric condition in which various substances are present at concentrations high enough above their normal ambient levels to produce a measurable effect to people, animals, vegetation or materials.

b) Atmospheric condition with a foreign substance either from natural anthropogenic sources that cause harmful effects on the biota due to their toxicity.

c) Air pollution can be define as an accumulation of unusable heat from human activities that disrupts ecosystems in the natural environment and described in context to local problems, as on global basis, the change in heat is insignificant.

d) Air pollution means any solid, liquid or gaseous substances present in the atmosphere in such concentrations that may or trend to be injurious to human beings or other living creatures or plants or property or enjoyment.

**02. What are the sources for air pollution?**

a) Industrial and urban wastes, b) Radioactive pollutants, c) Agricultural pesticides, biological agents. d) Domestic sewage and run-off. e) Burning fissile fuel, f) Industrial plants, g) Brick kilns, h) Vehicles i) Construction sites. j) Industrial effluents.

**03. Identify the air pollutant from vehicles.**

a) Particulate matter (PM). b) Volatile Organic compounds (VOx), c) Carbon monoxide (CO), d) Oxides of Nitrogen (NOx).

**04. What are the consequences of Air pollution?**

a) Atmosphere will be extreme hot, b) Atmosphere will be extreme cold, c) Many diseases like asthma, skin cancer etc. will increase d) Carbon dioxide and carbon monoxide will decrease. e) Rain fall will increase, f) Deforestation will increase; g) Sea level will increase. h) Population will increase. i) Industrial and agricultural productivity will decrease.

**05. How we can reduce Air pollution?**

- a) By political speech, b) Avoiding vehicles, c) Adopting various environmental rules and regulations, d) Less use of motor vehicles, e) Avoiding vehicles older than 20 years, f) Using proper lubricants, g) Reducing the number of vehicles on streets, h) Using CNG and LPG, i) Imposing extensive penalties on polluters, j) Relocating hazardous industries like brick kilns away from human habitations, k) Destruction of pathogens by proper treatment.

**06. What is Green House effect?**

- a) Green house effect is a warming of the Earth's surface and lower atmosphere that trends to intensify with an increase in atmospheric carbon dioxide.
- b) The green house effect means warming inside the house, formed with glassy shed so that man and other animal can live within the house comfort fully.
- c) The green house effect is a system by which man make his residence to live in so that he can protect himself from the adverse impact of winter.
- d) Green house effect means for the protection from the wild animal in winter oriented country, the houses made with hard glass in which man can easily live.

**07. What is the consequence of green house effect?**

- a) Atmosphere will be extreme cold and sea level will decrease.
- b) Biodiversity will increase in atmosphere
- c) Atmosphere will be extreme hot and low land will submerge by sea.
- d) There will be no change in atmosphere.

**08. What are green the green house gases and responsible for increasing temperature of the world?**

- a) Carbon dioxide ( $CO_2$ ), b) Water Vapor, c) Oxygen, d) Methane, e) Hydrogen, f) C. F. C (Chloroflouro carbon), g) Nitrous Oxide (NOx), h) Dust, i) Ozone

**09. What is the measure for preventing carbon dioxide ( $CO_2$ ) increase in atmosphere?**

- a) Establish Oxygen plant, b) Forestation, c) Deforestation; d) Increase the use of  $CO_2$ .

**(Knowledge About Water Pollution)**

**10. What do you mean by Water pollution?**

a) Water pollution is the contamination with a foreign substance, either from natural or anthropogenic sources that causes harmful effects on the biota due to their toxicity, reduces oxygen level in water, making it aesthetically unsuitable and spreads epidemic diseases.

b) Water pollution can be define as the problems in land lies in the leach and mounting amount of wastes that ooze out of the garbage heap are known to move slowly through the layers of soil beneath and contaminate the water resources deep down the land.

c) Water pollution means any solid, liquid or gaseous substances present in the atmosphere in such concentrations that may or trend to be injurious to human beings or other living creatures or plants or property or enjoyment.

d) It can be define as an accumulation unusable heat from human activities that disrupt ecosystem in the natural environmental and described in context to local problems, and on the global basis, the change in heat is insignificant.

**11. What are the sources for water pollution?**

a) Industrial garbage, b) vehicles and particulate matter, c) unsanitary latrine, d) fossil fuel, e) littering and dumping of rubbish, f) brick kilns, g) agricultural chemical and pesticides, h) volatile organic compounds (VOC), i) dust and construction sites, j) oxide of sulfur and nitrogen.

**12. What are the consequences of Water pollution?**

a) Atmosphere will extreme hot, b) Increase the diseases like diarrhea, dysentery, arsenicosis, c) sea level increase, d) decreases agricultural productivity, e)

deforestation, erosion will increase, f) many diseases like asthma, cancer etc. will increase, g) cyclone and tidal waves will increase, h) Increases biodiversity.

### **13. How we can reduce Water pollution?**

a) Proper planning of industrial area like zoning, b) Reducing the number of vehicles on streets, c) creating high boundaries of water body, d) relocating the hazardous industries like brick kilns to areas away from human habitations, e) using organic fertilizer, f) destruction of pathogens by proper treatment. g) imposing extensive penalties on polluters, h) Industrial and household wastes must not be disposed in rivers or lakes, i) Integrated pest management and not using of harmful chemical and pesticides in agriculture, j) By Establishing Effluent Treatment Plant (ETP).

### **(Knowledge About Soil Pollution)**

### **14. What do you mean by Soil pollution?**

a) It means any solid, liquid or gaseous substances present in the soil in such concentrations that may or trend to be injurious to human beings or other living creatures.

b) It means as metallic and radioactive pollutant, construction sites, dumping of rubbish mixing with soil.

c) Enormous volume of industrial and household wastes, polythene shopping bags, paper plastic that are threat to soil and drainage system, over use of agricultural pesticides, fertilizers that reduces the fertility of top soil is called soil pollution.

d)It consists of highly heterogeneous mass of discarded material from the urban community as well as more homogeneous accumulation of agricultural, industrial and mining wastes in soil.

### **15. What are the sources of soil pollution?**

a) Burning of fossil fuel, b) polythene bags, c) domestic sewages, d) agricultural pesticides, e) traffic congestion, f) vehicular emissions, g) Industrial and house hold garbage, h) fertilizers



**16. How we can reduce Soil pollution?**

a) Recycling papers, plastics and other materials, b) imposing extensive penalties on polluters, c) using natural fertilizers, e) destruction of pathogens by proper treatment, f) planting trees and reforestation, g) using proper lubricants, h) by political speech, i) adopting various environmental rules.

**17. What roles the forest plays to keep the balance of the environment?**

a) Forest controls the direction of wind. b) Forest protects from green house effects.  
d) Forest helps to keep environment cool. d) All the above.

**(Knowledge About Noise Pollution)**

**18. What do you mean by noise pollution?**

a) Traffic congestion, volatile organic compounds (VOx), Industrial and vehicular pollution are known as noise pollution.

b) Metallic and radioactive pollutant, construction sites, dumping of rubbish etc. are known as noise pollution.

c) Sound of road traffic, construction, industry, coal-fired power plants, consumer products are known as noise pollution.

d) When sound becomes loud or disagreeable, results in physiological or psychological harm and damaging human hearing and causes heart diseases is called noise pollution.

**19. What is responsible for noise pollution?**

a) Sound of cyclone, b) High volume music, c) Sound of birds and animals, d) Hydraulic motor horn, e) Sound of tidal and tornado, f) Sound of air craft, g) Sound of brick kilns h) Rocket engine.

**20. Mention the diseases which are created from noise pollution.**

a) Impairment of hearing, b) Respiratory problem, c) cancer and genetic effects, d) high blood pressure, e) Headache and fever, f) Stomach pain, g) heart diseases, h) Bronchitis, asthma.

### (Knowledge on Overall Environmental Pollution)

**21. Mention some hazards in our environment.**

a) Flood, b) fire in forest, c) drought, d) Tsunami, e) deforestation, f) ice falling, g) tornado, h) river erosion, i) salinity, j) acid rain, k) earthquake, l) cyclone.

**22. How we can protect our environment from pollution?**

a) By creating through awareness, b) reducing the growth of population, c) by recycling, d) by implementation of environmental laws, e) by political speech, f) threatening among people not to pollute the environment.

**23. One which date the 'world environment day' is celebrated?**

a) 5 April, b) 5 June c) 5 May. . d) 5 July.

### (Questionnaire on Environmental Practice)

**Direction:** These items are related with your environment related practice. Mentioned your opinion by a Tick (✓) mark

**24. Which water do you use for cooking and other works at home?**

a) Water tap water, b) Tube well water, c) Pond and River water d) From other sources....

**25. Do you wash your clothes in the pond or river?**

a) Don't wash in the pond/river water c) Never wash in the pond/river water, b) Sometimes wash in the pond/river d) Not applicable.

**26. What do you do if a water tap is opening unnecessarily?**

a) Off the tap, b) Don't off the tap; c) Don't take it under consideration, d) others (please write).....

**27. What do you do with the wastes of your family?**

a) Through it here and there, b) Put it at the fixed place, c) Bury in the ground, d) Others (please write).....



## Environmental Attitude Scale

**Direction: Give your opinion to the following statement. Mention your opinion by a Tick (✓) mark**

Statement Regarding Air	Fully Agreed	Mostly Agreed	Moderately Agreed	Less Agreed	Not Agreed
Increase of carbon dioxide in the air may bring danger for the environment.					
Nature will conserve air automatically because it is a part of the nature.					
Forestation prevents carbon dioxide increase.					
Green house gas is responsible for heating atmosphere.					
<b>Statement Regarding Water</b>					
Drinking polluted water is responsible for many stomach diseases.					
It is necessary to use water economically.					
Nature will conserve water automatically because it is a part of the nature.					
<b>Statement Regarding Soil</b>					
Polythene and Plastic reduces the fertility of Soil.					
Industrial and Urban wastes responsible for Soil pollution.					
Fertility of Soil does not decrease if a crop is grown on the same field every year.					
Thinking of soil pollution is unnecessary rather than other elements of environmental pollution.					
<b>Statement Regarding Noise</b>					
Everybody should aware about noise pollution like high volume music, motor horn etc.					
Noise pollution is responsible for high blood pressure and heart diseases.					
<b>Statement Regarding Overall Environment.</b>					
Since man has prospered highly in science, he does not need to depend on environment					

Balance of environment is not dependent on human activities.					
In order to keep the environment fresh and beautiful, its air, water and land must remain pollution free.					
Mosquitoes, flies, insects etc. should be destroyed because they are harmful.					
Everybody should obey the law of 'ban of polythene.					
It is not a matter if we, the younger, do not think about environmental pollution.					
The environment near our homes can be kept beautiful if we try a little.					

### Observation Schedule/ Checklist

Name of School: .....

Location:                     Urban             Rural

Observable Feature	Satisfactory	Moderate	Unsatisfactory
Cleanliness of the classroom			
Facilities of fresh air and light in the classroom.			
Use of waste basket			
Cleanliness of the school ground			
Amount of trees in the school compound			
Sufficiency of the latrines			
Cleanliness of the latrines			
Sufficiency of the environment related topics in the bulletin board.			
Books relates to environment in the school library			
Psychological environment of the school			

## Questionnaire for the Teacher Respondents

### Question 1: Biographical Data

Give a Tick Mark (✓) in the relevant block.

#### Gender

Male

Female

#### Age group

20-30 years

31-40

41-50

51-60.

#### Years of experience in Teaching

Less than 5 years

5-10 years

11-20 years

More than 20 years.

#### Position

Teacher

Head of Department

Vice Principal

Principal

#### Qualification

Graduate/Graduate (hons.) Degree

Masters Degree

M. phil Degree

Doctorate Degree

1.6 Mobile No. ....

## Questionnaire 2: Environmental Literacy/Education/Awareness for Teacher

(Please give a Tick Mark (√) in the relevant block)

2.1 Have you studied Environmental pollution education at your educational curriculum?

Yes	No
-----	----

2.2 Have you attended courses or training in environmental pollution education?

Yes	No
-----	----

2.3 Environmental pollution is one of the biggest problems in Bangladesh?

Yes	No
-----	----

If yes, then Rank according to importance.

Items	Rank
Air pollution	
Soil pollution	
Water pollution	
Noise pollution	
Others....	

2.4 There is a need to spend more time teaching students about the environment?

Yes	No
-----	----

If yes, then which element of environment should be given more time to teach?

Please Rank

a) Water ..... b) Air ..... c) Soil ..... d) Noise .....

2.5 There are numerous opportunities provided regularly to learn about environmental pollution in Bangladesh?

Yes	No
-----	----

If no, then mention, what are the elements that are needed to learn more about environmental pollution? .....

2.6 Do you think there is need a separate course at secondary level about environmental pollution education?

Yes	No
-----	----

2.7 Do you think that the environmental education should be mandatory at Primary, Secondary and Tertiary level?

Yes	No
-----	----

2.8 Do you think that there is a need for every teacher to receive environmental education (EE) training?

Yes	No
-----	----

If yes, then about which elements of environment should given more importance?

Please Rank according to importance.

- a) Water ....      b) Air .....      c) Soil .....      d) Noise .....

2.9 Do you think that the 'World Environment Day', 'World Health Day', 'World Aids day', 'Heritage Day' should celebrate for creating awareness in your school?

Yes	No
-----	----

2.10 Do you have any comments or particular suggestion for reducing environmental pollution in Bangladesh? If yes, please explain it details

.....  
.....  
.....  
.....



QUESTIONNAIRE  
(Questionnaire for M.Phil Projected Research)

Researcher: Mirza Md. Moyen Uddin  
M.Phil Fellow  
Institute of Education and Research  
University of Rajshahi, Rajshahi

Supervisor: Dr. Md. Abdul Wadud  
Ph. D (Newcastle, UK)  
Professor, Department of Economics  
University of Rajshahi, Bangladesh

Special Information:

Generally the data has to be collected from the respondents of selected area in Bangladesh. Privacy will be kept.

Question on socio-economic aspects

Questionnaire

No.....

Date:.....

Respondent's Information

Name of Respondent: ..... Male / Female

Name of Institution: .....

Designation: ..... Experience: .....

Address: .....

.....

## Questionnaire for the Policy Makers

(Policy and Issues (For Intellectual Level)

(Perspective to Making Curriculum at Secondary Level Education)

3.1 Do you think that the present educational curriculum is quite appropriate for creating awareness among the secondary level students about environmental pollution?

Yes	No
-----	----

3.2 Do you think that there is needed a separate environmental pollution education course at secondary level?

Yes	No
-----	----

3.3 Do you think that the environmental pollution education course should be mandatory for each group of students at secondary level?

Yes	No
-----	----

If yes, then Rank according to importance.

Items	Rank
Air pollution	
Soil pollution	
Water pollution	
Noise pollution	
Others....	

3.4 Do you think that there is needed to involve the environmental rules at secondary level education curriculum for creating awareness?

Yes	No
-----	----

3.5 Please comments or give particular suggestions for reducing environmental pollution through education in Bangladesh.

.....

.....

**Policy and Issues (For Intellectual Level)**  
(Perspective to Environment Related Rules and Activities)

4.1 Do you think motivation and peoples' support is stronger than the laws and regulations for sustainable improvement of environmental pollution quality?

Yes	No
-----	----

4.2 Do you think when people will be educated then the environmental laws will be more activated?

Yes	No
-----	----

4.3 Do you agree that if one violets the environmental laws and regulations then penalties should be implemented?

Yes	No
-----	----

4.4 Please, identify the causes of non- enforcing of laws and regulations at present situation.

- a) Lack of coordination among concerned agencies.
- b) Complicated system.
- c) Negligence and corruption of law enforcing agencies.
- d) Local pressure.
- e) Illiteracy,
- f) Others.....

4.5 Please comments or give particular suggestions for reducing environmental pollution in Bangladesh.

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