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A Research Analysis On The Studyof the relation between Scientific Knowledge, Aptitude and Environmental Awareness

Dr. Chandra Mukherjee
Assistant Professor
Department of Education
Seth Anandram Jaipuria College, Kolkata. India.

1. Introduction:

Mankind is in danger. Environmental degradation is occurring regularly as a result of random human activities, such as urbanization (Bhuvandas and Aggarwal 2012) , deforestation (Kumar ,2023) industrialization (Sinfgh,2015) , pollution (air, water and soil (Ali and Rahman ,2024) over-population (Jargin ,2025), and greenhouse gas emissions (Kumar and Rahman ,2024) As a result, the mother earth is suffering from global warming, (IPCC,2018), ozone depletion, (Wvebbles,2025) 0rise of sea water level due to melting of glaciers throughout the world (Amini,,2025), soil erosion, (Mahdi 2000) exhaustion of natural resources (ayad,2023) etc. Conscious efforts have been made worldwide to protect the natural environment through long-term policies, and awareness programs are also undertaken to change the behaviour and attitude of the people to think logically act responsibly and execute fruitfully check population growth.

1.1. Environmental Awareness

Awareness is watchfulness, being alert and paying close attention specially to potential danger or problem. It is a state of being vigilant and constantly aware of what is happening around an individual. From the psychological point of view, importance of the attitude and values cannot be denied, even if it has been argued by many that the attitude often is not transformed into real overt actions. Readiness to accept facts, which are contrary to one's personal interest, may more easily be transformed into overt actions by persuasion or otherwise than in the case where readiness is absent. Therefore, it is essential to include and assess the defective components of awareness in any comprehensive approach to its assessment.

Environmental Awareness is not merely called "Concern for environment", it is the existence of environment, into one's consciousness and that existence is not merely a passive presence of something, but an active and dynamic part of one's behaviour (action), intensive farming practice, over consumption of natural resources, destruction of bio-diversity, wildlife, knowledge (cognition) and values and attitude (affection). Thus, environmental awareness has three components – cognitive, effective and behavioural.
The uniqueness of this study lies in the knowledge and aptitude of science tend to grow proper environmental awareness, full of ethical values and beliefs in human conscience.
The lack of continuous research studies available in this field, which covers extensive studies of rural and urban and metro city Kolkata – higher secondary school students who were pursuing courses in Physics, Chemistry, Mathematics and Biology.

1.2. **Cognitive factors of awareness –**

It is posited that individuals who possess environmental awareness are inherently driven to acquire comprehensive knowledge about the environment. Consequently, they actively or incidentally gather, process, and store pertinent information. According to this assumption, one who is more aware of the environment has more knowledge about it, and vice versa. This is an indirect reference to the cognitive approaches of

psychological studies because peoples' perceptions and thoughts are largely related to the knowledge and skills necessary for acquiring knowledge.

1.3. Affective factors of awareness

Similarly, it is further posited that individuals who possess environmental awareness are likely to exhibit eco-friendly attitudes and values, as well as a motivation to engage with environmental issues. These traits are considered to be enduring characteristics in individuals, potentially manifesting as a readiness to understand and address environmental matters. From psychological point of view, the importance of attitudes and values cannot be denied, even if it has been argued by many that attitudes are often not transformed into real overt actions. Readiness to accept facts, which is contrary to one's personal interest, may more easily be transformed into overt action by persuasion or otherwise, than in the case where readiness is absent. Therefore, it is essential to include and assess the affective components of awareness in any comprehensive assessment - approach.

Behavioural factors of awareness

Behavioural factors or action components of environmental awareness is related to " What do people do ?" and "How do they manipulate their daily actions to preserve the environmental resources and maintain the sustainance of ecology ?"

In this study , environmental awareness is a key concept that represents the status of an individual in the matter of environment in terms of all the cognitive ,affective and behavioural factors.

There may be a question aroused that what role do the" knowledge of science" and" aptitude for science " play in development of "awareness"? " Knowledge of science" and " Aptitude for scientific knowledge "are often inseperable.and therefore, scientific knowledge and aptitude may be assumed to facilitate in the development of environmental awareness.

Scientific Knowledge and Aptitude

Scientific Knowledge is a body of organized information about the natural world, observation, analysis, and experimentation. It includes various disciplines or intellectual activities with regard to the physical world. In science, fundamental laws are tested with the highest precision: science refers to the knowledge of physical science, Chemistry, Mathematics, Biology, Zoology, Botany, Geology.

"Science is a process of thought, deals with mysteries and can benefit not only the minority involved with cosmic problems but in every day concerns." software (Aicken Frederich).

Aptitude is defined as a person's natural ability or skill, potential for learning certain activities, whether physical or mental, and whether developed or not. Aptitudes are psychological constructs of individual differences in learning or performance in situations in which individuals are required to learn from instruction. The aptitude test measures what an individual acquires as a result of a more general experience. It can predict an individual's ability to acquire new knowledge or skills in a given area, such as mathematics, mechanics, and foreign language learning. While prior achievement in areas such as mathematics is a better predictor of subsequent learning and performance, no formal instruction has previously occurred. In such cases, only an aptitude assessment was possible.

Scientific knowledge and aptitude which is an abridged version of " Knowledge of science " and aptitude for "Knowledge of science " interactively related to environmental awareness. The reasons are quite apparent in the concept itself .Environment in which the mankind lives is not only a part of the field in which the the mankind lives and not only a part of scientific knowledge one acquires through the years of schooling , but also forms a part of the field in which people find their real -life – manifestations. Besides that, affairs of environment may contribute to the development of deeper insight into scientific phenomena. Therefore, scientific knowledge and aptitude separately and as a whole selected for Life science , Physical Science and Mathematics of the present study.

Scientific knowledge and aptitude makes human beings more aware of his/her environment which helps to grow proper attitude values and beliefs from the psychological point of view

Psychological constructs in the subconscious mindset which drives human beings towards naturally devastative activities. Overpopulation leads to overconsumption of natural resources which may disrupt environmental sustainability.

Environmental awareness and proper judgement among individuals for consumption and restoration of natural resources which may disrupt environmental sustainabilities.

Therefore the research aims to find out whether there is any significant relationship between scientific knowledge and aptitude towards environmental awareness.

Problem

Therefore, the research problem of the present study intends to address to investigate the role of Scientific knowledge and aptitude in the process of generating one's environmental awareness.

2. Review of Related Literature

A review of earlier research studies was conducted for different purposes, as it explored the gap in existing knowledge, confirming the need for new studies and exploring new fields in this area. Some related studies are highlighted in this regard below.

1. Bombarg (2003) examined the infl)uence of environmental concern on specific behaviours, particularly through its impact on the generation and evaluation of situation-specific beliefs in the context of decisions to acquire information about green electricity products and their local providers. The weak direct relationship between environmental concern and specific environmentally related behaviours is attributed to the incorrect assumption that general attitudes, such as environmental concern, directly determine specific behaviours. Instead, only situation-specific cognitions directly determine specific behaviours. Future research should consider environmental concern not as a direct determinant but as an important indirect determinant of specific behaviour. As a general orientation pattern, it influences behaviour through four psychological approaches—neo-analytical, behavioural, social, and cognitive—which are useful for enhancing environmentally responsible behaviour among clients, communities, and professional associates (Winter, 2000).

Deborah Dev Nann Winter in 2000 published on article "Some Big Ideas for some Big problems" published in the American Psychologist. "In volume 55, this article discusses the role of psychology in addressing environmental issues.

By depth psychology, winter (2000) refers to a variety of concepts that have developed from Frend's psychoanalytical theory, especially the assumption that deeply buried motivations and defences drive human behaviour.

Behavioural Approaches – Applied behavioural analysis assumes that the way to change behaviours is to change the stimuli that surround them.

Social Psychological Approaches – Social Psychologists emphasize the social basis of environmentally relevant behaviours and beliefs, focusing on how people define a situation. Social and psychological insights into sustainability are crucial for building a sustainable culture.

Cognitive Approaches: Cognitive approaches stress the importance of information and how it is framed or communicated in the light of human perpetual and cognitive capacities. From this point of view, changing environmentally relevant behaviour requires changing peoples' perceptions and thoughts about environmental issues.

E. Scott Galler (1995)

The integration of theoretical frameworks and principles from behaviourism and humanism is proposed to develop a synergistic approach to addressing the human dimensions of environmental protection. The implementation of behaviour-change techniques that foster positive attitudes necessitates the involvement of numerous intervention agents globally. This approach requires individuals to engage in "active caring." A review of research supports the actively caring model, which posits that certain personal states enhance an individual's propensity to actively care for the environment. Strategies to augment these personal states or

expectancies are derived from the foundational principles and technology of behaviourism. Behaviourism provides the methodology for modifying behaviours and attitudes towards environmentally protective directions, while humanism contributes the personal states or expectancies necessary to increase individuals' propensity to actively care for the environment.

2.Narendra Kumar Singh (2017) conducted a survey- research at the secondary level under the U.P. Board in Jaunpur, U.P., running up to class X, with 300 random samples. The locality and sex comprised a 50:50 ratio, using the Environmental Awareness Ability Measure (EAAM) developed by P.K. Jha (2005) and the Scientific Attitude Scale developed by A. Greval (1990). For analysis, the C-R value was computed, and the results revealed that Environmental Awareness was highly correlated with Scientific Attitude.

3.Misbah Ahmed, Bukharzi Hakim, Qumariah, Fadila Umar, Nurlaela Muhamunad, Muhdi Harto, Warman Warman and Imus Ratna Ermawali (2024) studied the aims to analysis research trend of Environmental Awareness in Science learning (EA_SL) to support SDGs through biblio-metric analysis 668 documents were obtained based on the Scopus database with the keywords "Environmental Awareness" and "Science Learning". The limitations were made using specific criteria, so 44 documents/articles were analysed. The United States ranked first as the most productive country. Seven clusters were obtained for these keywords.

4.Jose, Preeti, Phani, and Rama (2018) – Attempted to measure the Environmental Awareness of 300 students of the State Board, CBSE School of Bhopal, MP in relation to the type of course, gender, religion, socioeconomic status (SES), and academic streams by the Environment Awareness Ability Measure (EAAM), developed by Dr. Praveen Kumar Jha. The tool consisted of 61 items intended to measure five components: 1) Causes of Pollution; 2) conservation of forest, soil, air, etc.; 3) energy conservation; 4) conservation of human health; and 5) conservation of wildlife and animal husbandry. The collected data of students' tests processed using SPSS (version16.0) revealed that students of the State Board course were more cognizant than students from the CBSE course. Females are more conscious and worried about environmental issues. The study also showed that gender, religion, socioeconomic status, and academic stream influence students' environmental awareness.

The study of xia, Zheng ,and Wang (2023) aimed to examinethe moderating effect of particiopation in informal science activities on the association of students"awareness of environmental issues and their attitudes towards science and epistemological beliefs 9841 15 year old students from Beiging, Sanghai, Jiansu and Guangdong – four Chinese provinces took part "International Student Assessment (pisa) in 2015.Results revealed that there is positive significant correlation between awareness of environmental issues and students" science self efficacy , interest in science and science epistemological beliefs.Informal science activities played a moderating effect on the relationship between awareness of environmental issues , informal science activities and their interaction in science learning and provided insights in implementation of results in science teaching.

The study of Tiwari and Anwar (2012) investigated the environmental awareness of undergraduate students. The environmental awareness ability test by P.K.Jha and scientific attitude scale by A.Grewal has administered upon 600 undergraduate students who chosen randomly for sampling. The findings indicated that environmental l awareness and scientific attitude had strong relationship with each other. Female students and science students showed higher scientific attitude than male students and arts students.

The study of Hadzigeor and Skoumios (2013) focused upon environmental awareness in school science ,focused on the relationship between the self and the natural environment and discusses the difficulties exist. The objective was to discuss the students' difficulties involved in the natural world.The study discussed about the interconnection of science and human life and educational importance of awarenesswas also discussed.

3. OBJECTIVES

The Objective of the present study was to ascertain the relationship between scientific knowledge and aptitudes with environmental awareness through the psychometric tools (scientific knowledge and aptitude test), developed by the researcher herself supported by two additional tools developed by Prof. Sengupta and Chakraborty, 2002.

A strong relation between environmental awareness and scientific attitude, female students showed more awareness more awareness than males and science students showed higher environmental awareness than arts students. (Tiwari and Anwar, 2012)

4. HYPOTHESIS

The following hypothesis were be stated.

H_1. Environmental Awareness is positively and significantly correlated with scientific knowledge and aptitudes.

H_2. Environmental Awareness is positively correlated withKnowledge and Aptitude for Biology.

H_3. Environmental Awareness is positively correlated with Knowledge and Aptitude for Physical Science.

H_4. Environmental Awareness is positively correlated with knowledge and aptitude for mathematics.)aimed to exa

5. METHODS AND PROCEDURE

The methods of dispersion, Inter Correlation, and regression are applied to study the impact of scientific knowledge and aptitude (Independent Variable) on Environmental Awareness (Dependent Variable).

5.1.Variables

Scientific Knowledge and Aptitude

In this study, scientific knowledge and aptitude a independent variables that the investigator intends to study in an attempt to ascertain their relationship with Environmental Awareness as a dependent variable.

5.2.Environmental Awareness

Environmental Awareness has been studied from two perspectives which are as follows :1. Environmental Awareness in Action

2. Environmental Awareness in Judgement

Environmental Awareness in Action – (EAA)

Environmental Action and Awareness (EAA) facilitates participation across all levels, promoting the resolution of environmental issues and fostering eco-friendly behaviour It is posited that Environmental Awareness can be assessed through self-reported pro-environmental behaviour r or actions.

Environmental Awareness in Judgment (EAJ) enables individuals to identify the symptoms and causes of environmental degradation, enhances critical thinking, and cultivates the ability to recognize environmental problems and their solutions.

Judgement is at dilemma related to environmental issues that form an elaborate personal code of conduct for the maintenance of environmental sustainability and eco-development (however, both of the faces of awareness are related to each other and they are studied on the basis of self-report).

Scientific knowledge and aptitude: One of the cognitive determinants of action and judgement is knowledge and aptitude in science, because the physical and living components of the environment are also the subject of study of science, whereas knowledge of mathematics is basic to all sciences. On the other hand, environmental affairs may contribute to the development of deeper scientific insights .Thus, it is logically assumed that environmental awareness has an interactive relationship with knowledge and aptitude in life sciences, physical sciencess and mathematics.

Table.1.1. Variables, Dimension and categories of the Present Study

Variable	Dimensions	Category
Environmental Awareness	• Environment Awareness in action (EAA) • Environment Awareness in Judgement (EAJ)	Dependent Variable
Scientific Knowledge and Aptitude	• Knowledge and Aptitude for Life Science • Knowledge and Aptitude for Physical Science • Knowledge and Aptitude for Mathematics	Independent Variable

5.3.Sampling

In India, the curriculum up to Class x is undiversified, in which physical science, Life Science and Mathematics are compulsorily studied by all Male and Female students along with other subjects. Diversification occurs from class XI onwards when students take the science stream and are to study physics, chemistry, mathematics, compulsory elective subjects, and biology as optional subjects.

However, they are permitted to interchange Biology with Mathematics as the third elective optional subject.
The approach of sampling was stratified random sampling .
Conventionally, rural and urban samples are included; however, this has a different significance in the present study. Environmental Awareness may differ in the two habitat areas because they live in different biological, physical, and social environments. Thus,the sample was drawn from rural and urban students of class XI in the science stream. Both male and female sex groups were included.

Rural samples were drawn from the districts of North and South 24 Parganas while urban samples were drawn from Kolkata School. Schools were approached in large numbers, and those who responded and agreed unconditionally to allow the collection of data were collected and finally selected. Since relatively fewer girls – students opted for science streams and still fewer in rural areas–the size of the rural sample was relatively smaller for girls.

Urban Schools in Kolkata (were less cooperative) and responded in fewer numbers out of the schools approached; data had to be collected from the available schools but it was carefully noted that all the students had undergone courses of study under the same board and hence, the curriculum (ii.e, West Bengal Board of Secondary Education for class X level and West Bengal Council of Higher Secondary Education for class XI level). The number and stratification of the samples are given in the table below.

Table – 1.2 Area, Grade and Sex wise break-up of the total sample is given below :

Area	Class	Boys	Girls	Total
Rural	XI	177	116	293
Urban	XI	175	125	300
Total		352	241	593

5.4.TOOLS

The following tools are used to measure the variables.

1. Environment Awareness Scale, developed by Prof. Dr. Pranab Kumar Chakraborty and Dr. Madhumala Sengupta (1999).
2. The Scientific Knowledge and Aptitude Test developed by the researcher, M/Sengupta, Mukherjee and Chakraborty (1999).

5.5.TOOLS FOR DATA COLLECTION

5.5.1. Environmental Awareness

The only test available to the investigator for measuring Environmental Awareness is one developed by the supervisor, Prof. Dr. Pranab Kumar Chakraborty (Retd. Now), and Dr. Madhumala Sengupta (Retd. Now) in 1999,

The self- reporting questionnaire on Environmental Awareness is in two parts, consists of total 48 items. The first part under the Name, i.e., Environmental Awareness in Action (EAA) consists of 27 items of a five -point rating scale and the second part under the name of Environmental Awareness in Judgement (EAJ), consists of 21 items and/or statements and/or opinions of multiple- choice response type.

Reliability

The Reliability of the Environmental Awareness was determined by K-R Formula.

Environmental Awareness in Action r = .706
Environmental Awareness in Judgement r = .63

Validity

The validity of the Environmental Awareness measure was assessed in terms of item validity using Tetrachoric Correlation. The reported validity for the items of the two subscales is as follows:

Environmental Awareness in Action (EAA) .66
Environmental Awareness in Judgement (EAJ) .67

It should be noted that almost all the validity coefficients are positive and significant.

Scientific Knowledge and Aptitude.

The researcher constructed and standardized a Scientific Knowledge and Aptitude test.

Pilot Testing

A draft test was administered to the boys (N=184) and girls (N=159) of classes VIII, IX and X of Secondary level from both Rural and Urban areas to determine the Difficulty Value and Discriminating Power of the items. The range of the Difficulty Value and Discriminating power are shown in the table below.

Table-1.3 Difficulty Values and Discriminating Power of the items of Pilot Testing of Scientific Knowledge and aptitude test.

Class	No of Students	Range of Difficulty Value	Range of Discriminating Power
VIII	225	.133 - .96	.14 - .885
IX	225	.044 - .938	.131 - .85
X	43	.116 - .977	Not Determined separately

All total of 100 items were finally selected from the 300 initial item pool so that the difficulty values were evenly distributed, and the range of discriminating power remained evenly scattered on both the sides of .50.

Table-1.4 Number of Items in the Scientific Knowledge and Aptitude Test

Subjects	No. of Items	
	Initial Pool	Selected Items
Life Science	90	30
Physical Science	120	40
Mathematics	90	30
Total	300	100

The final form of the test was administered to the standardization sample to determine the reliability and validity and the norm of the test. It should be noted that the samples for pilot testing and standardization were different from the sample stated in Table-1.

Table 1.5 STANDARDISATION SAMPLE

Area	Class	Boys	Girls	Total
Rural	X	72	94	166
Rural	XI	44	14	58
Urban	XII	68	51	119
Total		184	159	343

Validity

In order to determine the validity at first, inter-correlations of the scores of Life Science, Physical Science, and Mathematics of the four sub-groups i.e., Rural Boys, Rural Girls, Urban Boys, Urban Girls and Total Sample) were calculated .

The corresponding coefficients are given in Table 1.6 to 1.8

1.6 Inter correlation of Life Science, Physical Science, Mathematics and the Full Test : Rural Male and Female Group

1.6. Inter correlation of Life Science, Physical Science and Mathematics and the Full Test : Rural Male and Urban Female

Subjects	Rural Male			Rural Female		
	Phy. Sc.	Maths	Full Test	Phy. Sc.	Maths	Full Test
L. Sc.	.488	.353	.668	.454	.531	.709
Phy.Sc.		.743	.935		.672	.886
Maths			.868			.898

1.7 Inter correlation of Life Science, Physical Science and Mathematics and the Full Test :Urban Male and Urban Female

Subjects	Rural Male			Rural Female		
	Phy. Sc.	Maths	Full Test	Phy. Sc.	Maths	Full Test
L. Sc.	.353	.510	.797	.761	.579	.860
Phy.Sc.		.304	.744		.674	.940
Maths			.767			.845

1.8 Inter correlation of the sub test and the Full Test : Total Sample

	Whole Group		
Subject	Phy. Science	Math.	Full Test
Life Science	.729	.678	.866
Phy. Science		.767	.940
Mathematics			.900

The inter-correlation as presented above indicates that for all the sub-groups and for the total sample, the subtests correlate moderately with each other and highly with the full test. This is an index of the internal validity of the test.

External Validity

For the external validity of the Scientific Knowledge and Aptitude Test, the correlation of the scores of Life Science, Physical Science, and Mathematics obtained in thee Madhyamik Examination (School Leaving Certificate Examination at the end of Class X, conducted by The West Bengal Board of Secondary Education WBBSE) and the Scientific Knowledge and Aptitude test was determined.

The result is presented in the Table 1.9 below-

Table 1.9 Coefficient of correlation between Scientific Knowledge and Aptitude – Scores and Scores in Madhyamik Examination in Life Science Physical Science, Mathematics and Total Test.

Table 1.9. Coefficient of Correlation

Subject	Life Sc.	Physical Sc.	Maths	Total Test
Life Science	.314	.345	.416	.490
Physical Science	.328	.337	.460	.517
Mathematics	.256	.317	.514	.512
Total Test	.356	.395	.551	.602

The correlations shown above were low to moderate. This ensures validity of the test on the one hand and confirms the commonly known fact that the present form of examination is not a fully valid measure of Scientific Knowledge.

Reliability

The Reliability of Scientific Knowledge and Aptitude test was determined using the Split Half Method and by Kuder Richardson Formula (KR-21) to determine inter-item consistency. The Reliability Coefficients are presented in table 2.0 below.

2.0 Reliability of the Scientific Knowledge and Aptitude Test

Subjects	Kuder Richardson Reliability r_{GG}	Split Half Reliability
Life Science	.78	.75
Physical Science	.87	.83
Mathematics	.85	.77
Full Test	.93	.92

Scoring

The total Score fort he entire test was 100.One A score is given to each correct answer and 0 for an incorrect answer or blank.

Time Limit

A tentative time limit of 150 min, i.e., two and half an hour set for completion of the test. During administration, it was found to be adequate after listing, as 80% of the tesees required this time. Approximately 10% could not finish, and approximately the same percentage of examinees had finished earlier.

Norm

Norm was determined in terms of Mean and Standard Deviation (Table ...)

ANALYSIS

For the Research the following analysises have been done.

1.Descriptive analysis as performed by using the mean and standard deviation for rural males, rural females, urban males urban females. rural (Male+Female), urban (Male+Female), male (Rural + Urban, Female (Rural + Urban), and all groups together for all scores.

2.Correlation Analysis was conducted to examine the nature of the relationship among the variables and the correlation matrix for all the variables separately for all the groups stated above, and all groups together were prepared.

3.Regression Analysis was conducted for Environmental Awareness in Action (EAA) and Environmental Awareness in Judgement as dependent variable.

6. RESULT

The Difficulty Value ranges from .119 to .680. The discriminating power of the items ranged from.00078 to .856. However, items with lower discriminating power were not selected in the final form of the test.

MEAN AND OTHER STATISTIC

The mean and standard deviation of the sub-test scores and skewness and kurtosis of the scores of Life Science, Physical Science Mathematics, and Total Test scores separately for the four sub-groups, that is, rural boys,rural girls, urban boys, and urban girls, are presented in the tables presented below:

Descriptive Analysis

Mean and standard deviation for rural males, rural females, urban males, urban females, rural (Male+Female), urban (Male+Female),male (Rural+Urban), an female (Rural + Urban) were computed for the Scientific Knowledge and Aptitude Test. The sub-test scores of Life Science, Physical Science, Mathematics, and Total Test Scores, and the scores of Environmental Awareness, that is Environmental Awareness in Action (EAA), Environmental Awareness in Judgement (EAJ), and Total (Sum of the Scores of EAA & EAJ) are presented in Table 4.6.

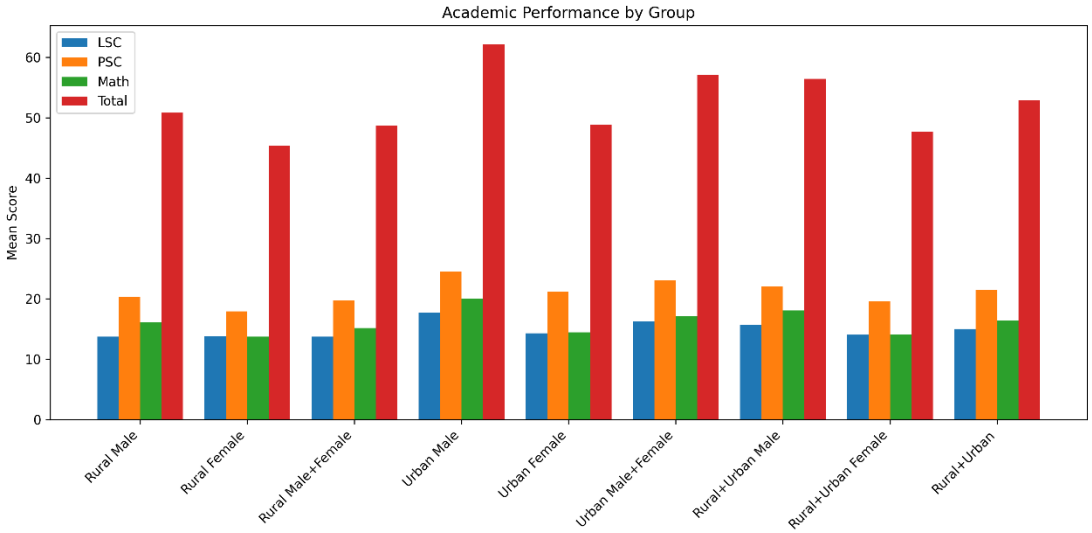

Fig. 1. Academic performance group

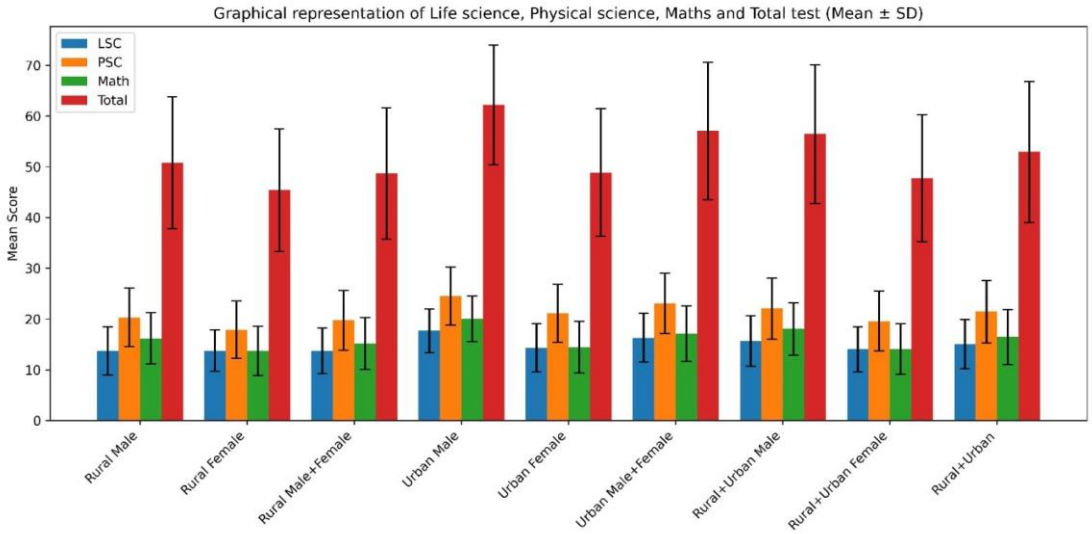

Fig.2. Graphical representation of Life Sc., Physical Sc., Maths and total test

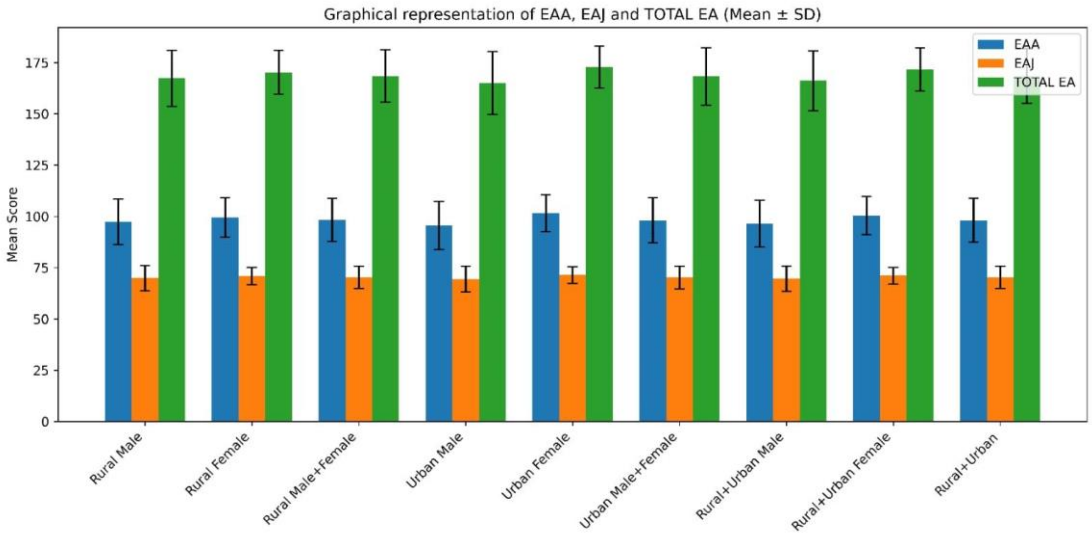

Fig.3. Graphical representation of EAA, EAJ.

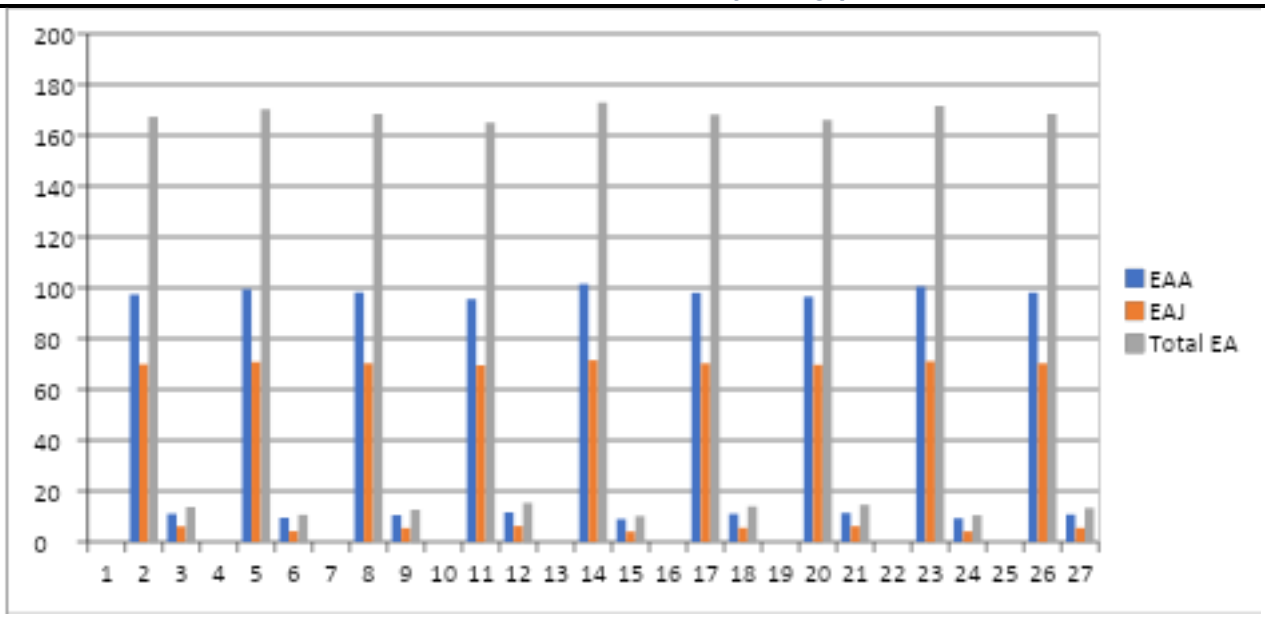

Fig. 4 Graphical representation Mean and SD of of EAA and EAJ & Total EA

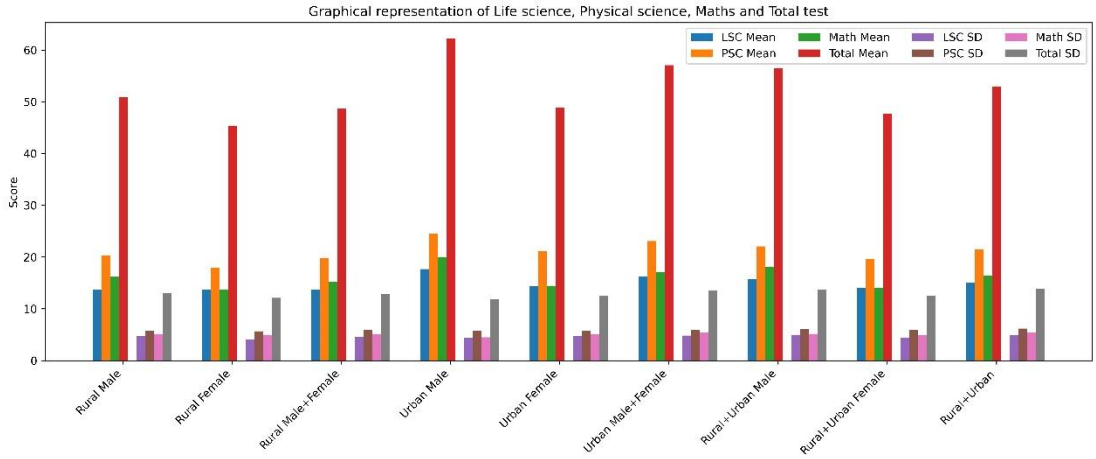

Fig.5. Mean and SD of Life S., Physical Sc., Maths and Total Test

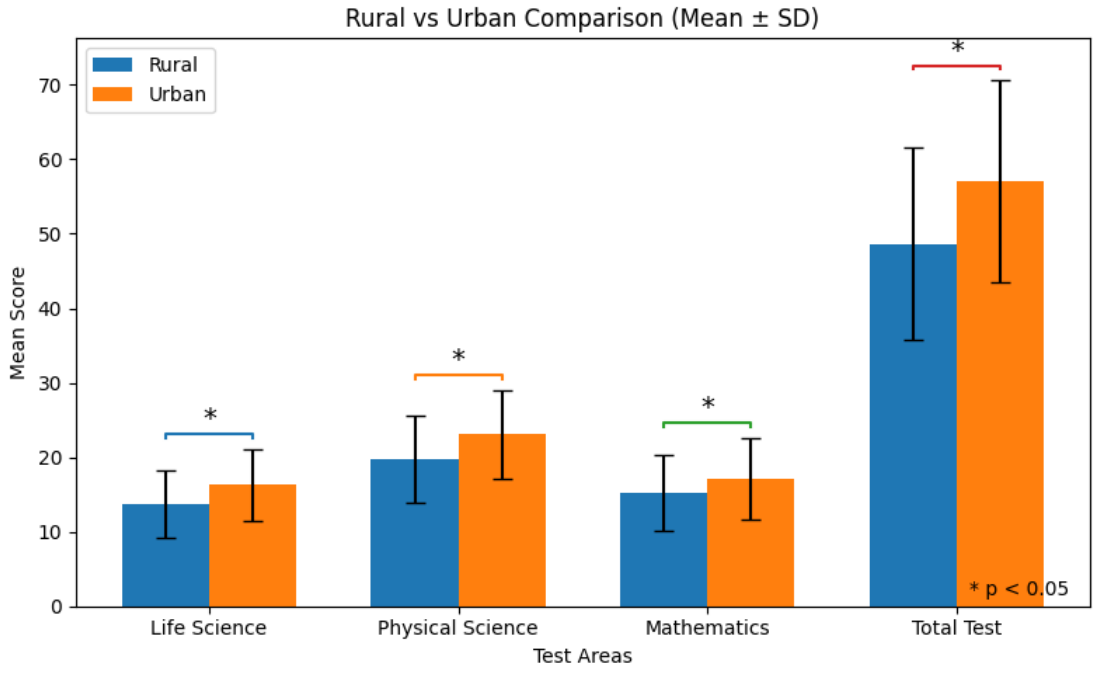

Fig 6. Area wise comparative analysis of mean and standard deviation.

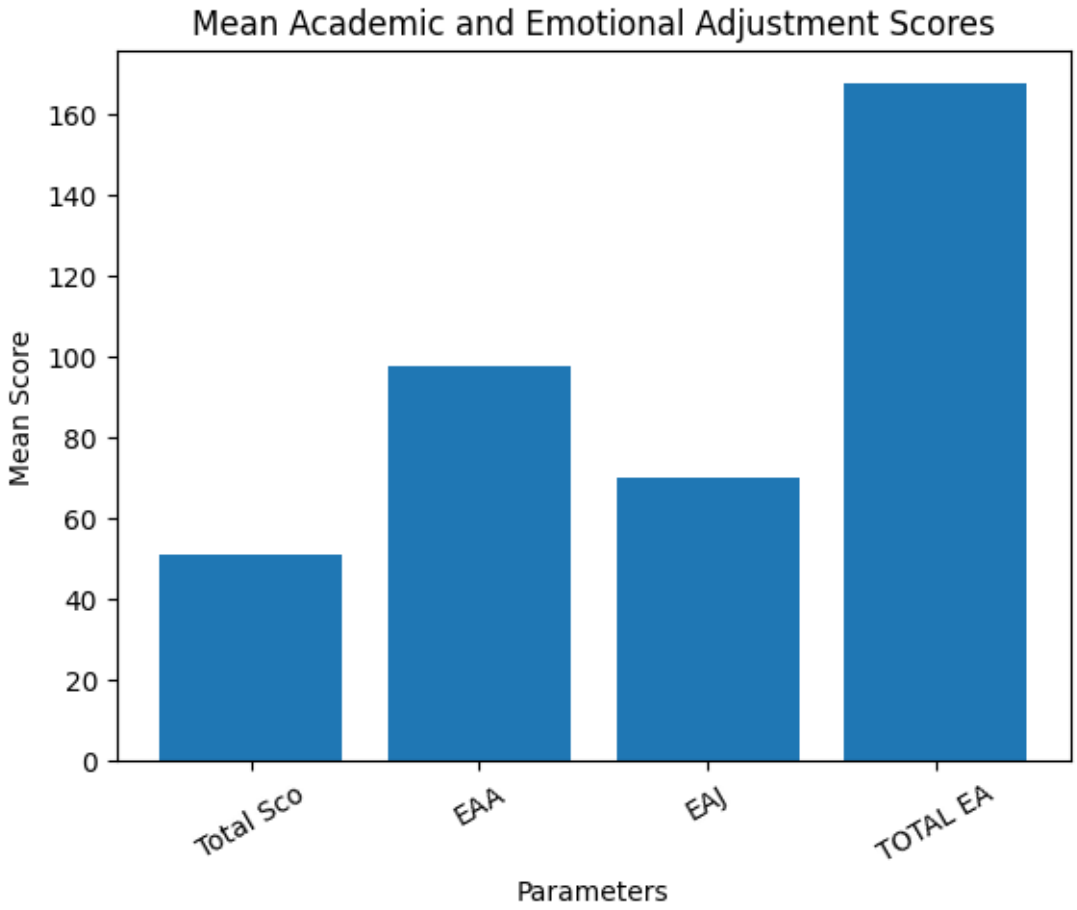

Fig 7. Comparison of mean scores of environmental awareness for action and environmental awareness for judgement.

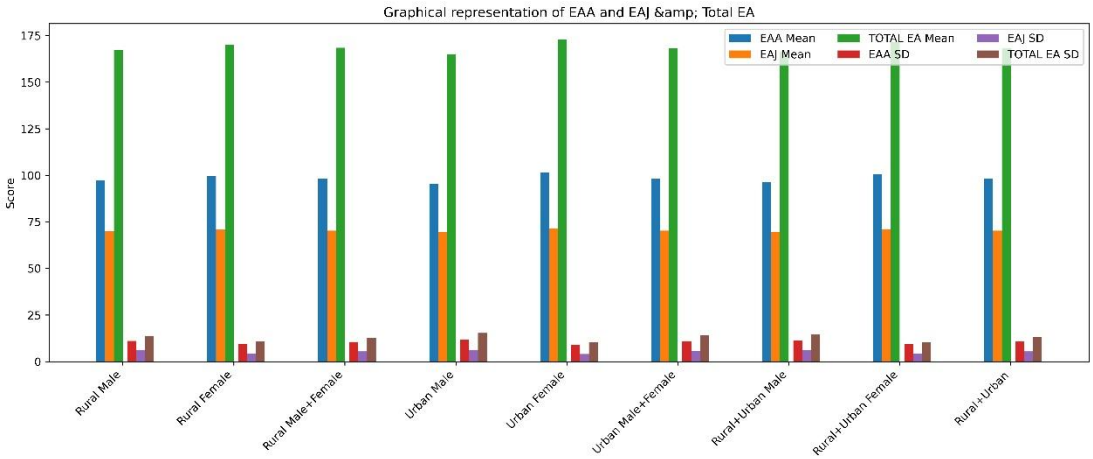

Fig. 8. EAA and EAJ

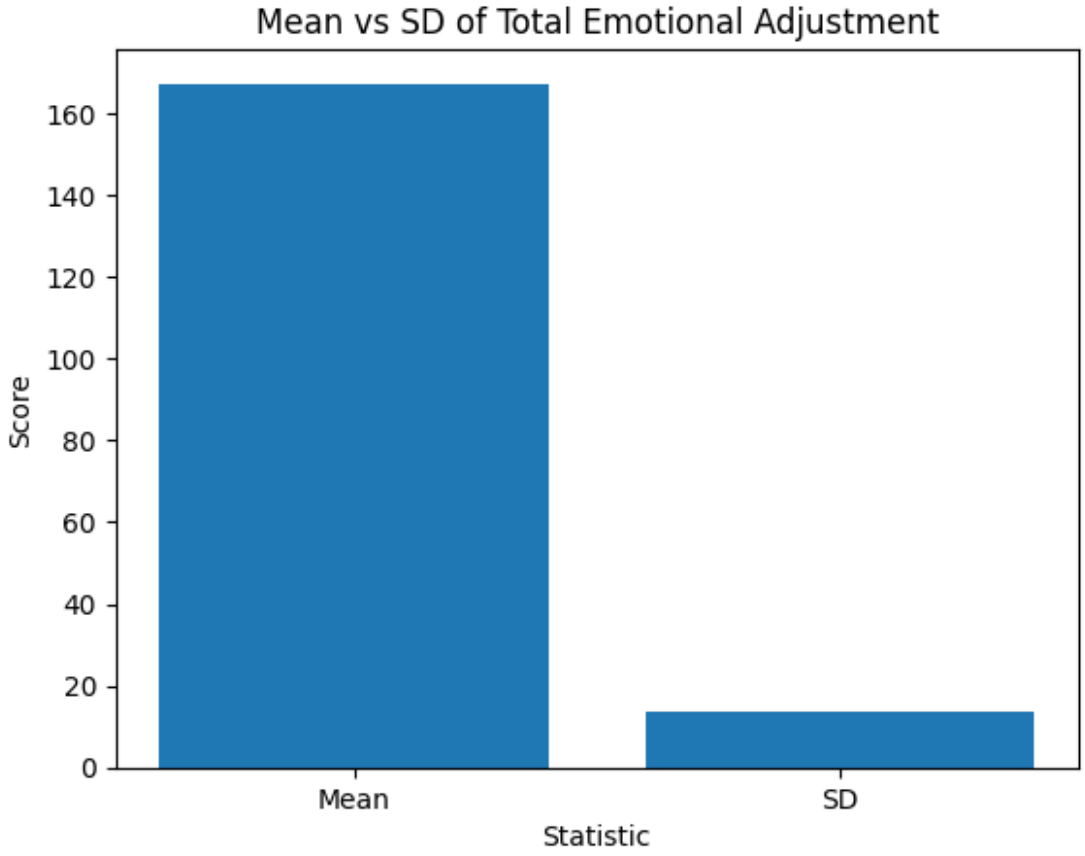

Fig. 9. Mean vs SK total emotional adjustment

Bivariate Correlation

The coefficient of correlation was computed separately between all possible pairs of variables for each sample group. These results are presented in Table 5.1 to 5.9.

Table 2.2. Inter Correlation Matrix for All Variables : Rural Male

Test	Scientific Knowledge & Aptitude				Environmental Awareness		
	Life Science	Physical Science	Mathematics	Total	EAA	EAJ	Total
Life Science		.576**	.566**	.846**	.139*	.045	.132*
Physical Science			.468**	.840**	.134	.130	.165*
Mathematics				.807**	.083	.080	.102*
Total Test					.143*	.106	.162*
Environmental Awareness for Action						.219**	.901**
Environmental Awareness for Judgement							.620**

N = 17 d.f = 175
Table value at .05 level r = .131
Table value at .01 level r = .173
** Correlation Significant at the 0.01 level
* Correlation Significant at the 0.05 level

Table 2.3. Inter Correlation Matrix for All Variables : Rural Female

Test	Scientific Knowledge & Aptitude				Environmental Awareness		
	Life Science	Physical Science	Mathematics	Total	EAA	EAJ	Total
Life Science		.652**	.361**	.787**	-.138	.148	-.065
Physical Science			.545**	.906**	-.084	.172	-.008
Mathematics				.777**	-.041	.026	-.027
Total Test					-.102	.141	-.036
Environmental Awareness for Action						.067	.920**
Environmental Awareness for Judgement							.452**

N = 116 d.f = 114
Table value at .05 level r = .184
Table value at .01 level r = .240..
** Correlation Significant at the 0.01 level
* Correlation Significant at the 0.05 level

Table 2.4. Inter Correlation Matrix for All Variables : Rural Male & Female

Test	Scientific Knowledge & Aptitude				Environmental Awareness		
	Life Science	Physical Science	Mathematics	Total	EAA	EAJ	Total
Life Science		.581**	.479**	.806**	.049	.073	.072
Physical Science			.527**	.870**	.030	.116*	.074
Mathematics				.805**	.015	.042	.031
Total Test					-.037	.096	.072
Environmental Awareness for Action						.182**	.907**
Environmental Awareness for Judgement							.579**

N = 293 d.f = 291
Table value at .05 level r = .115
Table value at .01 level r = .115
** Correlation Significant at the 0.01 level
* Correlation Significant at the 0.05 level

Table 2.5. Inter Correlation Matrix for All Variables : Urban Male

Test	Scientific Knowledge & Aptitude				Environmental Awareness		
	Life Science	Physical Science	Mathematics	Total	EAA	EAJ	Total
Life Science		.500	.352**	.743**	.144*	.133*	.163*
Physical Science			.571**	.885**	.034	.080	.058
Mathematics				.785**	.076	.141*	.115
Total Test					.098	.141*	.132*
Environmental Awareness for Action						.416**	.929**
Environmental Awareness for Judgement							.723**

N = 175 d.f = 291
Table value at .05 level r = 173
Table value at .01 level r = .131
** Correlation Significant at the 0.01 level
* Correlation Significant at the 0.05 level

Table 2.6. Inter Correlation Matrix for All Variables : Urban Female

Test	Scientific Knowledge & Aptitude				Environmental Awareness		
	Life Science	Physical Science	Mathematics	Total	EAA	EAJ	Total
Life Science		.544**	.393**	.785**			
Physical Science			.495**	.859**			
Mathematics				.776**			
Total Test							
Environmental Awareness for Action						.088	.918**
Environmental Awareness for Judgement							.475**

N = 125 d.f = 123
Table value at .05 level r = 184
Table value at .01 level r = .240
** Correlation Significant at the 0.01 level
* Correlation Significant at the 0.05 level

Table 2.7. Inter Correlation Matrix for All Variables : Urban Female (Male + Female)

Test	Scientific Knowledge & Aptitude				Environmental Awareness		
	Life Science	Physical Science	Mathematics	Total	EAA	EAJ	Total
Life Science		.564**	.474**	.794**	-.028	.107	.020
Physical Science			.585**	.875**	-.067	.092	-.016
Mathematics				.828**	-.089	.090	-.035
Total Test					-.075	.115*	-.014
Environmental Awareness for Action						.356**	.929**
Environmental Awareness for Judgement							.676**

N = 300 d.f = 298
Table value at .05 level r = .113
Table value at .01 level r = .148
** Correlation Significant at the 0.01 level
* Correlation Significant at the 0.05 level

Table 2.8. Inter Correlation Matrix for All Variables : All Male (Rural + Urban)

Test	Scientific Knowledge & Aptitude				Environmental Awareness		
	Life Science	Physical Science	Mathematics	Total	EAA	EAJ	Total
Life Science		.591**	.549**	.833**	.097	.066	.104
Physical Science			.567**	.871**	.055	.090	.081
Mathematics				.828**	.043	.088	.070
Total Test					.076	.097	.101
Environmental Awareness for Action						.322**	.916**
Environmental Awareness for Judgement							.674**

N = 352 d.f = 350
Table value at .05 level r = .105
Table value at .01 level r = .138
** Correlation Significant at the 0.01 level
* Correlation Significant at the 0.05 level

Table 2.9. Inter Correlation Matrix for All Variables : All Female (Rural + Urban)

Test	Scientific Knowledge & Aptitude				Environmental Awareness		
	Life Science	Physical Science	Mathematics	Total	EAA	EAJ	Total
Life Science		.583**	.381**	.781**	-.082	.221**	.015
Physical Science			.517**	.883**	-.029	.244**	.070
Mathematics				.775**	-.002	.191	.073
Total Test					-.044	.270**	.067
Environmental Awareness for Action						.084	.920**
Environmental Awareness for Judgement							.467**

N = 241 d.f = 239
Table value at .05 level r = .112
Table value at .01 level r = .160
** Correlation Significant at the 0.01 level
* Correlation Significant at the 0.05 level

Table 2.10. Inter Correlation Matrix for All Variables : Grant Total (Male + Female) + (Rural + Urban)

Test	Scientific Knowledge & Aptitude				Environmental Awareness		
	Life Science	Physical Science	Mathematics	Total	EAA	EAJ	Total
Life Science		.603*	.507	.815**	.006	.088*	.041
Physical Science			.584**	.883**	-.022	.100*	.023
Mathematics				.828**	-.041	.065	-.006
Total Test					-.024	.100*	.022
Environmental Awareness for Action						.272**	.919**
Environmental Awareness for Judgement							.630**

N = 593 d.f = 591
Table value at .05 level r = .082
Table value at .01 level r = .106
** Correlation Significant at the 0.01 level
* Correlation Significant at the 0.05 level

Regression Analysis

Regression Analysis of Environmental Awareness on other variables has presented separately for each sample group, and the results are reported in Table 6.1 to 6.7, which shows the results of Regression Analysis of Environmental Awareness (i.e., Environmental Awareness in Action and Environmental Awareness in Judgement) on all other variables, that is Scientific Knowledge and Aptitude includes Knowledge and Aptitude for Life Science, Physical Science, Mathematics, and Total Test Scores (i.e., sum of the scores of Life Science, Physical Science, and Mathematics).

Table 2.10. Regression of total Environmental Awareness (EAA=EAJ) on other Variables GROUP – RURAL MALE

Variables	b	SE (b)	a	SE (a)	R-sqr	F	d.f.	Level of Significance
Life Science	0.378	0.215	162.104	3.125	0.017	3.087	175	
Physical Science	0.393	0.177	159.056	3.850	0.027	4.920	175	5%
Mathematics	0.287	0.204	162.813	3.459	0.010	1.838	175	
Scientific knowledge & Aptitude Test	0.171	0.079	158.582	4.141	0.026	4.708	175	5%

F,1, 175,05 = 3.84 F, 1, 175, 01 = 6.63

It is evident from Table 2.10 that the variables Knowledge and Aptitude for Physical Science and Scientific Knowledge & Aptitude full test can predict Environment Awareness significantly corresponding to coefficient are shown in column b, and the levels of significance of F-values show that the variables other than those mentioned above may have only a non-linear relationship with the dependent variable. The values of the intercept are shown in Column a. However, the magnitudes of R^2 (R-sqr) show that a small proportion of variance in the Environmental Awareness scores can be accounted for by the predictor variables. In this case, that is for the Rural Male Group, only 4.2% of the variance can be accounted for as the highest value of R^2 = .042 and R = .2049.

Table–2.11. Regression of total Environmental Awareness (EAA=EAJ) on other Variables GROUP – RURAL FEMALE

Variables	b	SE (b)	a	SE (a)	R-sqr	F	d.f.	Level of Significance
Life Science	-0.171	0.245	172.605	3.514	0.004	0.488	114	None
Physical Science	-0.015	0.176	170.515	3.312	0.000	0.007	114	
Mathematics	-0.059	0.207	171.059	3.005	0.001	0.082	114	
Scientific knowledge & Aptitude Test	-0.032	0.083	171.707	3.879	0.001	1.151	114	

F,1, 114,05 = 3.91 F, 1, 114, 01 = 6.87

The figures in Table 2.11. show that none of the variables can significantly predict Environmental Awareness

Table–2.12 Regression of total Environmental Awareness (EAA=EAJ) on other Variables GROUP – ALL RURAL (MALE+FEMALE)

Variables	b	SE (b)	a	SE (a)	R-sqr	F	d.f.	Level of Significance
Life Science	0.203	0.164	165.676	2.376	0.005	1.522	291	
Physical Science	0.160	0.125	165.313	2.582	0.006	1.620	291	
Mathematics	0.077	0.146	167.294	2.333	0.001	0.279	291	
Scientific knowledge & Aptitude Test	0.070	0.058	165.034	2.895	0.005	1.500	291	

F,1, 191,05 = 3.84 F, 1, 291, 01 = 6.63

The figure in Table 2.12 show that none of the variables can predict Environmental Awareness significantly.

Table. 2.13. Regression of total Environmental Awareness (EAA=EAJ) on other Variables GROUP – URBAN MALE

Variables	b	SE (b)	a	SE (a)	R-sqr	F	d.f.	Level of Significance
Life Science	0.580	0.266	154.802	4.841	0.027	4.752	173	5%
Physical Science	0.156	0.204	161.228	5.119	0.003	0.589	173	
Mathematics	0.395	0.259	157.152	5.308	0.013	2.326	173	
Scientific knowledge & Aptitude Test	0.172	0.098	154.383	6.204	0.017	3.064	173	

F,1, 175,05 = 3.84 F, 1, 175, 01 = 6.63

The figure in Table 2.15 shows that only the variable Life Science can predict Environmental Awareness significantly. The corresponding b-coefficients are shown in Column b. However, R^2 (R-sqr) showed that approximately 4.8% of the variance in Environmental Awareness could be accounted for by the predictor variables mentioned above. (R^2 = .048 and R=0.2910).

Table. 2.14. Regression of total Environmental Awareness (EAA=EAJ) on other Variables GROUP – URBAN FEMALE

Variables	b	SE (b)	a	SE (a)	R-sqr	F	d.f.	Level of Significance
Life Science	0.143	0.192	170.756	2.895	0.005	0.558	123	
Physical Science	0.149	0.161	169.664	3.515	0.007	0.858	123	
Mathematics	0.303	0.179	168.439	2.744	0.023	2.845	123	
Scientific knowledge & Aptitude Test	0.100	0.073	167.804	3.729	0.015	1.915	123	

F,1, 114,05 = 3.91 F, 1, 114, 01 = 6.87

The figure in Table 2.14. shows that none of the variables can predict Environmental Awareness significantly. However,the knowledge and aptitude for Life Science, Physical Science, Mathematics and Total Scientific Knowledge and Aptitude Test scores could not predict Environmental Awareness significantly. The F-values show that the variables other than those mentioned above have only a non-linear relationship with the dependent variable. However, the magnitudes of R_2 (R-sqr) show that a small proportion of variance in Environmental Awareness scores can be accounted for, with the highest values of R_2=0.45, and R=0.2121).

Table. 2.15. Regression of total Environmental Awareness (EAA=EAJ) on other Variables GROUP – ALL URBAN (MALE+FEMALE)

Variables	b	SE (b)	a	SE (a)	R-sqr	F	d.f.	Level of Significance
Life Science	0.059	0.168	167.323	2.854	0.000	0.123	298	
Physical Science	-0.039	0.136	169.177	3.244	0.000	0.181	298	
Mathematics	-	0.148	169.858	2.739	0.001	0362	298	
Scientific knowledge & Aptitude Test	0.089 -0.014	0.060	169.110	3.501	0.000	0.059	298	

F,1, 291,05 = 3.84 F, 1, 291, 01 = 6.63

The figure in Table 2.15. show that none of the variables can predict Environmental Awareness significantly.

Table. 2.16. Regression of total Environmental Awareness (EAA=EAJ) on other Variables GROUP – ALL MALE (RURAL + URBAN)

Variables	b	SE (b)	a	SE (a)	R-sqr	F	d.f.	Level of Significance
Life Science	0.305	0.156	161.394	2.569	0.011	3.814	350	
Physical Science	0.197	0.129	161.699	3.035	0.007	2.329	350	
Mathematics	0.201	0.151	162.536	2.841	0.005	1.775	350	
Scientific knowledge & Aptitude Test	0.108	0.057	160.102	3.306	0.010	3.573	350	

F,1, 350,05 = 3.84 F, 1, 350, 01 = 6.63

The figure in Table 2.16. show that none of the variables can predict Environmental Awareness significantly.

Table. 2.17. Regression of total Environmental Awareness (EAA=EAJ) on other Variables GROUP – ALL FEMALE (RURAL + URBAN)

Variables	b	SE (b)	a	SE (a)	R-sqr	F	d.f.	Level of Significance
Life Science	0.034	0.152	171.097	2.245	0.000	0.050	239	
Physical Science	0.124	0.115	169.143	2.345	0.005	1.174	239	
Mathematics	0.154	0.136	169.401	2.038	0.005	1.282	239	
Scientific knowledge & Aptitude Test	0.056	0.054	168.901	2.665	0.004	1.077	239	

F,1, 239,05 = 3.84 F, 1, 239, 01 = 6.63

Table 2.17 show that none of the variables can predict Environmental Awareness significantly.

Table. 2.18. Regression of total Environmental Awareness (EAA=EAJ) on other Variables GROUP–ALL (MALE + FEMALE)+ (RURAL+URBAN)

Variables	b	SE (b)	a	SE (a)	R-sqr	F	d.f.	Level of Significance
Life Science	0.112	0.113	166.687	1.791	0.002	0.976	591	
Physical Science	0.051	0.089	167.288	1.986	0.001	0.322	591	
Mathematics	-0.016	0.101	168.629	1.751	0.000	0.024	591	
Scientific knowledge & Aptitude Test	0.021	0.040	167.251	2.163	0.000	0.286	591	

F,1, 591,05 = 3.84 F, 1, 591, 01 = 6.63

The figure in Table 6.9 shows that none of the variables can predict Environmental Awareness

Table. 2.19. Summary of results showing level of significance of regression coefficients by groups (Dependent variable : Environmental Awareness)

----------- G R O U P S -----------										
Independent Variables		**Rural**			**Urban**			**All(R+U) + (M+F)**		
		Male	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
	SCIENCE KNOWLEDGE AND APTITUDE	-	-	5%	-	-	-	-	-	-
	Life Science	-	-	-	-	-	-	-	-	-
	Physical Science	-	-	-	-	-	-	-	-	-
	Mathematics	5%	-	-	-	-	-	-	-	-
	Scientific Knowledge & Aptitude									

The figure in Table 2.19. show that none of the variables can predict Environmental Awareness significantly.

Results obtained by Regression Analysis of data show that Environmental Awareness can be predicted by Scientific Knowledge and Aptitude only in the case of one sample sub-group, that is Rural Male, Knowledge, and Aptitude in Life Science can predict Environmental Awareness only in urban males. This indicates that Knowledge and Aptitude in Science does not necessarily indicate or ensure Environmental Awareness. This proves the importance of environmental activism in sustaining the environment.

The following are the hypothesis tested and mentioned here briefly.

H_1 : Environmental Awareness is positively and substantially correlated with the scores of scientific knowledge and aptitude.

H_1-H_4 : Environmental Awareness will be positively correlated with knowledge and Aptitude in Biology, Physical Science, and mathematics taken separately.

Result

Scientific Knowledge & Aptitude
Mean Score Rural Male > Rural Female in Phy. & Math
Mean Score Urban Male > Urban Female in Life Sc.Phy.Sc, Math
Mean Score Male (rural + urban) > Female in Lsc. PhyS. & Maths.
Mean Score Urban (Male + Female) > Rural (Male + Female) in L. Sc., Phy. Sc &Maths.

Environmental Awareness

Mean Score Rural Female > Rural Male
Mean Score Urban Female > Urban Male
Mean Score Rural almost equal to Urban (M+F) (Rural + Urban)
Mean Score Male (Rural + Urban) > Female (R+U)

FINDINGS

1. The correlation between Environmental Awareness and Scientific Knowledge and Aptitude (H_1)

Rural Male Environmental Awareness for Action is positively correlated with Life Science (r=.139, P<.05),Urban Male Environmental Awareness for Action is positively correlated with Life Science (r=.144, P<.05),Environmental Awareness for Judgement is positively correlated to Life Science (r=.133, P<.05), and Total Environmental Awareness is positively correlated to Life Science)r=.163, P<.05). Urban Female Environmental Awareness for Judgement was positively correlated with Life Science (r=.278, P<.01), Physical Science (r=.298, P<.01), Mathematics (r=.336, P<.01), and Total Scientific Knowledge and Aptitude score (r=.376, P<.01). In the case of the Female group, Environmental Awareness for Judgement was positively correlated with Life Science (r-.221, P<.01), Physical Science (r=.244, P<.01), and Scientific Knowledge and Aptitude Test (.207, P<.01)

2. The correlation between Environmental Awareness and the Knowledge and Aptitude in Life Science (H_2).

In the case of the Rural Male sample group, Environmental Awareness of action was positively correlated with life sciences (r=.139, P<.05). Total Environmental Awareness for Judgement was positively correlated with Life Science in the case of Urban Male (r=.144, P<.05), Urban Female (r=.278, P<.01), All Female (Rural+Urban) (r=.221, P<.01), and the entire sample group (N=593) (r=.088, P<.05).

3. The correlation between Environmental Awareness and the Knowledge and Aptitude in Physical Science (H_3).

Environmental awareness for Judgement was positively correlated with Physical Science in the rural sample group (Male + Female) (r=.116, P<.05), urban females (r=.298, P<.01), and the total sample group (N=593) (r=.100, P<.05).

4. The correlation between Environmental Awareness and the Knowledge and Aptitude in Mathematics (H_4).

Environmental awareness of Judgement was positively correlated with mathematics only in the case of urban males (r=.141, P<.05) and Urban Female groups (r=.336, P<.01).

7. CONCLUSIONS:

Scientific knowledge and aptitude necessarily ensure environmental awareness. However, the knowledge of Life science, and Total scientific knowledge and aptitude is necessarily positively and significantly correlated to environmental awareness .

The objective of the present study fulfils the notion that there is positive relationship between scientific knowledge and aptitude and environmental awareness.

The study answers the research questions which are as follows :

Firstly, environmental awareness is positively and significantly correlated to scientific knowledge and aptitude.

Secondly, environmental awareness is positively and significantly correlated to the knowledge and aptitude of Life science.

Thirdly, environmental awareness is positively and significantly correlated to the knowledge and aptitude of Physical science.

Fourthly, environmental awareness is positively and significantly correlated to the knowledge and aptitude of Mathematics.

8. IMPLICATIONS OF THE STUDY

Knowledge and Aptitude in Science refer more to students' tendency to excel in formal examinations. The present form of education is completely detached from the natural environment and its problems. Thus, present day students are more alien to environmental problems with respect to their school studies. If the study of sciences could be done in the direct setting of the natural environment, learners could develop better awareness about the environment among themselves.

The current form of Science Education should also be changed. This is directly related to the natural environment.

It appears that learning by doing is most essential in science classes, environment-related contents, and practices with the environment, and projects related to the environment may be more effective in the development of environmental awareness.

Students should be provided time to interact with and work outdoors in as natural environment.

9. LIMITATIONS

No research endeavour can encompass all or even many of the relevant factors within it. There are inherent limitations associated with individual efforts to investigate the complexities of environmental issues. The present study acknowledges several such limitations, which are outlined below.

1. The sample was drawn from a relatively small geographical area, which introduces the potential for sampling bias. However, the researcher implemented all necessary precautions from the outset to mitigate such bias.

2. The research design focused exclusively on the science stream at the Higher Secondary level as the population. In contrast, including samples from other academic streams could have more distinctly elucidated the relationship between Environmental Awareness and Scientific Knowledge, Aptitude, or Cognitive Style. This was not feasible due to the already substantial sample size, which precluded further expansion.

3. In the remote rural areas of North and South 24 Parganas, no female students were found in the science stream with Physics, Chemistry, and Mathematics. Only a few girls were enrolled in the Bio-Science stream, which is not comparable to the number of boys in these rural areas.

gap, proper analysis of data along with manuscript preparation and communication.

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