The Hashemite Kingdom of Jordan

National Center for Educational Research and Development (NCERD)

NATIONAL SURVEY OF ENVIRONMENTAL KNOWLEDGE AND AWARENESS OF 8TH AND 10TH GRADE STUDENTS IN JORDAN

by

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Publications Series No. 20

March 1994

This Study was supported by a grant from UNICEF

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ACKNOWLEDGMENTS

UNICEF's interest and active involvement in global environmental protection goes far back. Raising environmental awareness through education and mass media is critical to combat complex environmental problems threatening the living planet Earth. While acknowledging UNICEF's financial assistance, the authors extend their cordial thanks to Mr. Nigel Fisher, Deputy Director of the Regional Office in Amman, and for Mrs. Maha Homsi, program officer, for their interst in the study.

Survey studies naturally involve the cooperation and participation of numerous people. Starting from respondents to questionnaires (8th and 10th grade students in this case), teachers and principals of the sampled schools, test administrators, andregional coordinators, to the research and support staff of the National Center for Educational Research and Development (NCERD), various groups and individuals have cooperated in various ways at the different statges of this study. The authors express their gratitude to all of them.

Special acknowledgements, however, are due to Mr. Ramzi Abu Ghazaleh for numerous statistical analyses of data, to Mr. Hisham Al-Dhajeh for designing the tables and meticulous checking for mumerical accuracy, and to Hala Masoud for typing the tables. Finally, thanks are due to Mr. Mohammad Khier Balqar for giving the final shape to this document.

EXECUTIVE SUMMARY

Introduction

Wide spread ecological disasters and environmental degradation at colossal scales have affected the course of life of numerous communities and nations throughout the world. Many species of plants, animals and birds have become extinct. This has sensitized thoughtful people and the scientific community to take positive action towards environmental protection and ecological conservation. Concerted efforts of concerned people and pressure groups have culminated into 'Rio Declaration on Environment and Development' which proclaims the right of all human beings to a healthy and productive life in harmony with nature. To that effect many countries including Jordan have adopted strategies to combat environmental pollution and to preserve ecological balance.

Creating mass awareness about the environmental and ecological issues and all sorts of pollution by integrating environment and ecology contents in the school curricula and spreading knowledge, is the most commonly adopted strategy. In Jordan, the Ministry of Education (MOE) has resolved to incorporate environment and ecology contents in the basic school science curriculum which is currently being introduced under the ongoing education reform program.

Purpose

The main purpose of this study was to provide necessary feedback to the educationists and environmentalists about :

(i) the current status of environment and ecology related knowledge and awareness of the basic school students in Jordan.
(ii) weaknesses and strengths of relevant environmental subject matter areas.
(iii) the disparities in knowledge and awareness of students of different gender, in rural and urban areas, under different education authorities across different governorates.

The secondary objectives therefrom included :

(i) developing an environment awareness assessment and feedback system,
(ii) studying the relationship of environmental awareness with other core school subjects; and
(iii) providing for a forum for environmental education policy formulation and implementation of such policy in Jordan.

Methodology

A 30-question environment knowledge and awareness scale was developed and administered to a national sample of 5762 grade 8 and grade 10 students in 153 schools selected from all the schools in Jordan on the basis of stratified random sampling procedure . In the total sample, 3453 students were from 8th grade and 2309 from the 10th grade; while genderwise the sample included 2962 males and 2800 females. The 30 items of the scale were grouped in terms of their content into 6 subscales, viz., Water (WAT), Atmospheric Pollution (ATP), Global Warming (GLW), Biodiversity (BIDI), Solid Waste (SOWA), and General (GEN). Psychometric properties of the scale were established.

Descriptive, variational, and linear relational statistical analyses were used to establish performance level and to study various types of differences and associations. Knowledge and awareness levels were established on individual items, subscales, and the total test score.

Student gender and school location differences were analyzed on every individual item but the differences among governorates and education authorities were analyzed on subscales and the total test score.

RESULTS

A. Grade Differences

The difference between the performance of 8th and 10th grade students occurs on almost all items in the expected direction, it varies form item to item and is generally marginal even though statistically significant.

B. Relative Strength and Weakness of the Combined Sample Across Different Items

The level of knowledge and awareness of the students varies widely from item to item. The range of their performance runs from 11% correct to 85% correct. "Place of UN Earth Summit in 1992" was identified correctly by only 11% of the sample while on the popular side "Major cause of pollution in the Gulf of Aqaba" was correctly selected by 85% of the sample.

Among the questions found particularly difficult by the students were: 'Main reason for careful handling of expired batteries', and 'Effect of population growth on water supply in Jordan'.

C. Gender Differences in Environmental Awareness

In the whole sample, male students scored significantly higher than female students on 18 (60%) of the items, and lower than female students on 6 (20%) of the items, whereas on 6 (20%) of them the differences between male and female students' means were not statistically significant at the 5% level of significance. Furthermore, in the rural areas the gender effect was still stronger in favor of male students.

D. Urban/Rural Location Differences in Environmental Awareness

Altogether, on 19 (63.3%) of the items urban students scored significantly higher and on 4 (13.3%) items significantly lower than their rural cohorts, while on 7 (23.3%) items there were no significant differences between the means of the two groups. The four items on which rural students showed more awareness are: (a) 'Main pollutant of King Talal Reservoir', (b) 'Major pollutant of underground water', (c) 'Main hazard from plastic wastes in Jordan', and (d) 'Most industrially polluted basin in Jordan'.

E. Location by Gender Interaction

On 14 out of 30 items the location and gender effects are confounded in several ways. For instance, on two questions viz., "Effect of population growth on water supply in Jordan" and "Main reason for rise in sea level" urban males have scored better than the other three groups (urban females, rural males and rural females) whereas among them there are no differences. On other four items namely: "Effect of excessive use of chemical fertilizers", "Effective method for reducing car pollution", "Effect of oil spills in the seas", and "Main objective of creating natural reserves in Jordan", rural females have scored lower than the other three groups while among them there are no differences.

On "Main hazard from misuse of chemical detergents" having no differences between themselves both urban male and female students scored higher than both rural male and female students but between the two rural groups rural females did significantly by better than rural males. On "Protection of wild animals for ecological balance", urban females did better than urban males who in turn were better than both rural males and females, while there was no difference between the two rural groups. On "Effect of factory fuel burning" urban males did the best of all, urban females were second, rural males did better than rural females who scored lowest of all.

In general, with respect to student gender, males have an edge over females, whereas, in respect of location urban students show superiority over rural students.

F. Environmental Awareness at the National Level and Across Governorates

Overall national performance on the whole test is rather modest. The national average is 54.5% correct. The students' scores range from 0% to 100% correct. The lowest 10% of the scores are below 35% correct, while one-third of the population falls below 46% correct. Although one student in the whole sample of 5762 scored 100% correct, 99.9% of the scores fall below 88.5% correct. The top 10% of the student scores (excluding the one perfect score) fall within 76% to 88.5% correct range.

At the Governorate level, Amman Governorate performed the best followed by Irbid and Karak, then come Zarqa and Aqaba, then Balqa followed by Tafileh and Mafraq, the poorest performers on this test.

G. Relative Performance Across the Six Content Areas of the Test

Relatively speaking, the national awareness is highest in the area of Atmospheric Pollution. Then comes Biodiverity followed by Global Warming. Water, inexplicably, takes the 4th place. General knowledge takes the 5th rank and Solid Waste the last place.

H. Environmental Awareness Differences Among the Four Education Authorities

On the whole, the Private school students got the highest scores among students of all the four authorities. UNRWA students took the second place, the MOD students came third and the MOE students showed poorest performance among the four.

I. Gender and Location Differences Within Each Education Authority

Within each education authority, in general, male students outperformed the female students, as well as urban students outperformed their rural cohorts.

J. Linear Association Between Environmental Awareness and Achievement in the Key School Subjects

Linear correlations between various environment scale components and the Arabic, Math, and Science achievement tests ranged from .12 to .55. The lowest being between Solid Waste and Math and the highest between Environment (total score) and Science. Environment scale correlates the highest with Science and lowest with Math. Its correlation is .55, .47, and .38 with Science, Arabic, and Math, respectively.

Conclusions and Recommendations

The test measured student knowledge and awareness on a wide variety of topics ranging from very general to very specific and from academic to experience-based. The following conclusions can be reached on the basis of the results of this study.

1. The upper basic school students' knowledge and awareness of the environmental issues varies widely across the content areas.

2. On the whole, the knowledge and awareness of the 8th and 10th grade students about environmental issues is rather modest (54.5% correct on the average).

3. Student performance varies widely across different problems according to the nature of the problems. On specific questions their scores range from 11% correct to 85% correct.

4. Student performance varies significantly with respect to gender, male students, in general, scored higher than female students.

5. Student performance also varies according to school location, urban students scored higher than rural students.

6. Student gender and area (rural/urban) interact with the nature of the content. While urban students and male students, in general, did relatively better than their respective counterparts on theoretical questions, the performance of students on experience-based localized items varied significantly according to the experiences of the students of different sex in specific social and physical environments. For example, on 'pollutant of underground water' and 'hazard caused by plastic waste', rural males did better than others while on 'main hazard of misuse of chemical detergents', rural females did better than rural males.

7. Student knowledge and awareness of the environmental problems varies across governorates. Amman's performance is at the top followed by Irbid and Karak, Zarqa and Aqaba come next, then comes Balqa followed by Tafileh and Mafraq.

8. Among the education authorities, Private school students' performance comes at the top, UNRWA comes 2nd, MOD third and MOE the last.

9. In terms of association between environmental knowledge and awareness and achievement in Science, Arabic and Math, there seems to be more in common between environment and science and environment and Arabic than between environment and Math.

10. Since the differences in performance over academic questions can be explained by general ability and socioeconomic status of the students, and availability of educational and informational resources, and differential performance over experience-based items can be accounted for by real life encounters of students with specific environmental problems as they occur in particular localities, it leads to the conclusion that, so far, the impact of including environmental and ecological component in basic science curriculum is hardly noticeable. Below the baseline performance on general knowledge and global issues further lends support to lack of curricular impact on environmental knowledge and awareness of the students.

11. The lower performance of urban students on four crucial items despite their overall superiority lends support to the global hypothesis that city people living in technologically supported smug environments are little aware of irreparable damage done to natural ecologies and life-supporting elements like underground water resources in the rural areas to sustain the comforts of city life.

12. Both lack of awareness, in general, and differential knowledge of different groups of students over different content areas call for closer attention of the agencies concerned with spreading environmental and ecological education in Jordan.

13. In particular, the findings of this study implicate that divergent knowledge-bases and disparate needs of different communities in different regions require diversified curricular content and emphasis appropriately designed for different target populations.

INTRODUCTION

In his preoccupation with the conquest of 'wild nature' reinforced by insatiable greed for wealth and power, blinded by indomitable lust for super technology, in the name of social progress and advancement of human civilization, modern man has cruelly exploited, defiled, and raped the mother nature whose vital ecological balance had, erstwhile, superbly sustained all forms of life on the planet earth. It had to be the virtual death of several seas, numerous lakes, rivers and tropical forests, once jostling with life activity of myriad forms, spread all over the globe, to break the spell of man and force the human race to amaze at the folly of senseless actions perpetrated in the name of economic development.

Ecological disasters and wide spread environmental degradation at colossal scales have changed the course of life of numerous nations and communities. Many species of birds, animals and plants have become extinct. Drastic consequences of shortsighted policies and unscrupulous actions tanken and implemented by individuals, corporate bodies or governments, in due course of time, led to their logical consequences; they unleashed vicious cycles of environmental degradation, ecological upheaval and unmitigated human suffering. Chyrrnoble, Ural sea, Rhine, Volga, Ganges or Zarqa river are only a few examples from a long list of environmental and ecological disasters that have ravaged the earth within a short span of the past 5 decades. These days virtually no country is free from the effects of water and atmospheric pollution, deforestation or desertification.

By their very nature most environmental problems have far reaching global impact, their immediate effects in their intensity and duration, however, may be unevenly distributed across different parts of the world.

Ripple effects of environmental disturbances, sooner or later, reach every part of the world. No country can remain immune from their foreseen/unforeseen consequences. For example global/warning will have universal consequences but midocean islands will bear more devastating impact. Widening hole in the ozone layer affects the entire globe but polar regions and countries lying nearer the poles will suffer more drastically than distant ones. Similarly, deforestation, diminishing rain forests, vanishing species of plants, birds, and animals have more direct and immediate impact on the areas where they occur; in the long run, such disturbances, however, perpetrate ecological imbalance at the global level. Whether it is pumping toxic chemicals into living rivers, lakes and seas, or dumping dangerous radioactive waste into the ocean deeps, the ultimate consequences of such actions have to be borne by the whole planet earth. This is an undeniable fact because the ecological system of the planet earth is a unified whole in which every single element is delicately balanced in harmony with all other elements and, therefore, a tiny vibration cannot help but disturb the equilibrium of the whole system.

Environmental degradation and natural upheavals have both short-term and long-term, as well as local and global impacts. Conservation of environment and preservation of ecological balance and biodiversity is the concern of not the selected few but of every single individual living upon the planet earth. It is the single most critical issue before the whole human race because its survival is inseparably tied with sustenance of ecological balance and environmental integrity of the only living planet we know of. Although environment is a whole entity, environmental issues are myriad. They are multiple and complex by nature; as diverse as the flora and fauna, geophysical and climatic conditions, and social and industrial development in different regions of the world.

Complex nature of the environmental, issues, coupled with the fact that some issues are more critical for some countries or regions than for others because of the locus of the impact of specific environmental problems, makes it evident to us that urgency of problems and peoples' concerns vary a good deal from country to country and from one region to another within the same country. Peoples' concerns also vary according to the degree of knowledge and awareness of different communities about local and global environmental problems and their consequences upon the survival of the biological world.

Eventually, pressure groups and NGO's formed in many countries supported by UN agencies like UNEP made their orchestrated voices heard and finally their efforts culminated in the United Nations Conference on Environment and Development, held in June 1992 in Rio De Janeiro. The thoughtful deliberations of the environmental scientists, ecologists, and politicians from all over the world are epitomized in the 'Rio Declaration on Environment and Development.'

Amongst other things, the Rio Declaration on Environment and Development recognizes that all human beings are entitled to a healthy and productive life in harmony with nature. It emphasizes the role of environmental awareness and participation of all human beings especially of the females and youth at all levels: individual, local, national and global. For instance, Principle 10 of the Rio Declaration proclaims that environmental issues are best handled with the participation of all concerned citizens at the relevant level. The critical role of dissemination of information in enhancing knowledge and awareness of the people at the grassroots level is particularly stressed.

Having realized that it is the human being that has perpetrated the problems related to environmental degradation and ecological imbalance, it is not far to see that solution (if there is any) to the environmental and ecological problems also lies in the concerted effort based on the involvement and active participation of all individuals and communities at their grassroots levels.

Masses typically act according to their knowledge, belief and awareness of the issues. Environmental degradation can be checked and ecological balance can be restored only by conscious and concentrated efforts of all individuals, communities and nations throughout the world.

Knowledge and awareness are enhanced and spread by means of free flow of scientific (objective) information. Information regarding the quality of environment, ecological imbalance, atmospheric and underground or ground water pollution, etc., the causes and agents of environmental and ecological hazards and their consequences for the quality of biological life and for the future of this earth along with the information about positive viable actions and solutions should flow freely among all individuals and communities. Only then, concerned people can make informed decisions and implement them with strength of their conviction and article of faith.

Free flow of vital information could help the situation in three ways: (a) by educating the masses about the issues, (b) by enhancing their awareness and raising their consciousness and conscience, and (c) by encouraging debates and reaching consensus about ways and means to protect the environment and about how to combat the existing problems most effectively.

Most countries in the world today have their own national systems of basic education. Although mobilizing national and community resources to spread knowledge and create awareness about environmental issues could be taxing for some countries and beyond the means of many, all countries can easily utilize their existing education systems and available channels of mass communication. Strengthening the

community awareness potential of the existing educational systems and efficiently utilizing the educative processes in their current or appropriately extended forms could prove attractive and cost effective to all countries.

Jordan is a small country with a diverse ecology hard pressed by scarcity of natural resources, especially of the very source of life, water. The country has consistently strived to develop its limited water resources carefully, and constructed several water reservoirs in different regions. At the same time, the country has made commendable efforts to build up its basic infrastructure and to develop its agriculture, transportation and communication, as well as, industry and skilled manpower.

While the efforts have brought fruits and the country has prospered in many aspects, the industrial and agricultural development has not been without its adverse side effects, increased pollution and rapid environmental degradation in all its forms. Atmospheric pollution, water pollution, desertification, health hazards to animals and humans, to name but a few, multiple problems have raised their heads.

Jordan, with its modest resources and fair share of environmental degradation and water, as well as air pollution problems, has taken some essential steps in the right direction.

Environmental and Ecological Activities in Jordan

Royal Society for Conversation of Nature (RSCN) was established in early sixties to raise national awareness about the critical role played by plants and animals in maintaining ecological balance. Since its creation, RSCN has played a significant role in nature protection activities mainly through its Nature Club program for schools. RSCN runs over 80 Nature Clubs spread all over the country.

In 1980 the Ministry of Municipal and Rural Affairs and the Environment (MMRAE) created a separate department which has since then (in 1991) developed a National Environment Strategy (NES) for Jordan which includes identifying environmental problems and proposing practicable solutions for them.

The Jordanian Society for the Control of Environmental Pollution (JSCEP) was created in 1988 to wage a campaign against all forms of pollution (water, air, soil, noise, solid waste, etc.) and to create and spread public awareness about the protection of the environment from all pollutants, through mass media and all other viable channels of information dissemination.

In 1991 the MMRAE established the Division of Environmental Awareness and Communication while during the same period the Ministry of Education (MOE) developed its environmental education strategy to include environmental and ecological concepts in the science curriculum and textbooks at all grades (1-12). New textbooks that contain environment and ecology related topics have been introduced in all grades of the basic education cycle except grades 4 and 8. New textbooks for these two grades will be introduced at the beginning of the 1994-95 school year.

The Environments Sector at the Higher Council for Science and Technology (HCST) has developed "Science and Technology Policy and Strategies in the Environment Sector" to enhance environmental awareness of all people in Jordan. Currently, HCST is developing the Extracurricular Environmental Activities Manual in cooperation with the MOE's Directorate of Curriculum and Textbook Development.

More recently (April 1993) USAID has released a report "Strengthening Environmental Information/Education/Communications in Jordan" which sounds an

encouraging note that "Many Jordanians are joining in the call for greater awareness of environmental issues". The local NGOs are coming forth with their initiatives with increasing enthusiasm.

Increased participation of both public and private bodies is heartening, but more needs to be done to actually combat the environmental pollution and ecological degradation in Jordan. Creating awareness of the problem and its dangers among the masses is the critical first step to finding a solution, not the solution of the problem. Education programs prove effective only when they are designed to match the existing levels of knowledge and understanding of the target groups. Environment education and awareness programs are more likely to prove successful if the information content is calibrated to the need and conceptual level of the target populations.

In order to design effective educational programs one needs to know the present status of knowledge and awareness of different target groups. It is in this context that this study is going to meet timely needs of all those who are concerned or going to be concerned with environment and ecology in Jordan, in the Middle East, and elsewhere.

Purpose

In view of the background of environmental problems and ecological degradation faced by peoples in Jordan and, further, in view of the scope and prospectus of the strategy adopted by the Ministry of Education (MOE) in cooperation with such local NGO's as Jordanian Society for the Control of Environmental Pollution (JSCEP) and the Royal Society for the Conservation of Nature (RSCN) to spread knowledge and to create awareness of the environmental and ecological problems and issues in the local communities and common masses via educating the basic school children by introducing relevant topics in their normal science curricula, this study aims to meet the following objectives:

1. To develop and validate an environmental knowledge and awareness scale for the basic school students in Jordan.
2. To establish the current levels of knowledge and awareness of the environmental problems among basic student population in Jordan.
3. To establish general parameters of the scope of their knowledge in the vast and varied domain of environmental problems and issues.
4. To identify the areas of relative strengths and weaknesses in the content domain of local and global (specific and general) environmental problems.
5. To study the differences in the environmental knowledge and awareness of the basic school students across:
   (a) the eight governorates,
   (b) four education authorities,
   (c) urban/rural locations, and
   (d) student gender.
6. To study the relationship between environmental knowledge and academic achievement in certain key school subjects (Arabic, Math, and Science).
7. To provide reasonable explanations for the observations of the study.
8. To raise environmental education policy questions and encourage an open forum for discussion of related problems and strategies.

METHODOLOGY

Population and Sample

The National Center for Educational Research and Development (NCERD, Amman) is conducting a comprehensive evaluation of the quality of basic education in Jordan for which the NCERD had drawn a representative two-stage stratified random sample from the population of basic schools in Jordan.

Ideal population of the 'Quality of Education' study comprised all the basic schools and by implication all the students enrolled in basic schools in the whole country.

The real sampling frame, however, contained a restricted population of schools defined on the constraint that a school must have at least one of the three specified grades (4th, 5th, and 8th) for qualifying as an element of the defined population. From this defined population a stratified random sample of 245 schools was selected. Education authority was the dimension of stratification. Almost proportional representation was sought from the three major education authorities (Public, UNRWA, and Private).

An exception was made to the Ministry of Defense (MOD) which operates only a few schools 6 of them were randomly selected for the sample. The 245 schools were distributed among the four education authorities as follows: 204 Public, 6 MOD, 12 UNRWA, and 23 Private. As for the rural/urban dimension, 101 schools were from urban areas while the rest, 144, were from the rural areas.

Since the sampling procedure did not require all selected schools to have Grade 8 or Grade 10, the sample of environment awareness study consisted of 153 schools which fulfilled the requirement of having at least one of these two grades. Although all the 153 schools had Grade 8, only 99 of them had Grade 10.

Fifty-nine (59) of the sampled schools were urban and 94 were rural. According to education authority, 125 schools were Public, 6 belonged to MOD, 11 were Private, and 11 belonged to UNRWA.

Table (1) Sampling Distribution of Schools Among Governorates Across Education Authority and School Location (n=153)

	Authority										
	Public		MOD		Private		UNRWA		National		
	N = 125		N = 6		N = 11		N = 11		N = 153		
Governorate	U	R	U	R	U	R	U	R	U	R	Total
Amman	23	14	-	-	10	-	4	-	37	14	51
Zarqa	7	3	1	-	1	-	2	1	11	4	15
Balqa	2	7	-	-	-	-	-	1	2	8	10
Irbid	4	30	-	-	-	-	2	1	6	31	37
Mafraq	-	14	-	-	-	-	-	-	-	14	14
Karak	1	8	-	-	-	-	-	-	1	8	9
Tafileh	4	-	-	-	-	-	-	-	-	4	4
Ma'an	1	7	1	4	-	-	-	-	2	11	13
National	38	87	2	4	11	-	8	3	59	94	153

Table (2) Sampling Distribution of Students Among Governorates Across Gender and Location Within Each Governorate (N=5762)

	Sex						
	Male			Female			
Governorate	U	R	M-Tot	U	R	F-Tot	Total
Amman	612	215	827	1362	188	1550	2377
Zarqa	253	56	309	277	116	393	702
Balqa	-	155	155	92	34	126	281
Irbid	218	709	927	144	312	456	1383
Mafraq	-	168	168	-	172	172	340
Karak	23	238	261	-	20	20	281
Tafileh	-	56	56	-	34	34	90
Ma'an	81	178	259	1	48	49	308
National	1187	1775	2962	1876	924	2800	5762

With respect to Governorates all the eight governorates had a fair representation of their basic school population. The distribution of the school sample over the 8 governorates across education authorities and across urban/rural location within each education authority is given in Table 1.

Although school was the unit of sampling the unit of analysis was student. The estimates of the environmental awareness whether they are among governorates or education authorities are based upon the number of students in each subsample. Similarly, the comparisons between the performance of male and female students on the one hand, and rural and urban students on the other, whether at the governorate level or at the national level are based upon the sample size of students. Therefore, the sampling distribution of students among all governorates and across school location and student gender within each governorate in given in Table 2.

The whole sample of this study constituted of 5762 students of which 3453 were in the 8th grade and 2309 in the 10th grade. With respect to school location, 3063 were urban and 2699 rural. As for student gender, 2962 were males and 2799 females.

Data Collection and Data Analyses

The data for this study was collected along with other data for the "Assessment of Instructional Quality" study in the last week of May,1993. "The Environment Awareness Scale" was administered to 8th and 10th grade students by trained test administrators who were largely supervisors in various education directorates and who had been particularly trained to follow standard procedures to administer the battery of tests and questionnaires specially designed and developed for the national survey of educational quality in Jordan.

After preliminary checking of each questionnaire, the responses were coded and entered into the NCERD's computing system. Most analyses, used to obtain status-level parameters and levels of significance needed to describe the environmental knowledge and awareness of the basic school students in Jordan, were confined to descriptive, comparative and relational statistical analyses such as frequency distribution, variance analyses and linear correlation. However, procedures like Reliability and Principal Axis Factor Analysis were also used to explore the homogeneity and content structure of the test and to gather sufficient information about its validity for the purpose of this type of survey.

Construction and Development of Environment Awareness Scale

In view of this background it was decided that the environment awareness scale should be constructed such that it would reflect the relative gravity of the environmental issues facing Jordanian people without losing sight of the major global concerns at the same time.

As water is the vital factor for the survival of all forms of life, the scarcity of water resources in Jordan, apparently, poses an increasing threat for the people in Jordan.

Atmospheric pollution and decreasing diversity of biological life in the country are some of the other major problems that are becoming increasingly critical in the life of Jordanian people. As industrialization and consumerism have been marching forward, side by side, safe disposal of the steadily growing tonnage of solid waste has become a problem. While global warming is a universal concern, Jordan, being a member of the world community, shares the global concerns too. Besides these major content areas, general knowledge about local environmental problems and hazards specifically related to Jordan, along with recent international events related to environment, was also incorporated in the scale.

In line with this type of thinking, it was decided that the environment awareness measuring instrument should include, in addition to general knowledge about environmental issues (GEN), the following components: water related issues and concerns in Jordan (WAT), atmospheric pollution (ATP), global warming (GLW) biodiversity (BIDI), and solid waste (SOWA).

Instrumentation: Initially, the scale contained 50 multiple-choice items covering the 6 above-mentioned content domains. Each item went through careful reviews by environmental scientists, educationists and psychometricians. Most items were modified and improved in the light of the reviewers' critique and suggestions, and subsequently, a trial form containing 50 items was prepared. The test was pilot-tested on a sample of 732 8th grade students, 295 males and 437 females, from 13 schools representing the Public, UNRWA, and Private schools in three of the 8 Governorates. The test administrators recorded students' queries, any remarks, and the time students took to complete the test.

Students' responses were entered and subjected to item analysis procedures. Classical test theory based item statistics (item difficulty and discrimination indices) were computed for each item. Especially, students' responses to all alternatives of each multiple choice item in conjunction with the language of the stem were carefully rexamined to detect ambiguity or other types of item flaws.

In light of the item-analysis results, thirty items were selected for the final form of the test. Test format and instructions were revised and each item was reviewed again for clarity of wording and any other flaws.

Psychometric Properties of the Instrument: The environment scale was finally adminstered to a national sample of 5762 students of which 3453 were from 8th grade and 2309 from the 10th grade; while for both grades combined, 2962 of them were males and 2800 females. The response data were subjected to classical test theory based test score analyses. Using Reliability procedures described in SPSS (Norusis, 1990) Cronbach's coefficient α which, for dichotomous items, is the same as KR 20; the propotion correct (difficulty index Pi), standard deviation, and item-remainder correlation coefficient (an index of discrimination power and criterion-related validity

of the item) were computed for the 30-item scale on the three samples (8th grade, 10th grade, and both grades combined).

The results from different analyses consistently demonstrated aberrant behavior on the part of four of the 30 items. In every case, the Pi value (difficulty index) was below chance level and the discrimination index was negative.

With respect to their content areas these four items belonged to four different subscales. When reliability analyses were conducted separately for each subscale of the test, each item in relation with other items in the subscale manifested the same ill condition, near zero difficulty and negative item-remainder correlation coefficient. A negatively discriminating item relates negatively with the construct measured by the remaining set of items. Moreover, it confounds the interpretation of the total test score in case of the whole scale and that of the subscale score in case of the subscale. Although item statistics were reported, that is, proportion correct or item mean and item standard deviation, for all the 30 items; the four items were discarded from computations of the total or subscale scores. So, for all intents and purposes, the environment scale consisted of 26 items composing 6 different scales as follows: Water (WAT, 8 items), Atmospheric Pollution (ATP, 4 items), Global Warming (GLW, 2 items), Biodiversity (BIDI, 5 items), General Knowledge about Environment (GEN, 5 items), and Solid Waste (SOWA, 2 items). General description of the subscales and the number of items composing each subscale is given in the following Table (3), while further detail of the psychometric properties of the scale and subscales are given in Annex I.

Table (3): Name and Contents of the 6 Subscales of the Environmental Awareness Scale

Numbe	Variable	Content	No. of Items
1	WAT	Water issues and problems: Source of supply, pollutants, effects of shortage, and soliutions to the problem.	8
2	ATP	Atmospheric pollution: Major causes, effects, and solutions.	4
3	GLW	Global warming: Causes and effects.	2
4	BIDI	Biodiversity: Importance, causes of degradation, conservation.	5
5	GEN	General Knowledge about local common problems and international events.	5
6	SOWA	Solid waste: Hazards, safe disposal.	2
	Total		26

A. THE EXTENT OF ENVIRONMENTAL AWARENESS AMONG 8TH AND 10TH GRADE STUDENTS IN JORDAN

Grade Differences

Table (4) presents means and standard deviations on each of the 30 items administered to the national sample of 8th and 10th grade students. The item number is the same as appeared in the original test. The three letter or four-letter acronym signifies the subscale, that is, the content domain to which the item belongs, and the text in the content column gives the main problem tested by the item. The performance level of 8th grade students, 10th grade students and of both grades combined, is the mean score of each group on each item. The mean score of an item is actually the proportion of students who answered the item correctly. If we read it disregarding the decimal point then it is simply percentage of students answering the item correctly. An overall picture of the comparatively better performance of the 10th grade students is presented in Figure (1).

For example, the figure 0.54 in the cell defined by the row of item 1 and column 'Mean' of 8th grade sample simply tells that 54% of the 3453 eighth grade students in the sample chose the correct answer for this item. Going along row 1 in appropriate columns, it is noted that 54% of the 8th grade and 71% of the 10th grade students could correctly identify the major source of drinking water in Jordan. While in the combined sample of 8th and 10th grade students 61% of the 5762 supplied the correct response to this question.

The relatively superior knowledge of 10th graders in this matter is evidently clear from the comparison of the two means: 71% is higher than 54%. But, this difference has been observed between the two samples. The interest lies, beyond the sample results, in comparing the whole populations of 8th and 10th grade students in Jordan.

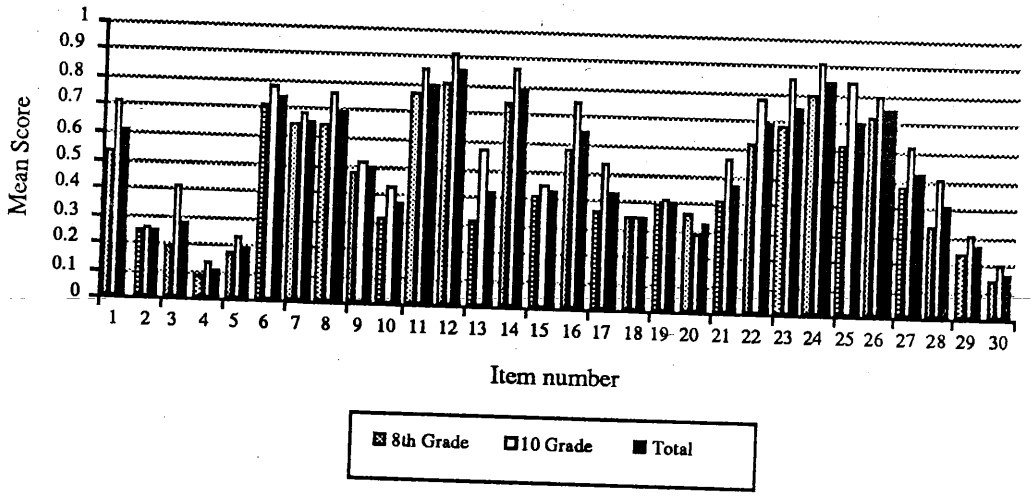
It is hoped that the sample results would be generalized to the populations from which the two samples were selected. In order to do that with greater confidence, statistical tests of significance were conducted. The last column of Table 4 presents the statistical significance, that is the level of confidence with which we rejected the null hypothesis of no difference between the performance levels of the two populations of students and accept the conclusion that the difference in the two populations is more real than by chance. The negative '-' sign indicates that 8th grade students' performance is better. The '+' sign is used to show that the performance of 10th grade students is better than that of 8th grade students. The three stars signify that the level of statistical significance is ($P<.001$). Blank cell indicates that the difference between the two means did not reach statistical significance at the prescribed a level of (.05).

Table (4): Extent of 8th and 10th Grade Students' Knowledge/Awareness About Environmental Issues

No.	Scale	Content	8th Grade N=3453 M	8th Grade N=3453 SD	10 Grade N=2309 M	10 Grade N=2309 SD	Total N=5762 M	Total N=5762 SD	Dif. 10th-8th
1	WAT	The main source of water in Jordan	0.54	0.5	0.71	0.45	0.61	0.49	+***
2	WAT	Main pollutant of water in King Tala Reservior	0.25	0.43	0.26	0.44	0.25	0.43	
3	WAT	Effect of population growth on water supply	0.19	0.39	0.41	0.49	0.28	0.45	+*
4	GEN	Place of U.N Earth Summit in July 1992	0.09	0.28	0.13	0.34	0.11	0.31	+***
5	WAT	Consequence of over use of ground water in Jordan	0.17	0.37	0.23	0.42	0.19	0.39	+***
6	WAT	Environmental consideration in choosing a dam site	0.71	0.45	0.78	0.41	0.74	0.44	+***
7	WAT	Pollutant of underground water	0.65	0.48	0.68	0.47	0.66	0.47	+**
8	WAT	Way to control water consurnption at home	0.65	0.48	0.76	0.42	0.69	0.46	+***
9	GEN	Effect of excessive use of chemical fertilizers	0.48	0.5	0.52	0.5	0.5	0.5	+***
10	ATP	Main reason for air pollution	0.32	0.47	0.43	0.5	0.37	0.48	
11	ATP	Effective method of reducing car pollution	0.77	0.42	0.85	0.36	0.8	0.4	+***
12	ATP	Major cause of pollution in the Gulf of Aqaba	0.81	0.39	0.91	0.28	0.85	0.35	+***
13	GLW	Effect of gases produced by fuel in the factories	0.32	0.47	0.58	0.49	0.42	0.49	+***
14	GLW	Importance of ozone layer	0.74	0.44	0.86	0.34	0.79	0.41	+***
15	WAT	Cause of drought in Jordan	0.41	0.49	0.45	0.5	0.43	0.49	+***
16	BIDI	Reason for plant protection	0.59	0.49	0.75	0.44	0.65	0.48	+***
17	GEN	Reason for energy conservation	0.36	0.48	0.54	0.5	0.43	0.5	+***
18	GEN !	Main oil substitute in Jordan	0.35	0.48	0.35	0.48	0.35	0.48	
19	SOWA!	Harm done by plastic wastes	0.39	0.49	0.41	0.49	0.4	0.49	
20	ATP !	Major cause of led pollution in the air	0.36	0.48	0.29	0.45	0.33	0.47	-***
21	GEN	Effect of over use of chemical detergents	0.41	0.49	0.57	0.5	0.47	0.5	+***
22	BIDI	Cause of decreasing number of elephants	0.62	0.49	0.78	0.41	0.69	0.46	+**
23	ATP	Cause of acid rain	0.68	0.47	0.85	0.35	0.75	0.43	+***
24	BIDI	Effect of oil leak in the seas	0.8	0.4	0.91	0.29	0.84	0.36	+***
25	BIDI	Reason for sanctuaries	0.62	0.49	0.84	0.37	0.7	0.46	+***
26	GEN	Factory polluted harbour	0.72	0.45	0.8	0.4	0.75	0.43	+***
27	SOWA	Effective method for disposal of solid house waste	0.48	0.5	0.62	0.49	0.53	0.5	+***
28	BIDI	Protection of wild animals for ecological balance	0.34	0.47	0.51	0.5	0.41	0.49	+***
29	SOWA	Reason for careful handling of expired batteries	0.24	0.43	0.31	0.46	0.27	0.44	+***
30	GLW!	Cause of sea level increase	0.14	0.35	0.2	0.4	0.16	0.37	+***

Note: != Discarded from subscales and total score
* = (.05 ≤ p>.01); ** = (.01 ≤ p>.005) *** = (p≤.005)

Figure (1): Average Performance of the 8th , and the 10th Grade Students



It is reasonable to expect the 10th grade students with their 2 years of extra schooling and life experience to score higher than the 8th grade students in the same schools. The lack of difference and the negative difference (i.e. 10th graders scoring lower than 8th graders) should raise some eyebrows.

Table (4) shows that on one question, the 8th grade students outperformed the 10th grade students while on three other items the score of the 10th grade students was no better than that of their 8th grader cohorts. This calls for an explanation. Starting with the negatively differentiating item, the four items were examined more closely. This is item 20 which asks about the 'Major cause of lead air pollution'. Only 29% Grade 10 students in contrast with 36% Grade 8 students answered this question correctly. Possibly, some 8th grade students are better informed on this problem perhaps because of inclusion of this content in their curriculum. The other three questions about which Grade 10 students know no better than grade 8 students are respectively about "The major pollutant of King Talal Reservoir (item 2)". "The major substitute of oil energy in Jordan (item 18)", and "Major hazard from plastic wastes in Jordan (item 19)".

The first question (item 2) is answered correctly by 25% of the Grade 8 students and 26% of the grade 10 students. One should know here that on a four-option item 25% correct is the guessing level. It is suspected that this item, somehow, is biased against girls. In the total sample, 31% of the boys answered the question right while only 19% of the girls did so.

Regarding item 18 which taps awareness about major substitute of oil energy in Jordan, there is a significant confounding effect of gender and location. Girls in the villages show significantly greater knowledge in this field than either boys in villages or girls and boys in the urban areas. That is, while there is no difference between girls' and boys' score in the urban sample, in rural sample there is statistically significant difference between the mean score of girls and boys; girls outperform the boys. Neither gender nor location main effect is significant

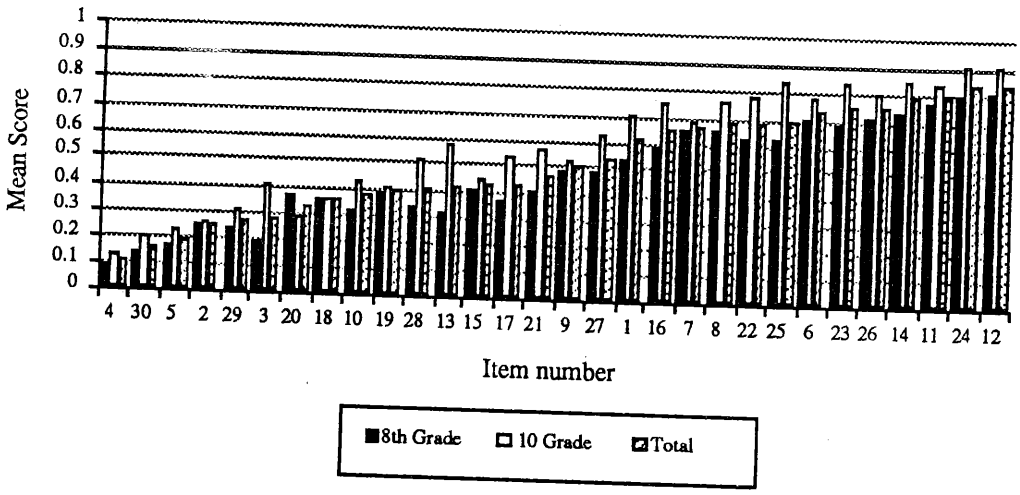
On item 19, 'Main hazard from plastic waste in Jordan', again the grade effect is not significant, but both gender and location main effects are significant. Male students know better than females and rural students know better than urban students.

Areas of Relative Strength and Weakness Across Different Environment Awareness Items

In the combined sample of 8th and 10th grade students (See Table (4), Column Total), the performance on items varies from 11% correct to 85% correct. Only three of the 30 items enjoy the popularity indices in.80s. Item 12 'Major cause of pollution in the Gulf of Aqaba', correctly answered by 85% of the students, is at the top. It is followed by item 24, 'Effect of oil leak in the seas' 84% correct, which is followed by item 11, 'Effective method of reducing car pollution' answered correctly by 80% of the sample. Item 14 'Importance of Ozone layer' with 79% correct, ranks 4th. Figure (2) gives a graphic presentation of the items ranked in terms of their mean scores of the combined sample.

Fifth rank with 75% correct is tied between item 23, 'Cause of acid rain' and item 26 "Most industrially polluted basin in Jordan'. Item 6 'Environmental considerations in choosing a dam site' with 74% correct occupies the 6th rank, while item 25 'Main objective of creating natural reserves in Jordan', correctly answered by 70% of the students ranks 7th. Of the next five items with their popularity indices in 60s, three belong to Water (WAT) subscale and two belong to Biodivesity (BIDI) subscale. Then, two items are answered correctly by about 50% of the students.

Figure (2): Average Performance of the 8th and the 10th Grades, and both 8th and 10th Grades Combined in an Increasing Order



The remaining 15, that is, 50% of the test items have been answered correctly by less than half the student population. Of these the three most difficult items answered correctly by 11%, 16%, and 19% of the students, respectively, are item 4 (Place of July 92 UN Earth Summit), item 30 (Main reason for rise in the sea level), and item 5 (Consequence of the over pumpage of ground water in Jordan). Amoung the items found particularly difficult by students are, item 29 (Main reason for careful handling of expired batteries) and item 3 (Effect of population growth on water supply in Jordan). The former is answered correctly by 27% and the latter by 28% of the 5762 students in the national sample of this study.

Gender Differences in Environmental Awareness

We talked earlier about the heterogeneity of the items included in the Environment Awareness Scale. That is, each item addresses a specific problem. According to traditional differentiation in the roles and expectations of girls and boys some problems are considered primarily male concerns, others are generally female concerns. On the rural-urban dimension also some problems are specific to rural environment, others are more specific to urban environment. Table (5) presents differential performance of male and female students in each location.

Table (5): Comparative Performance of Male and Female Students on Environmental Awareness Items

	Scale	Content	MALE N=2962 M	MALE N=2962 SD	FEMALE N=2799 M	FEMALE N=2799 SD	Dif. M-F
1	WAT	The main source of water in Jordan	0.65	0.48	0.57	0.5	+***
2	WAT	Main pollutant of water in King Tala Reservior	0.31	0.46	0.19	0.39	+***
3	WAT	Effect of population growth on water supply	0.29	0.46	0.26	0.44	+*
4	GEN	Place of U.N Earth Summit in July 1992	0.14	0.35	0.07	0.26	+***
5	WAT	Consequence of over use of ground water in Jordan	0.21	0.41	0.17	0.38	+***
6	WAT	Environmental consideration in choosing a dam site	0.72	0.45	0.76	0.43	-***
7	WAT	Pollutant of underground water	0.66	0.48	0.67	0.47	
8	WAT	Way to control water consumption at home	0.66	0.47	0.73	0.45	-***
9	GEN	Effect of excessive use of chemical fertilizers	0.51	0.5	0.49	0.5	
10	ATP	Main reason for air pollution	0.4	0.49	0.33	0.47	+***
11	ATP	Effective method of reducing car pollution	0.82	0.38	0.78	0.42	+***
12	ATP	Major cause of pollution in the Gulf of Aqaba	0.87	0.34	0.84	0.42	+***
13	GLW	Effect of gases produced by fuel in the factories	0.44	0.5	0.41	0.49	+*
14	GLW	Importance of ozone layer	0.8	0.4	0.79	0.41	
15	WAT	Cause of drought in Jordan	0.45	0.5	0.4	0.49	+***
16	BIDI	Reason for plant protection	0.6	0.49	0.71	0.45	-***
17	GEN	Reason for energy conservation	0.42	0.49	0.45	0.5	-**
18	GEN!	Main oil substitute in Jordan	0.35	0.48	0.36	0.48	
19	SOWA!	Harm done by plastic wastes	0.45	0.5	0.34	0.48	+***
20	ATP !	Major cause of led pollution in the air	0.33	0.47	0.32	0.47	
21	GEN	Effect of over use of chemical detergents	0.45	0.5	0.49	0.5	-***
22	BIDI	Cause of decreasing number of elephants	0.7	0.46	0.67	0.47	+*
23	ATP	Cause of acid rain	0.75	0.43	0.75	0.43	
24	BIDI	Effect of oil leak in the seas	0.86	0.35	0.82	0.38	+***
25	BIDI	Reason for sanctuaries	0.72	0.49	0.69	0.46	+***
26	GEN	Factory polluted harbour	0.77	0.42	0.74	0.44	+***
27	SOWA	Effective method for disposal of solid house waste	0.54	0.5	0.52	0.49	
28	BIDI	Protection of wild animals for ecological balance	0.38	0.49	0.44	0.5	-***
29	SOWA	Reason for careful handling of expired batteries	0.31	0.45	0.22	0.41	+***
30	GLW!	Cause of sea level increase	0.18	0.38	0.15	0.35	+***

Note: != Discarded from subscales and total score
* = (.05 ≤ p>.01); ** = (.01 ≤ p>.005) *** = (p≤.005)

There are only three possible outcomes. Either boys outscore the girls, i.e., (M > F) or girls do better than boys, i.e., (F > M) or there is no significant difference between the performance of boys and girls. In each location we classified the 30 items into the three mutually exclusive categories. Mutually exclusive here means that each item can belong to one and only one category. The result of this classification is given in Table (6):

Table (6): Distribution of Items into Type of Gender Difference in Each Location

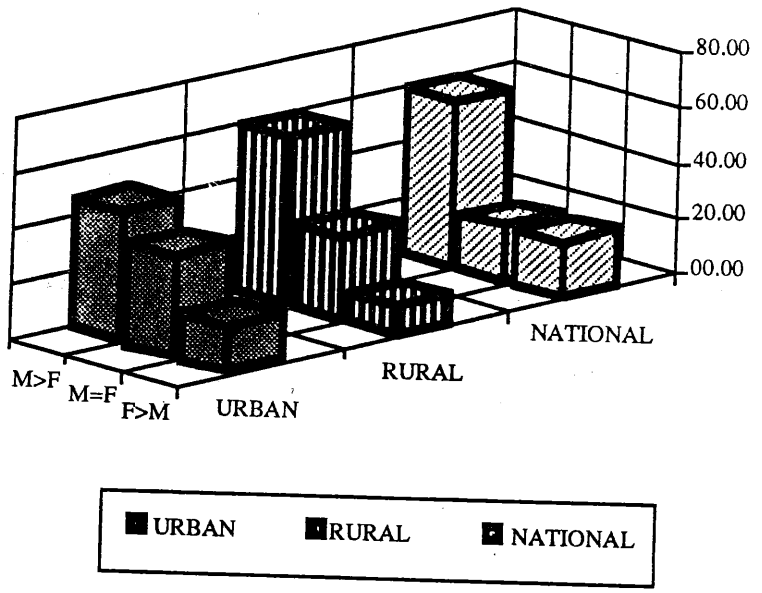
Location	M>F	M=F	F>M	Total
URBAN	14	11	5	30
	46.70%	36.70%	16.60%	100%
RURAL	18	9	3	30
	60%	30%	10%	100%
NATIONAL	18	6	6	30
	60%	20%	20%	100%

From Table (6) we can see that gender differences are more pronounced in the rural population than in urban. In the rural sample, male students have done better

than their female cohorts on 60% of the items, while in the urban sample they have done so only on 47%. In the same vein, there are no gender differences on 37% of the items in urban areas as compared with 30% in the rural areas. Female students did better than male students on 5, that is, 17% of the items in urban areas while they did so on 3, that is, 10% of the items in the rural areas. Figure (3) gives a clear picture of this phenomenon.

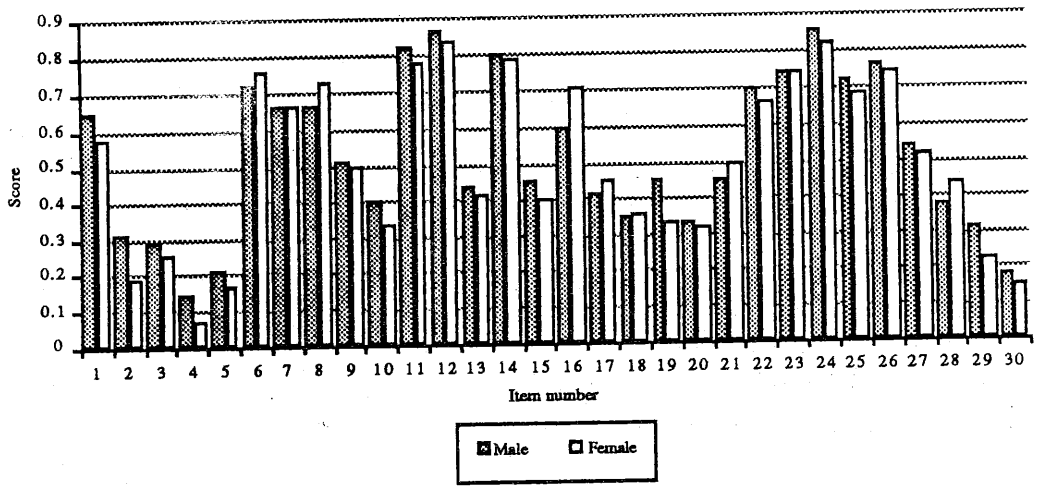
This is, perhaps, because gender stereotyped roles and expectations change more slowly in rural than in urban areas. Modernization and enlightened attitudes spread faster in urban than in the rural communities which are typically more conservative and hold longer on their old traditions and values. In the combined population too, on 18 (60%) of the items male students outperformed their female cohorts, on 20% items there was no significant difference while on 20% of them female students did better than male students.

Figure (3): Distribution of Items into Type of Gender Difference in Each Location



Comparative performance of male and female students on each item in the national sample is shown in Figure (4).

Figure (4): Comparative Performance of Male and Female Students on Each Item in the National Sample



Now if we concentrate on the six items on which girls have done significantly better than boys we see that two of them are concerned with rationing: one about rationing water and the other about rationing energy consumption. One item is related to misuse of detergents, one to choosing a dam site, and two are related to conservation of flora and fauna.

Water, energy consumption, and detergents are the substances with which the female members of the Jordanian households have to deal with almost on daily basis. Washing, cooking, cleaning etc., are the routine chores mainly done by the female members of the family. May be, it is the everyday practical experience of girls in handling these materials that makes female students more aware of and more concerned with these issues than the male students who are perhaps more concerned with other matters that fall within the domain of male interests. Also, females are generally more sensitive than males when it comes to conservation of mother nature and maintenance of ecological balance.

Urban-Rural Differences in Environmental Awareness

The mean scores (the percent correct scores) of urban and rural students and the statistical significance of each difference are given in Table (7) while Figure (5) gives a visual picture of the differences.

Table (7): Locatin Differences in Combined the 8th and the 10th Grade Students' Performance on Environmental Awareness Test Items

	Scale	Content	Urban N=3063 M	Urban N=3063 SD	Rural N=2699 M	Rural N=2699 SD	Dif. U-R
1	WAT	The main source of water in Jordan	0.61	0.49	0.61	0.49	
2	WAT	Main pollutant of water in King Tala Reservior	0.23	0.42	0.27	0.44	-***
3	WAT	Effect of population growth on water supply	0.29	0.45	0.27	0.44	
4	GEN	Place of U.N Earth Summit in July 1992	0.12	0.33	0.09	0.28	+***
5	WAT	Consequence of over use of ground water in Jordan	0.21	0.41	0.16	0.37	+***
6	WAT	Environmental consideration in choosing a dam site	0.76	0.43	0.71	0.45	+***
7	WAT	Pollutant of underground water	0.65	0.48	0.69	0.46	-***
8	WAT	Way to control water consumption at home	0.72	0.45	0.66	0.47	+***
9	GEN	Effect of excessive use of chemical fertilizers	0.51	0.50	0.48	0.50	+***
10	ATP	Main reason for air pollution	0.38	0.48	0.36	0.48	
11	ATP	Effective method of reducing car pollution	0.82	0.39	0.78	0.41	+***
12	ATP	Major cause of pollution in the Gulf of Aqaba	0.86	0.34	0.84	0.37	+*
13	GLW	Effect of gases produced by fuel in the factories	0.48	0.50	0.37	0.48	+***
14	GLW	Importance of ozone layer	0.82	0.38	0.75	0.43	+***
15	WAT	Cause of drought in Jordan	0.42	0.49	0.44	0.50	
16	BIDI	Reason for plant protection	0.72	0.45	0.57	0.49	+***
17	GEN	Reason for energy conservation	0.47	0.50	0.39	0.49	+***
18	GEN!	Main oil substitute in Jordan	0.35	0.48	0.36	0.48	
19	SOWA!	Harm done by plastic wastes	0.32	0.47	0.49	0.50	-***
20	ATP!	Major cause of led pollution in the air	0.32	0.47	0.33	0.47	
21	GEN	Effect of chemical detergents over use	0.52	0.50	0.42	0.49	+***
22	BIDI	Cause of decreasing number of elephants	0.72	0.45	0.65	0.48	+***
23	ATP	Cause of acid rain	0.77	0.42	0.72	0.45	+***
24	BIDI	Effect of oil leak in the seas	0.86	0.35	0.82	0.38	+***
25	BIDI	Reason for sanctuaries	0.73	0.45	0.68	0.47	+***
26	GEN	Factory polluted harbour	0.73	0.44	0.78	0.42	-***
27	SOWA	Effective method for disposal of solid house waste	0.55	0.50	0.52	0.50	+**
28	BIDI	Protection of wild animals for ecological balance	0.49	0.50	0.31	0.46	+***
29	SOWA	Reason for careful handling of expired batteries	0.27	0.45	0.26	0.44	
30	GLW!	Cause of sea level increase	0.19	0.35	0.14	0.35	+***

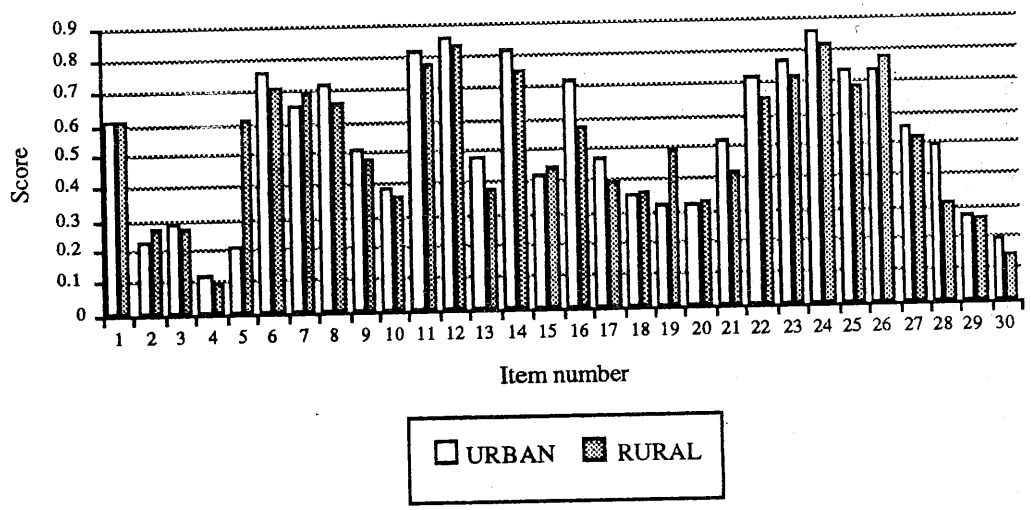
Note: ! = Discarded from subscales and total score.
* = (.05 ≤ p>.01); ** = (.01 ≤ p>.005) *** = (p≤.005)

Generally speaking, urban students, on the whole, do better than their rural counterparts on most achievement tests as well as on tests of general knowledge. Apart from this, there is yet another factor that may have tipped the balance further in favor of urban students. That is, that all the private schools (which cater for students coming from higher socioeconomic status families and are supposed to be of better quality) are located in urban areas. The following Table (8) summarizes the data comparing the performance of rural and urban students on the 30 test items, while Figure (5) presents the complete picture.

Table (8): Distribution of Items Across the Three Outcome Categories Comparing the Performance of Rural and Urban Students

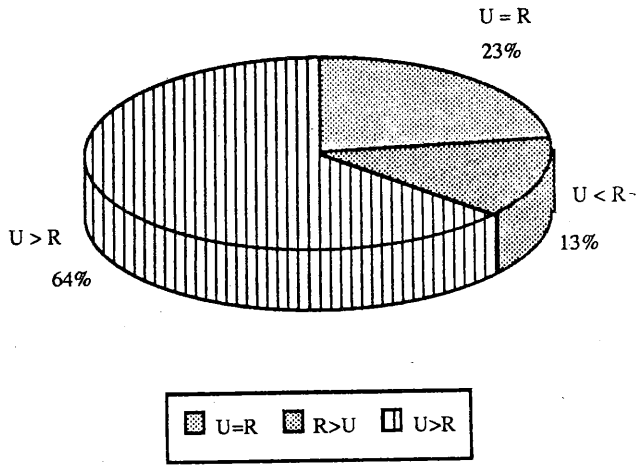
	U>R	U=R	R>U	Total
Count	19	7	4	30
%	63.3	23.3	13.3	100

Figure (5): Differential Performance of Urban and Rural Students on Each Item of the Environment Scale



From Figure (5) and Table (8) we observe that on 19 (63.3%) of the 30 items urban students have scored significantly better than their rural cohorts. On 7 (23.3%) items the performance of the two groups does not differ significantly at the .05 α level. On 4 (13.3%) of the items the rural students have performed better than their urban cohorts. Let us examine these 4 items.

Figure (6): Distribution of Items Across the Three Outcome Categories Comparing the Performance of Rural and Urban Students



From Table (7) we can see that these are: item 2 (Main pollutant of King Talal Reservoir), item 7 (Major pollutant of ground water), item 19 (Major hazard from plastic waste in Jordan), and item 26 (Most industrially-polluted basin in Jordan). Clearly, all the four items are so specific, not only about Jordan but also about specific locations in Jordan, that they cannot be answered on the basis of theory or

commonsense alone. For instance: sheep and goats die by eating plastic waste in rural areas, whereas, villages surrounding King Talal Reservoir are more familiar about the major agent of its pollution. Also, major sources of ground water are located in the rural areas and it is the village people and desert farmers who are more likely to depend upon underground water supply more directly and, therefore, they are more likely to be directly aware of the agents of its pollution. In view of this information the better performance of rural students on these items only stands to reason.

Location by Gender Interactions on Student Environmental Awareness

The essential statistical parameters, that is, the mean, the standard deviation and the level of statistical significance of the difference between the means of male and female students on each item, are given in Table (5). The same parameters for the urban and rural locations are given in Table (7).

Table (9) gives the gender parameters separately under each location for each item. Table (9a) gives the results of statistical analyses: the degree of significance of each main effect (gender difference, and location difference), and the level of significance and the nature of two-way (location by gender) interaction effect on each item.

Table (9) Gender Differences on Environmental Awareness Test Items in Each Location

Item	Scale	Content	URBAN (N=3063)					RURAL (N=2699)				
			Male		Female		Dif.	Male		Female		Dif.
			M	SD	M	SD	M-F	M	SD	M	SD	M-F
1	WAT	The main source of water in Jordan	0.66	0.47	0.57	0.49	+***	0.64	0.48	0.55	0.5	+***
2	WAT	Main pollutant of water in King Tala Reservior	0.3	0.46	0.19	0.39	+***	0.31	0.46	0.18	0.39	+***
3	WAT	Effect of population growth on water supply	0.33	0.47	0.26	0.44	+***	0.27	0.44	0.26	0.44	+***
4	GEN	Place of environment conference in July 1992	0.19	0.39	0.08	0.27	+***	0.11	0.31	0.05	0.22	+***
5	WAT	Consequence of over use of ground water in Jordan	0.25	0.43	0.19	0.39	+***	0.18	0.39	0.13	0.33	+***
6	WAT	Environmental consideration in choosing a dam site	0.73	0.44	0.78	0.41	-***	0.71	0.46	0.72	0.45	
7	WAT	Pollutant of underground water	0.6	0.49	0.67	0.47	-***	0.69	0.46	0.67	0.47	
8	WAT	Way to control water consumption at home	0.67	0.47	0.75	0.43	-***	0.65	0.48	0.69	0.46	-*
9	GEN	Effect of excessive use of chemical fertilizers	0.51	0.5	0.52	0.5		0.5	0.5	0.43	0.5	+***
10	ATP	Main reason for air pollution	0.42	0.49	0.35	0.48	+***	0.39	0.49	0.29	0.46	+***
11	ATP	Effective method of reducing car pollution	0.84	0.37	0.81	0.39	+*	0.81	0.39	0.72	0.45	+***
12	ATP	Major cause of pollution in the Gulf of Aqaba	0.88	0.32	0.85	0.36	+**	0.86	0.35	0.81	0.39	+***
13	GLW	Effect of gases produced by fuel in the factories	0.5	0.5	0.46	0.5	+*	0.4	0.49	0.3	0.46	+***
14	GLW	Importance of ozone layer	0.82	0.39	0.83	0.38		0.78	0.41	0.7	0.46	+***
15	WAT	Cause of drought in Jordan	0.45	0.5	0.4	0.49	+***	0.45	0.5	0.41	0.49	+*
16	BIDI	Reason for plant protection	0.66	0.48	0.76	0.42	-***	0.56	0.5	0.6	0.49	
17	GEN!	Reason for energy conservation	0.46	0.5	0.46	0.5		0.39	0.49	0.4	0.49	
18	GEN!	Main oil substitute in Jordan	0.36	0.48	0.35	0.48		0.34	0.47	0.39	0.49	+**
19	SOWA!	Harm done by plastic wastes	0.35	0.48	0.29	0.46	+***	0.52	0.5	0.45	0.5	+***
20	ATP!	Major cause of led pollution in the air	0.33	0.47	0.31	0.46		0.33	0.47	0.33	0.47	
21	GEN	Effect of chemical and detergent over use	0.52	0.5	0.51	0.5		0.41	0.49	0.45	0.5	+*
22	BIDI	Cause of decreasing number of elephants	0.75	0.43	0.7	0.46	+***	0.67	0.47	0.61	0.49	+***
23	ATP	Cause of acid rain	0.77	0.42	0.78	0.42		0.73	0.44	0.69	0.46	+*
24	BIDI	Effect of oil leak in the seas	0.86	0.34	0.86	0.35		0.86	0.35	0.76	0.43	+***
25	BIDI	Reason for sanctuaries	0.74	0.44	0.72	0.45		0.71	0.45	0.61	0.49	+***
26	GEN	Factory polluted harbour	0.75	0.43	0.72	0.45		0.79	0.41	0.77	0.42	
27	SOWA	Effective method for disposal of solid house waste	0.56	0.5	0.55	0.5		0.54	0.5	0.47	0.5	+***
28	BIDI	Protection of wild animals for ecological balance	0.47	0.5	0.51	0.5	-*	0.32	0.47	0.3	0.46	
29	SOWA	Reason for careful handling of expired batteries	0.33	0.47	0.24	0.42	+***	0.3	0.46	0.19	0.39	+***
30	GLW!	Cause of sea level increase	0.23	0.42	0.16	0.36	+***	0.14	0.35	0.13	0.33	

Note: != Discarded from subscales and total score
* = (.05 ≤ p>.01); ** = (.01 ≤ p>.005) *** = (p≤.005)

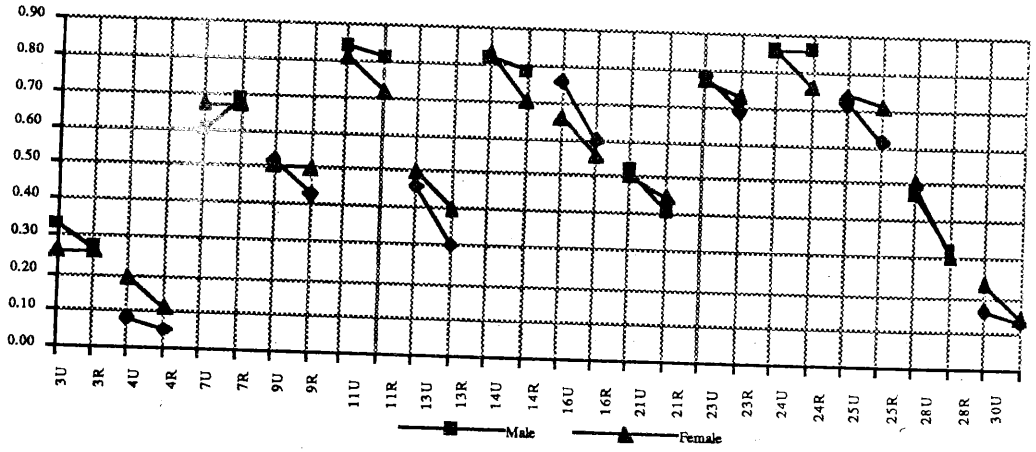
Table 9a: Environmental Awareness Across Governorates (Mean, Standard Deviation and Rank) for 8th and 10 Grade Students Combined

Item #	Scale	Content	Location	Gender	Loc. by Gen.
1	WAT	The main source of drinking water in Jordan		+***	
2	WAT	Main pollutant of water in King Tala Reservior	-***	+***	
3	WAT	Effect of population growth on water supply		+*	UM>(RF, UF, RM)*
4	GEN	Place of UN Earth Summit in July 1992	+***	+***	UM>RM>UF>RF***
5	WAT	Consequence of over use of ground water in Jordan	+***	+***	
6	WAT	Environmental consideration in choosing a dam site	+***	-***	
7	WAT	Pollutant of underground water	-***		(RM, RF, UF)>UM***
8	WAT	Way to control water consumption at home	+***	-***	
9	GEN	Effect of excessive use of chemical fertilizers	+***		(UF, UM, RM)>RF***
10	ATP	Main reason for air pollution		+***	
11	ATP	Effective method of reducing car pollution	+***	+***	(UM, RM,UF)>RF***
12	ATP	Major cause of pollution in the Gulf of Aqaba	+*	+***	
13	GLW	Effect of gases produced by fuel in the factories	+***	+*	UM>UF>RM>RF*
14	GLW	Importance of ozone layer	+***		(UF, UM)>RM>RF***
15	WAT	Cause of desertification in Jordan		+***	
16	BIDI	Reason to protect natural flora	+***	-***	UF>UM>RF>RM**
17	GEN	Reason for rationing energy consumption	+***	-**	
18	!GEN	Main substitute for oil energy in Jordan			
19	!SOWA	Main hazard from plastic wastes in Jordan	-***	+***	
20	!ATP	Major cause of led pollution in the air			
21	GEN	Effect of chemical detergent so overuse	+***	-***	(UM, UF)>RF>RM*
22	BIDI	Cause of decreasing number of elephants	+***	+*	
23	ATP	Cause of acid rain	+***		(UF, UM)>RM>RF*
24	BIDI	Effect of oil leak in the seas	+***	+***	(UM, UF, RM)>RF***
25	BIDI	Main objective of creating natural reserves in Jordan	+***	+***	(UM, UF, RM)>RF***
26	GEN	Most industrially-polluted basin in Jordan	-***	+***	
27	SOWA	Effective sanitary for disposal method of solid house waste	+**		
28	BIDI	Protection of wild animals for ecological balance	+***	-***	UF>UM>(RM, RF)*
29	SOWA	Reason for careful handling of expired batteries		+***	
30	!GLW	Cause of sea level increase	+***	+***	UM>(UF, RM, RF)***

Note: != Discarded from subscales and total score
* = (.05 ≤ p>.01); ** = (.01 ≤ p>.005) *** = (p≤.005)

The last column of Table (9a) shows that on 14 of the 30 test items the location by gender interaction is significant to varying degrees of statistical significance. The level of statistical significance ranges from .05 (the prescribed α level) to less than .001. A single star indicates $\alpha \leq .05$; two stars, $\alpha \leq .01$; and three stars indicate the values of $\alpha \leq .005$. The last column of Table (9), apart from the level of statistical significance of the interaction, also explicates the nature of the interaction. The acronyms UM, UF, RM and RF, stand respectively, for **urban male, urban female, rural male, and rural female**. The groups enclosed in parentheses do not differ from one another at $\alpha \leq .05$ level of statistical significance. While the positive and negative signs in the two main effect columns indicate the direction of differences. Greater than '>' symbol is used to show the significant ordered differences in the interaction column. The negative '_' sign for gender difference represents female superiority while the positive '+' sign does the reverse. Similarly, '_' sign for location differences shows rural superiority over urban and '+' sign shows the opposite of the former. We will examine the nature of interaction on every one of the 14 items. Since the nature of interaction can be better appreciated via a visual image, Figure (7) presents the graphic view of each one of the 14 significant interactions.

Figure (7): Location by Gender Interaction Effect on the 14 Items



To start with the first significant interaction, on item 3 (Effect of population growth on water supply) urban males have scored significantly better than both urban and rural females as well as rural males, whereas, among the latter three groups there are no significant differences.

Item 4 (Place of UN Earth Summit in July 92) was found to be, by far, the most difficult question in the whole test. Only 11% of all the 8th and 10th grade students identified the correct name of the place of 92 Earth Summit. However, the location and gender effects were confounded. Urban male students scored the highest of the four groups; rural males scored higher than both urban and rural females, while, urban females scored better than rural females. Each interaction is illustrated by visual graphics in Figure (7).

Item 7 (Major pollutant of underground water in Jordan) was correctly answered by 66% of the total sample. While location main effect was highly significant in favour of rural students the gender main effect was not significant. Highly significant gender by location interaction shows that urban males have scored significantly lower than the other three groups (rural males, rural females, and urban females) among which there are no statistically significant differences. This effect has already been explained in an earlier section of this report.

Item 9 (Effect of excessive use of chemical fertilizers) was correctly answered by 50% of the students in the total sample. Location main effect was significant, in favour of urban students. Gender effect was not significant. However, a significant location by gender confounding shows that the rural females have performed significantly poorly as compared to the other three groups which have no significant differences among themselves. In addition to item 9, on three other items viz., item 11 (Effective method of reducing car pollution), item 24 (Effect of oil leak in the seas), and item 25 (Main objective of creating natural reserves in Jordan), rural female students did significantly worse than the other three groups which showed no significant differences among one another.

These are not the only items on which the scores of rural female students are the lowest among all the groups. These four items are singled out because of the sameness of the nature of interaction; other groups scoring significantly better than rural females while showing no significant differences among themselves.

Scanning Table (9a) further reveals that on three of these four items both main effects are significant, that is, male students have scored higher than female students and urban students have scored higher than rural students. On one of them, however, gender effect is significant in favour of urban students. It seems that content of these items deals more with general information with a theoretical penchant than with specifically Jordanian content of particular interest to rural females. On the whole we have seen that males have performed better than females and urban students have performed better than rural students.

Interaction on these items is caused by the fact that while there are no significant differences among the three groups (viz., urban males, urban females, and rural males), rural female students' knowledge in these matters seems to be particularly poor.

Item 13 deals with the (effect of burning fuel in the factories); both main effects are significant in the usual direction; the two-way interaction rank orders the four groups as follows. Urban males have scored the highest followed by urban females who, in turn, have scored higher than rural males who have scored higher than rural females. (UM>UF>RM>RF).

Item 14 asks about the (Importance of ozone layer). On this item while there is no significant difference between urban males and urban females, both groups have scored significantly better than rural males who, in turn, have outperformed rural females.

On item 16 (Reason to protect national flora) both main effects are significant; while location effect is typically in favour of urban students, the gender effect is atypical, female students (group as a whole) have done significantly better than male students. This is perhaps because human female is instinctually better inclined to preserve and protect life, including plant life, than human male.

Item 21 (Main hazard from misuse of chemical detergents) has both main effects significant; urban students have scored better than rural ones and female students have done better than their male cohorts. In urban location, however, there is no significant difference between males and females, whereas, rural females have done significantly better than rural males. The high performance of girls in the rural areas, on this item, is to be accredited for the significant main effect in favour of girls. While urban students are generally better informed than rural students in matters of general knowledge, it is the rural girls, perhaps, who have the practical experience of using chemical detergents in washing and cleaning on day to day basis. It is this experience that contributes to greater awareness of the rural girls, about the hazards of the misuse of chemical detergents.

Item 23 (Cause of acid rain) has only location main effect, as usual, urban students scoring better than rural students. Interaction is produced by the fact that while there is no significant gender difference in the urban areas, in the rural areas males have done significantly better than their female cohorts. The answer to this item requires academic knowledge rather than first-hand experience of the students. Acid rain is not a common phenomenon in all parts of Jordan. It is limited only to certain specific localities, even there it is a rare event.

Item 28 (Protection of wild animals for maintaining ecological balance) has both main effects significant. Urban students have outperformed the rural students, but in terms of gender, female students have done significantly better than the male students. Interaction seems to have been caused by the fact that females have done significantly better than males in the urban location while in the rural location there is no significant difference between males and females.

Item 30 (Main reason for the rise in sea level) was answered correctly by only 16% of the total sample; much below chance level for an 4 -alternative multiple-choice item. Both main effects, however, are significant and in the usual direction, male doing better than females and urban students doing better than rural students. Interaction seems to have occurred due to the fact that only urban males have scored significantly higher than the other three groups of students among whom there were no significant differences. This type of performance trend could be explained on the ground that answer to this question depends more upon academic rather than experiential knowledge of the students; the male urban students, probably, perform better than others in matters of scientific general interests.

B. ENVIRONMENTAL AWARENESS ACROSS DIFFERENT GOVERNORATES IN JORDAN

Having explained performance of male/female and urban/rural students on each individual item, now we look at the differences in the level of environmental awareness among the eight governorates. As stated earlier, the four items with negative discrimination-power index were excluded from computation of the total test score and the six content-based subscale scores. The composition of the six content-subscales has already been described in an earlier section of this report.

We compared the performance of all students (both male and female) in each governorate with the performance of all students in every other governorate on seven separate test scores: total test score and the six subscale scores. In order to compare the means of pairs of governorates Newman-Keul's method of Simultaneous Multiple Comparisons was used at α =.05 level of significance. To start with, One-Way Multivariate Analysis of Variance, specifying unique sums of squares for each cell to take into consideration the unequal sample sizes in different governorates, was conducted on the set of six content-subscale scores as dependent variables, while a Univariate One-Way ANOVA was used for the total tet-score. Since the multivariate null hypothesis of no difference on the set of subscale scores among the eight governorates was confidently rejected (P<.000), we subjected each subscale score also to Univariate One-Way and Newman-Keuls' test of Multiple Comparisons. The results of the set of analyses are presented in Tables (10 and 11) while Figure (8) displays comparative achievement of governorates on each scale.

The rows of Table (10) show the mean, the standard deviation, and the rank order of each governorate on each score. Since total test score is an overall measure of awareness of environmental issues, we compare relative standing of governorates by rank-ordering them in terms of their means on the total test score. From the first to the last the rank order is as follows:

{Amman>Karak>Balqa>Aqaba>Zarqa>Irbid>Tafileh>Mafraq}.

Amman governorate students with their average of 56.3% correct have scored the highest which, however, is only 2 percentage points higher than the national average of 54.6% correct.

These ranks based upon minuscule raw mean differences could be misleading if taken on face value of ranks. We need to ensure that a difference between any two governorates is real rather than a reflection of error of measurement or of sampling fluctuation. From Table (11) we can see that when Amman is compared with every other governorate, one by one, only four of the seven differences turn out to be statistically significant at α =.05 level of significance. The four governorates that have

scored significantly lower than Amman Governorate on the environment awareness scale as a whole, are Irbid, Zarqa, Tafileh, and Mafraq.

Table (10): Environmental Awareness Across Governorates (Mean, Standard Deviation and Rank) for 8th and 10th Grade Students Combined

Scale	Sta.	Amm. N=2377	Zarqa N=702	Balqa N=281	Irbid N=1383	Maf. N=340	Karak N=281	Tafile N=90	Aqaba N=308	National N=5762
TOTSCORE	M	56.3	53.9	54.3	53.8	48.9	54.7	50.3	54.0	54.6
(26)	SD	16.2	16.0	15.6	15.7	15.9	14.2	16.0	14.9	16.0
	R	01.0	05.0	03.0	06.0	08.0	02.0	07.0	04.0	
WAT	M	48.9	47.3	47.8	47.2	44.4	49.5	45.7	52.0	48.1
(8)	SD	18.7	19.3	19.9	18.6	18.5	18.1	18.8	18.1	18.8
	R	03.0	05.0	04.0	06.0	08.0	02.0	07.0	01.0	
ATP	M	70.9	67.2	70.6	68.5	61.9	69.8	68.3	70.3	69.2
(4)	SD	23.5	24.1	22.3	22.9	27.3	22.3	24.2	22.3	23.6
	R	01.0	07.0	02.0	05.0	08.0	04.0	06.0	03.0	
GLW	M	65.0	59.8	54.6	59.4	49.4	64.6	51.1	54.9	60.8
(2)	SD	34.8	35.1	37.7	35.1	35.2	35.4	35.9	35.3	35.4
	R	01.0	03.0	06.0	04.0	08.0	02.0	07.0	05.0	
SOWA	M	40.2	38.2	42.0	40.7	36.6	40.3	42.8	40.4	40.0
(2)	SD	34.2	34.8	33.8	34.0	36.5	34.6	34.8	34.9	34.4
	R	06.0	07.0	02.0	03.0	08.0	05.0	01.0	04.0	
BIDI	M	69.6	67.2	64.7	63.9	52.2	63.6	53.6	59.5	65.9
(5)	SD	28.0	27.1	27.8	27.8	29.3	26.2	26.8	26.3	28.0
	R	01.0	02.0	03.0	04.0	07.0	05.0	08.0	06.0	
GEN	M	46.3	44.4	46.1	45.4	41.9	44.0	42.9	43.9	45.3
(5)	SD	23.0	21.7	21.6	21.3	21.3	20.0	21.5	21.5	22.0
	R	01.0	04.0	02.0	03.0	08.0	05.0	07.0	07.0	

Figure (8): Environmental Awareness Across Governorates for 8th and 10th Grades Combined

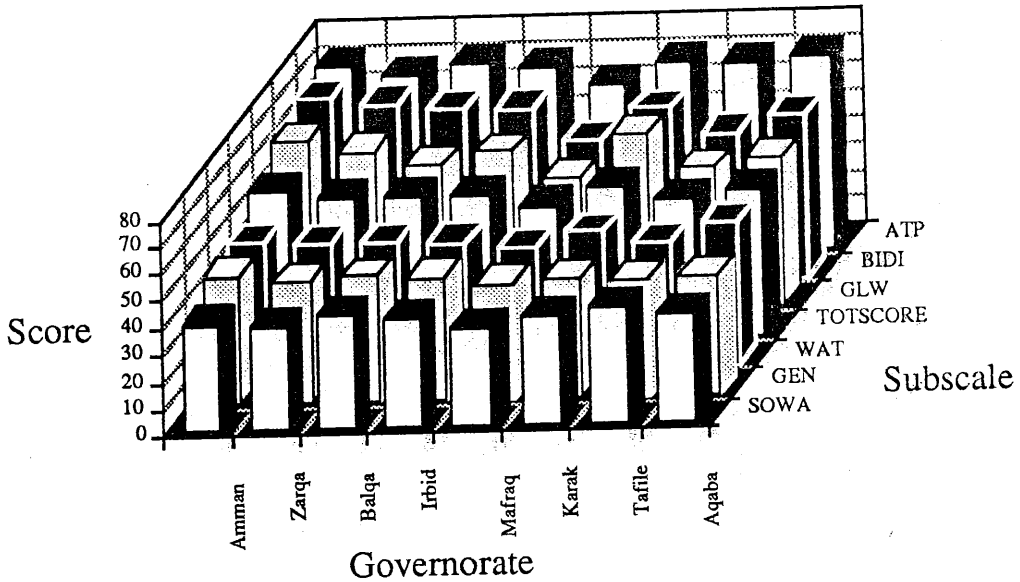


Table (11): Differences Sigificant at (α = .05) Level Between Pairs of Governorates

Governorate	Scale	Mean	Se	Amm.	Irbid	Karak	Aqaba	Zarqa	Balqa	Tafileh	Maf.
Amman	WAT	48.9	0.38		*						*
	ATP	70.9	0.48		*			*			*
	GLW	65.0	0.71		*		*	*	*	*	*
	SOW	40.2	0.70								
	BIDI	69.6	0.57		*	*	*	*	*	*	*
	GEN	46.3	0.47								
	TOT	56.3	0.33		*			*		*	*
IRBID	WAT	47.1	0.49								*
	ATP	68.5	0.62								*
	GLW	59.4	0.94				*				*
	SOW	40.7	0.91								
	BIDI	63.9	0.75				*			*	*
	GEN	45.4	0.57								
	TOT	53.8	0.42							*	*
KARAK	WAT	49.5	1.07								*
	ATP	69.8	1.33								*
	GLW	64.6	2.11				*		*	*	*
	SOW	40.2	2.07								
	BIDI	63.6	1.56							*	*
	GEN	44.0	1.19								
	TOT	54.7	0.85								*
AQABA	WAT	52.0	1.02	*	*			*	*		*
	ATP	70.3	1.27								*
	GLW	54.9	2.01								
	SOW	40.4	1.99								
	BIDI	59.5	1.50								
	GEN	43.9	1.23								
	TOT	54.0	0.85								*
ZARQA	WAT	47.3	0.72								
	ATP	67.2	0.91								*
	GLW	59.8	1.33								*
	SOW	38.2	1.31								
	BIDI	67.2	1.02		*		*			*	*
	GEN	44.4	0.82								
	TOT	53.9	0.60								*
BALQA	WAT	47.8	1.18								
	ATP	70.6	1.33								*
	GLW	54.6	2.25								
	SOW	42.0	2.02								
	BIDI	64.7	1.66							*	*
	GEN	46.1	1.29								
	TOT	54.3	0.93								*
TAFILEH	WAT	45.7	1.98								
	ATP	68.3	2.55								
	GLW	51.1	3.79								
	SOW	42.8	3.67								
	BIDI	53.6	2.82								
	GEN	42.9	2.27								
	TOT	50.3	1.69								
MAFRAQ	WAT	44.4	1.00								
	ATP	61.9	1.48								
	GLW	49.4	1.91								
	SOW	36.6	1.98								
	PIDI	57.2	1.59								
	GEN	41.9	1.15								
	TOT	48.9	0.86								

Though Irbid stands lower than Amman yet it has scored higher than Tafileh and Mafraq. Also, Karak, Aqaba, Zarka, and Balqa have done significantly better than Mafraq. Using greater than '>' symbol and bracketing those which do not differ with each other we summarize the significant differences between pairs of governorates as follows:

Amman > (Irbid, Zarqa), (Tafileh, Mafraq),
Irbid > (Tafileh, Mafraq), and
(Karak, Aqaba, Zarqa, Balqa) > Mafraq.

Apparently, the performance of Mafraq and Tafileh governorates is the poorest among all the governorates. Irbid, Karak, Balqa, Aqaba and Zarqa have nearly equal means which are approximately the same as the national mean (54.6% correct). It would not be unfair to say that while Amman is slightly better and Tafileh and Mafraq a little worse, the performance of the whole country is rather mediocre.

Distribution of Total Score in the Population

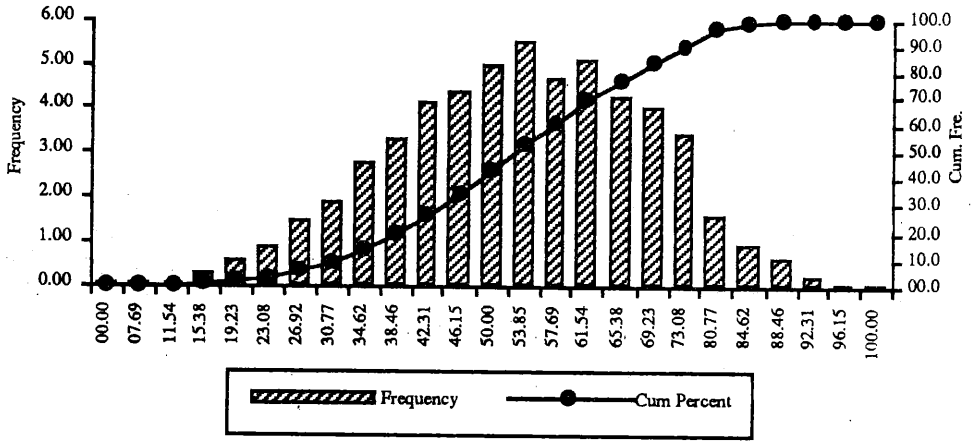
As Table (12) and Figure (9) indicate, the distribution of the total test score is almost normal. The median and the mode of the score coincide while the mean is nearly the same as median and mode. The percent correct score ranges from 0.0 to 100.0. Actually, three students out of 5762 (0.1%) of the sample scored zero while on the other end one student got 100% correct. Table (12) shows percent correct interval, number of students and its percentage falling in each interval, and the cumulative percentage up to each interval.

Table (12): Interval Frequency Distribution of the Total Scale Score

Value	Frequency	Percent	Cum Percent
00.00	3	0.1	00.1
07.69	3	0.1	00.1
11.54	7	0.1	00.2
15.38	31	0.5	00.8
19.23	56	1.0	01.7
23.08	87	1.5	03.2
26.92	148	2.6	05.8
30.77	190	3.3	09.1
34.62	278	4.8	13.9
38.46	329	5.7	19.6
42.31	409	7.1	26.7
46.15	442	7.7	34.4
50.00	497	8.6	43.0
53.85	549	9.5	52.6
57.69	468	8.1	60.7
61.54	509	8.8	69.5
65.38	424	7.4	76.9
69.23	402	7.0	83.9
73.08	341	5.9	89.9
80.77	159	2.8	96.8
84.62	92	1.6	98.4
88.46	63	1.1	99.5
92.31	23	0.4	99.9
96.15	7	0.1	100
100.00	1	0.0	100
Total	5762	100	100

Mean=	54.5	SD=	15.96	Min=	0.00
Median=	53.85	SE=	0.21	Max=	100.0
Mode=	53.85				

Figure (9): Interval Frequency Distribution of the Total sSale sSore



For example, 6 students which is 0.1% of the sample got scores from 0% to 10% correct; 94 students (that is 1.6% of the sample) fall within the score interval of 11% to 20% correct, while the 1.7 cumulative percentage shows that 1.7% of students have scored below 21% correct. Nearly 20% scores are below 41% correct, while 61% of the scores lie below 61% correct. On the cheery side 345 students, that is, over 6% of the sample scored above 80% correct. Table (13) gives the percentiles and percentile score values below which fall the given percent of scores.

Table (13): Percentile Values of the Total Score (N=5762)

Percentile	value	Percentile	Value	Percentile	Value
01.00	19.231	02.00	23.077	03.00	23.077
04.00	26.923	05.00	26.923	06.00	30.769
07.00	30.769	08.00	30.769	09.00	30.769
10.00	34.615	11.00	34.615	12.00	34.615
13.00	34.615	14.00	38.462	15.00	38.462
16.00	38.462	17.00	38.462	18.00	38.462
19.00	38.462	20.00	42.308	21.00	42.308
22.00	42.308	32.00	42.308	24.00	42.308
25.00	42.308	26.00	42.308	27.00	46.154
28.00	46.154	29.00	46.154	30.00	46.154
31.00	46.154	32.00	46.154	33.00	46.154
34.00	46.154	35.00	50.000	36.00	50.000
37.00	50.000	38.00	50.000	39.00	50.000
40.00	50.000	41.00	50.000	42.00	50.000
43.00	50.000	44.00	53.846	45.00	53.846
46.00	53.846	47.00	53.846	48.00	53.846
49.00	53.846	50.00	53.846	51.00	53.846
52.00	53.846	53.00	57.692	54.00	57.692
55.00	57.692	56.00	57.692	57.00	57.692
58.00	57.692	59.00	57.692	60.00	57.692
61.00	61.380	62.00	61.538	63.00	61.538
64.00	61.838	65.00	61.538	66.00	61.538
67.00	61.538	68.00	61.538	69.00	61.538
70.00	65.385	71.00	65.385	72.00	65.385
73.00	65.385	74.00	65.385	75.00	65.385
76.00	65.385	77.00	69.231	78.00	69.231
79.00	69.231	80.00	69.231	81.00	69.231
82.00	69.231	83.00	69.231	84.00	73.077
85.00	73.077	86.00	73.077	87.00	73.077
88.00	73.077	89.00	73.077	90.00	76.923
91.00	76.923	92.00	76.923	93.00	76.923
94.00	77.769	95.00	80.769	96.00	80.769
97.00	84.615	98.00	84.615	99.00	88.462

For example, under 'percentile' column we find 33 and on the right of 33 in the same row under the 'value' column we read 46.154. This means that 33% of the students scored below 46.154% correct. Against 99th percentile the value 88.462 tells us that 99% of the students have scored less than 88.5% correct. Actually 99.5% of the scores fall below 88.5% correct score and only .5% of them that is 31 students have scored above 88.5% correct score.

Comparative Awareness of the Eight Governorates on the Six Components of Environment Awareness Scale

It was described earlier that 26 items were retained to form different content subscales. They are distributed over the six subscales as follows: Water (WAT, 8 items), Atmospheric Pollution (ATP, 4 items), Global Warming (GLW, 2 items), Biodiversity (BIDI, 5 items), General (GEN, 5 items), and Solid Waste (SOWA, 2 items).

It is of interest to know whether different governorates have preferential awareness in some areas over others. This is because environmental problems arise in particular localities or regions due to specific negligence or irresponsible actions on the part of decision makers and/or common people.

Water Subscale (WAT)

As in case of the total test score, Table (10) ranks the eight governorates on each subscale score, while Table (11) identifies the pairs of governorates between which the difference is statistically significant at the .05 $\propto$ level of significance.

It is interesting to note that on Water (WAT) subscale it is Aqaba that has attained the 1st rank instead of Amman which ranks third and Karak, retains the second rank as it did on the total test score. While Balqa became 4th instead of 3rd on total score, Zarka, Irbid, Tafileh and Mafraq maintain respectively 5th, 6th, 7th, and 8th ranks, same as on the total score. As regards statistical significance, Table (11) shows that only a few differences are statistically significant.

Aqaba > (Amman > Irbid > Mafraq), (Zerqa, Balqa).
Karak > Mafraq.

Aqaba scored (on Water) significantly better than Amman, Irbid, Mafraq, Zarqa and Balqa; whereas, there were no significant differences among Aqaba, Karak, and Tafileh on one hand and between Zarqa and Balqa, on the other; Karak scored higher than Mafraq. Among Amman, Irbid and Mafraq, Amman did better than Irbid which, in turn, did better than Mafraq. Mafraq with its lowest score although did significantly poorer than Aqaba, Amman, Irbid, and Karak yet maintained parity with Mafraq, Zarqa, Balqa, and Tafileh.

Tafileh for instance with its mean percent correct score of 45.7 on Water, though only second from the bottom, was not significantly different from any other governorate including the highest scoring Aqaba.

Distribution of Water Subscale Score in the Population

In terms of the national performance on the 8-item water subscale, the mean of the percent correct score was 48.1, the median and the mode were both 50.0, individual scores ranged from 0.00% correct through 100.00% correct. The distribution of the score was almost normal. Actually on the lower end 41 students approximately .7% (7 students per thousand) got zero, that is, they did not answer any

of the 8 items right. As given in Table (14) 13.6% of the students got 25% correct; 25.1% of the students 50% correct and on the upper end 3.1% of the students got 87.50% correct while 51 students (.9%) got 100.00% correct. The histogram of the Water subscale score distribution is shown in Figure (10).

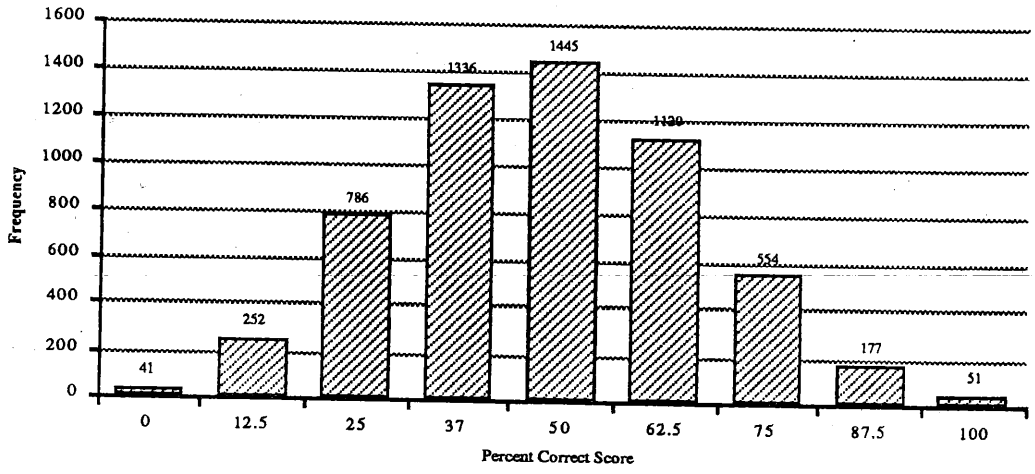
From the median value of 50.0 we know that 50% of the scores fall below 50% correct score, nevertheless, there were many more students who got the same score (50% correct), therefore, as can be seen from the frequency table for WAT, 67% of the cases fall at or below this value (50% correct). In the next category that is answering 5 out of 8 items correctly fall 19.4% of the students raising the cumulative percentage from 67 to 86.4. Only 9.6% of the students obtained 75% correct; 3.1%, 87.5% correct; and .9% of them got 100% correct. So 96% of the students fall within the range of first three quartiles, that is, from zero to 75 percent correct.

Table (14): Frequency Distribution of the Water Subscale Score

Value	Frequency	Percent	Cum.%
00.00	41	00.7	00.7
12.50	252	04.4	05.1
25.00	786	13.6	18.7
37.00	1336	23.2	41.9
50.00	1445	25.1	67.0
62.50	1120	19.4	86.4
75.00	554	09.6	96.0
87.50	177	03.1	99.1
100	51	00.9	100
Total	5762	100	

Mean=	48.12	SD=	18.79	Min=	0
Median=	50.00	SE=	0.25	Max=	100
Mode=	50.00	Skew=	0.12		

Figure (10): Histogram of the Water Subscale Score



Atmospheric Pollution Subscale (ATP)

On the 4-item Atmospheric Pollution subscale, Amman, governorate ranked 1st, Balqa 2nd, and Aqaba 3rd while Karak (after maintaining 2nd rank on the total score and Water subscale) slipped to the 4th rank. Irbid got 5th rank, Tafileh 6th, Zarqa 7th and Mafraq remained 8th (the last). (See Table 10 and Figure 8).

Regarding statistical significance of the difference between pairs of governorates, all governorates except Tafileh have scored significantly better than Mafraq. Amman, besides Mafraq, has done significantly better than both Irbid and Zarqa, while Tafileh has no difference with any other governorate. (See Table 11 and Figure 8).

Amman > (Irbid, Zarqa) > Mafraq;
(Balqa, Aqaba, Karak, Irbid, Zarqa) > Mafraq.

Distribution of Atmospheric Pollution (ATP) Subscale Score in the Population

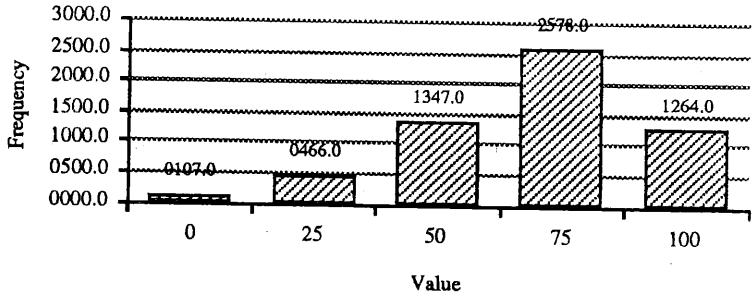
In comparison to national performance on other subscales including total test score, ATP mean percent correct score is the highest. The national mean is 69.2% correct. Among the eight governorates, the mean score varies from 61.9% correct (in Mafraq) to 70.9% correct (in Amman). The interval frequency distribution and its histogram are shown in Table 15 and Figure (11), respectively. The score distribution with mean of 69.2 and both mode and median coinciding at 75.0 is rather negatively skewed which is indicative of easier test or better student achievement. On ATP subscale 1.9% of the students got zero percent correct; 8.1% got 25% correct; 23.4% got 50% correct; 44.7% got 75% correct and 21.9% of the students got 100% correct. It's clear from the ATP score distribution given in Table (15) and Figure (11) that exactly two-third of the sample scored above 50% correct. Roughly one quarter of the students got full marks (100% correct).

Table (15):Frequency Distribution of the Atmospheric Pollution Subscale Score

Value	Frequency	Percent	Cum.%
0	107	01.9	01.9
25	466	08.1	09.9
50	1347	23.4	33.3
75	2578	44.7	78.1
100	1264	21.9	100
Total	5762	100	

Mean=	69.20	SD=	23.59	Min=	00.0
Median=	75.00	SE=	00.31	Max=	100.0
Mode=	75.00	Skow=	.63		

Figure (11): Histogram of the Atmospheric Pollution Subscale Score



Global Warming

Intergovernorate Comparisons

The Global Warming (GLW) subscale contains only two items. Amman with 65% correct got the top rank while Mafraq (49.4% correct mean score) stayed at the bottom of the eight governorates. Mafraq's difference, however, was statistically significant with only four governorates, viz; Amman, Irbid, Karak, and Zarqa; all four scored significantly higher than Mafraq.

Amman scored significantly higher than all other governorates except Karak which outscored Aqaba, Balqa, Tafileh, and Mafraq. Irbid did better than Aqaba and Mafraq (See Table 10 and 11 and Figure 8).
Amman > ((Irbid > (Aqaba, Mafraq)), (Balqa, Tafileh), (Zarqa > Mafraq).
Karak > (Aqaba, Balqa, Tafileh, Mafraq).

National Performance on Global Warming

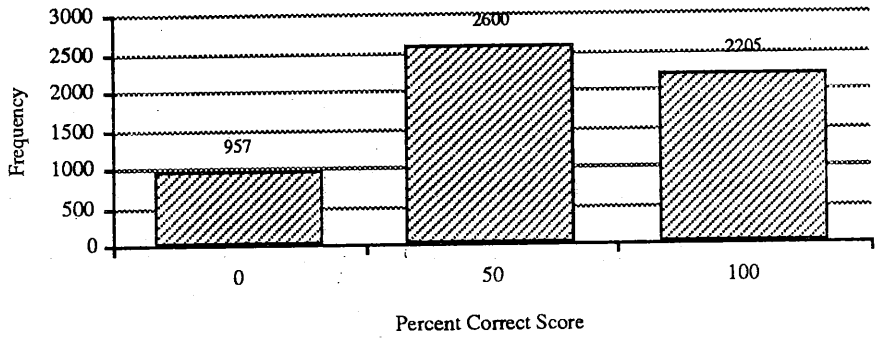
The national performance on Global Warming was second only to Atmospheric Pollution. The mean of the percent correct score was 60.8 while both median and mode coincided at 50. About 17% of the students got zero; 45% of them got one item right and thus obtained 50% correct, while 38% of them got both items right and obtained 100% correct score. Table (16) gives the frequency distribution of GLW subscale score, while Figure (12) shows the histogram of the distribution.

Table (16): Frequency Distribution of the Global Warming Subscale Score

Value	Frequency	Percent	Cum.%
0	957	16.6	16.6
50	2600	45.1	61.7
100	2205	38.3	100
Total	5762	100	

Mean=	60.83	SD=	35.42	Min=	20.00
Median=	50.00	SE=	0.47	Max=	100.0
Mode=	50.00	Skew=	.34		

Figure (12): Histogram of the Global Warming Subscale Score



Solid Waste

Intergovernorate Comparisons

Solid Waste (SOWA) scale also included only two items. The national performance on this scale was the lowest among all the scales. The mean performance ranged from 36.6% correct the lowest (Mafraq) to 42.8% correct the highest (Tafileh). On this scale Tafileh ranked 1st, Balqa 2nd, Irbid 3rd, Aqaba 4th, Karak 5th, Amman 6th, Zarqa 7th, and Mafraq 8th. No pairwise differences, however, were statistically significant.

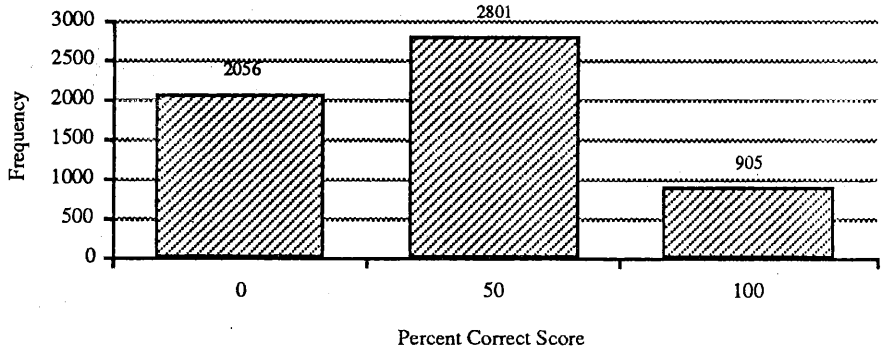
The frequency distribution of the SOWA percent correct score is given in Table (17) and its histogram is shown by figure (13). About 35.7%, that is, more than one-third of the students could not answer either of the two items and consequently got zero. Nearly half the students (48.6%) got only one item right and scored 50% correct. Only 15.7% of the students could answer both items right and got 100% correct. The national mean on this scale is 40.01. The median and the mode coincide at 50. In fact, from Table (4) we know that item 29 (Reason for careful handling of expired batteries) was answered correctly by 44% of the national sample and the other item 27 (Effective sanitary disposal method of solid waste) was correctly answered by 53% of the sample.

Table (17): Frequency Distribution of the Solid Waste Pollution Subscale Score

Value	Frequency	Percent	Cum.%
0	2056	35.7	35.7
50	2801	48.6	84.3
100	905	15.7	100
Total	5762	100	

Mean=	40.01	SD=	34.43	Min=	.28
Median=	50.00	SE=	0.45	Max=	100.0
Mode=	50.00	Skew=	.28		

Figure (13): Histogram of the Solid Waste Subscale Score



Biodiversity

Intergovernorate Comparisons

Biodiversity subscale (BIDI) consists of five items. Amman, as usual, secured the highest (69.6% correct) score, Zarqa came 2nd, Balqa 3rd, Irbid 4th, Karak 5th, Aqaba 6th, Mafraq 7th and Tafileh 8th. (See Table 8).

Quite a few differences were statistically significant too. As can be seen from Table 11 Amman has scored significantly better than every one of the other seven governorates.

While Zarqa has scored higher than Irbid, both Zarqa and Irbid have scored higher than Aqaba, Mafraq and Tafileh; there are no significant differences among Aqaba, Mafraq and Tafileh on one hand, and between Balqa and Kerak, on the other.

Amman>Zarqa>Irbid>(Aqaba, Mafraq, Tafileh), (Balqa, Kerak);
(Balqa, Kerak)>(Mafraq, Tafileh).

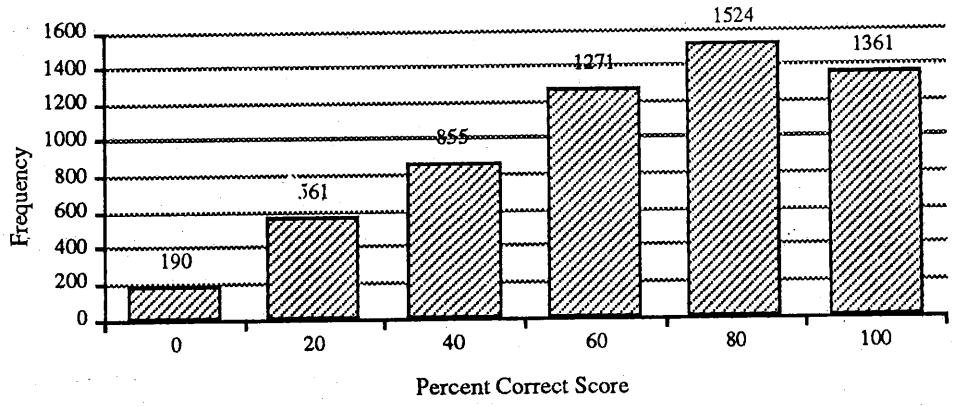
National Performance on BIDI Subscale

Relative by, national performance on Biodiversity sub subscale (65.9% correct) was higher than that on all other subscales including total test score; except on Atmospheric Pollution subscale which was at the top. Both the median and the mode coincided at 80.00. The distribution was fairly negatively skewed with about half the scores centered on 80% and 100% correct. The lowest score (0.0% correct) was obtained by only 3.3% of the sample, the highest score (100.00% correct), on the other hand, was achieved by 23.6% of the sample. The frequency distribution of the BIDI percent correct score is presented in Table (18), and the shape of the distribution is shown by Figure (14).

Table (18): Frequency Distribution of the Biodiversity Subscale Score

Value	Frequency	Percent	Cum.%
0	190	03.3	03.3
20	561	09.7	13.0
40	855	14.8	27.9
60	1271	22.1	49.9
80	1524	26.4	76.4
100	1361	23.6	100
Total	5762	100	

Mean=	65.90	SD=	27.98	Min=	0.00
Median=	80.00	SE=	0.37	Max=	100.0
Mode=	80.00	Skew=	-.52		



General Subscale

Intergovernorate Comparisons

The General (GEN) subscale also consisted of five items. Amman with 46.3% correct average was at the top and Mafraq with 41.9% at the bottom. As can be seen from Table (10) the performance on this subscale was generally low with a narrow range of barely four points between the lowest and the highest scoring governorates. When the mean score of each governorate was compared with every other governorates mean score, no pairwise difference was found statistically significant; except one, between Amman and Mafraq.

National Performance on General Subscale

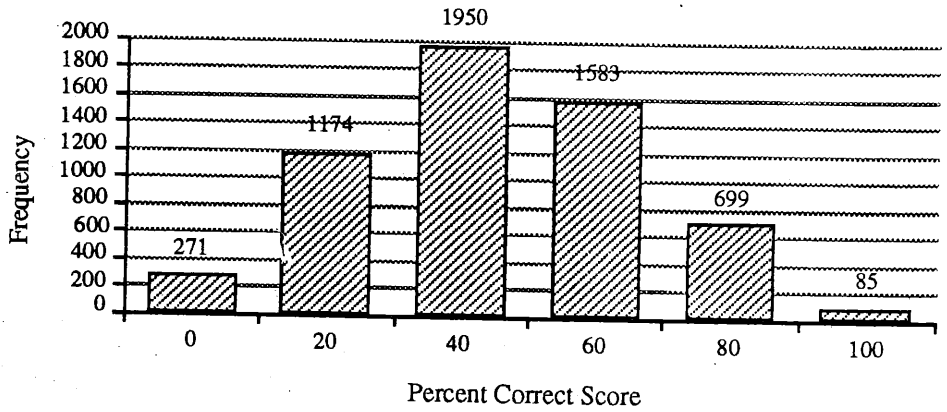
The national mean was 45.3%. Both median and mode coincided at 40. With higher proportion of scores clustering at the lower end of the scale, the distribution was positively skewed, indicating low performance. Individual scores ranged from zero to 100% correct but only 1.5% of the sample obtained 100% correct, while in contrast, 4.7% of the sample got zero% correct. The frequency distribution of the score is given by Table (19) and its histogram by Figure (15).

Table (19): Frequency Distribution of the General Subscale Score

Value	Frequency	Percent	Cum.%
0	271	04.7	04.7
20	1174	20.4	25.1
40	1950	33.8	58.9
60	1583	27.5	86.4
80	699	12.1	98.5
100	85	01.5	100
Total	5762	100	

Mean=	45.28	SD=	22.05	Min=	00.0
Median=	40.00	SE=	0.29	Max=	100.0
Mode=	40.00	Skow=	.0.06		

Figure (15): Histogram of the General Subscale Score



Over one quarter of the students, answering only one or no item correct, fell at or below 20% correct score. For example, the GEN item 4 (Place of UN Earth Summit in July 92) was answered correctly by only 11% (See Table 4) of the total sample, a score much below the level of guessing score on a 4-alternative multiple-choice item.

Variation Across Subscales

To sum up, the relative performance on different subscales varies from 40% correct (on Solid Waste) to 69.2% correct (on Atmospheric Pollution). It is obvious that among different content areas national awareness in the area of Atmospheric Pollution is the best, then comes Biodiversity followed by Global Warming. In the area of Water problems, however, the low national performance is hard to explain. Low awareness in the areas of General Knowledge and Solid Waste, although understandable, should not be condoned.

C. DIFFERENCES IN ENVIRONMENTAL AWARENESS AMONG SCHOOLS UNDER DIFFERENT EDUCATION AUTHORITIES

The national survey included schools administered by four different education authorities viz., Ministry of Education (MOE), United Nations Relief and Works Agency (UNRWA), Private Bodies (Private), and Ministry of Defense (MOD). Although all schools follow the same curricula yet they might differ in their treatment of environment related content. Students studying under different education authories come from different social and economic backgrounds, and may subscribe to different

norms and values. Despite the commonly shared education system, schools run by different education authories may differ in their general ethos and common school culture too.

Evidently MOE is the principal authority responsible for the whole country's basic education system (78% of the students study in MOE schools). But, the other three, generally speaking, cater for different clientele. UNRWA deals with the education of Palestinian refugee children. MOD schools provide education only for the children of military personnel and employees and have their own school culture and discipline. Private schools on the other hand, cater for the education of children with different socioeconomic background. One can see that while MOE and UNRWA schools provide education for the common masses, Private and MOD schools do so for some select groups of children. MOE schools are spread over the whole country and reach even the remotest of the settlements in Jordan; UNRWA schools are located only in the refugee camp areas; MOD schools are few and located in cantonment areas; the Private schools are mainly located in cities and urban areas.

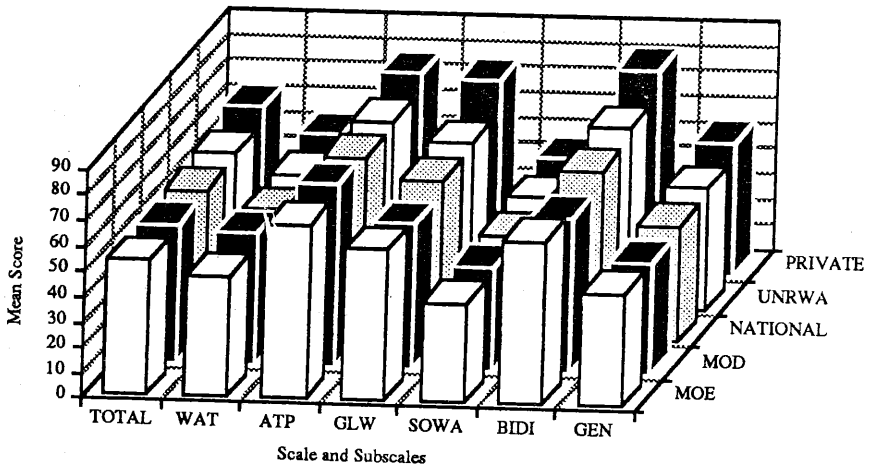
So far as academic achievement is concerned, we know from other research studies that Private schools excel because of their better school quality. Environmental awareness is a slightly different field. The issues are varied, some could be academic and theoretical, others are experiential and localized such that they create awareness among the people who face them. In this context we compared the achievement of students studying in schools run by the four education authorities on the Environment Awareness Scale. The means, the standard deviations, and the ranks of the four education authorities on each subscale score and on the total test score are given in Table (20).

Table (20) Environmental Awareness Across the Education Authorities (Mean, Standard Deviation, and Rank) for 8th and 10th Graders Combined

Scale	STA	MOE N=4263	UNRWA N=815	Private N=470	MOD N=214	National N=5762
TOTSCOR	M	53.3	56.7	62.7	54.2	54.6
	SD	15.8	16.2	14.9	14.7	16.0
	R	4	2	1	3	
WAT	M	47.3	49.0	52.3	51.2	48.1
	SD	18.7	19.6	18.5	17.5	18.8
	R	4	3	1	2	
ATP	M	68.0	70.7	76.6	71.1	69.2
	SD	24.0	22.5	20.1	24.0	23.6
	R	4	3	1	2	
GLW	M	59.1	63.1	74.9	56.8	60.8
	SD	35.3	35.9	31.4	36.8	35.4
	R	3	2	1	4	
SOWA	M	39.0	42.5	44.6	40.7	40.0
	SD	34.4	33.8	34.4	36.3	34.4
	R	4	2	1	3	
BIDI	M	63.8	69.8	80.5	60.4	65.9
	SD	28.2	26.7	24.3	24.1	28.0
	R	3	2	1	4	
GEN	M	44.1	47.6	52.6	43.8	45.3
	SD	21.6	22.3	24.3	21.9	22.0
	R	3	2	1	4	

The Private schools, got the top rank on the total test score as well as on every subscale score. UNRWA schools emerged second on the total test score and on four of the six subscale scores. On the two subscales (viz., Water and Atmospheric Pollution) the MOD took the second rank. We should recall that among the 8 governorates, Aqaba, in which most of the MOD schools in our sample are located, had ranked 1st on Water subscale and 3rd on Atmospheric Pollution subscale. The MOD students, however, took 3rd rank on the total test score and Solid Waste and the lowest rank (4th) on the other 3 subscales (viz., Global Warming, Biodiversity and General). Finally, the MOE students scored the lowest on the total test,Water, Atmospheric Pollution and Solid Waste while they got the 3rd rank on three subscales viz., Global Warming, Biodiversity, and General). A graphic presentation of the means of the four authorities on each subscale and on the total test is given by Figure (16).

Figure (16): Average Percent Correct (Mean) Performance of the Four Education Authorities on Each Environment Subscale and on the Total Test



The statistically significant differences between the pairs of education authorities on each scale or subscale score are presented in Table (21).

Private schools scored significantly higher than: (a) the MOE schools on all the subscales including the total test; (b) the UNRWA schools on the total test and all the subscales except Solid Waste; and (c) the MOD schools on all except two subscales viz., Water and Solid Waste. UNRWA schools did significantly better than MOE schools on all the subscales including the total test; but they did better than MOD schools on only the total score and the Biodiversity subscale. MOD despite ranking 2nd on WAT and ATP subscales emerged, in terms of statistical significance, better than only MOE on only Water subscale. No other differences were statistically significant. These differences are presented below in a summary notation.

Scale	Differences
TOT:	Private > UNRWA> (MOD, MOE).
WAT:	Private > UNRWA > MOE;MOD > MOE.
ATP:	Private > (UNRWA > MOE), MOD.
GLW:	Private > (UNRWA > MOE), MOD.
SOWA:	(Private, UNRWA) > MOE.
BIDI:	Private > UNRWA > (MOD, MOE).
GEN:	Private > (UNRWA > MOE), MOD.

Table (21): Differences Significant at (Alpha= .05) Level Between Pairs of Education Authorities

SCALE	STA	Mean	S.E	Private	UNRWA	MOD	MOE
PRIVATE	WAT	52.3	0.85		*		*
	ATP	76.6	0.93		*	*	*
	GLW	74.9	1.45		*	*	*
	SOW	44.6	1.58				*
	BIDI	80.5	1.12		*	*	*
	GEN	52.6	1.12		*	*	*
	TOT	62.7	0.69		*	*	*
UNRWA	WAT	49.0	0.69				*
	ATP	70.7	0.79				*
	GLW	63.1	1.26				*
	SOW	42.5	1.18				*
	BIDI	69.8	0.94			*	*
	GEN	47.6	0.78				*
	TOT	56.7	0.57			*	*
MOD	WAT	51.2	1.19				*
	ATP	71.1	1.64				
	GLW	56.8	2.51				
	SOW	40.7	2.48				
	BIDI	60.4	1.64				
	GEN	43.8	1.50				
	TOT	54.2	1.00				
MOE	WAT	47.3	0.29				
	ATP	68.0	0.37				
	GLW	59.1	0.54				
	SOW	39.0	0.53				
	BIDI	63.8	0.43				
	GEN	44.1	0.33				
	TOT	53.3	0.24				

The private school students' superior performance is apparent and understandable. Private school students are generally better off in every thing. They come from more advanced, high socioeconomic status, communities. Their homes and schools are generally better equipped to provide stimulating learning environments and, on the whole, they are better informed and more knowledgeable.

The UNRWA school students on the other hand, are refugee-camp dewellers. They come from poor working class families, live in camps with poor sanitation and impoverished environmental conditions. Then, what makes the UNRWA students more aware of environmental conditions than their counterparts, the MOE and MOD mainstream students? Is it because the impoverished environmental conditions in the refugee camps make the children and the UNRWA teachers more sensitive to the environmental problems? Again, the experiential hypothesis seems to be appealing. The females as well as the rural students outperformed others on the items that addressed the issues that are faced by those students in their daily life. The particular environmental hazards are understood better by those people at whose door-steps they lie.

Gender Differences Within Each Education Authority and at the National Level

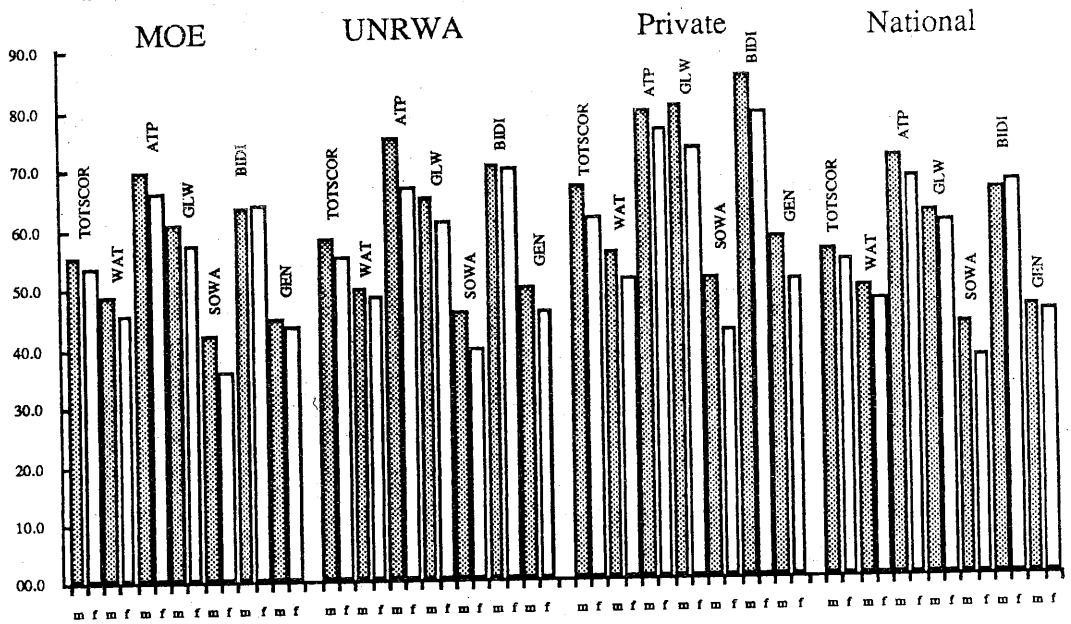
Differences in the performance of male and female students on the whole scale and on the six subscales were investigated within each education authority and for the country as a whole. Since MOD schools held only male students, the results of the gender comparisons within the MOE, UNRWA, and the Private education authorities along with those from the national sample are presented in Table (22). Figure (17) presents a graph of the mean scores of male and female students on each subscale and on the total test in each education authority.

Within each education authority, as well as in the national sample, on every scale/subscale male students tend to score higher than their female counterparts. In the whole sample, on five of the seven scores male students outscored the female students at the statistical level of significance ranging from ($p < .05$) to ($p < .000$).

Table (22): Gender Differences on Environmental Awareness at the Authority and National Levels for 8th and 10th Graders Combined

		MOE N=4263		UNRWA N=815		Private N=470		National N=5762	
Scale	STA	Male	Female	Male	Female	Male	Female	Male	Female
TOTSCOR	Sig		+***		+***		+***		+***
	M	54.4	52.2	58.3	54.9	66.7	61.1	55.48	53.65
	SD	16.0	15.5	16.8	15.3	16.0	14.1	16.30	15.6
WAT	Sig		+***				+*		+***
	M	48.7	45.8	49.8	48.3	55.6	51.1	49.35	46.82
	SD	19.4	17.7	21.2	17.7	20.2	17.8	19.60	17.8
ATP	Sig		+***		+***				+***
	M	69.7	66.2	75.0	66.4	78.9	75.9	70.95	67.35
	SD	23.8	24.0	20.6	23.5	20.4	19.9	23.40	23.7
GLW	Sig		+***				+*		+*
	M	60.6	57.4	65.0	61.0	80.1	73.0	61.80	59.82
	SD	35.4	35.1	37.6	34.0	30.3	31.7	35.90	34.9
SOWA	Sig		+***		+**		+*		+***
	M	41.9	35.9	45.6	39.2	51.2	42.1	42.78	37.1
	SD	35.2	33.3	35.6	31.6	34.1	34.2	35.30	33.2
BIDI	Sig						+**		
	M	63.6	64.1	70.0	69.6	85.0	78.8	65.19	66.65
	SD	27.7	28.7	26.6	26.8	20.4	25.4	27.50	28.5
GEN	Sig				+*		+*		
	M	44.6	43.6	49.5	45.7	57.5	50.7	45.77	44.75
	SD	21.5	21.6	23.0	21.4	26.3	23.3	22.20	21.9

Figure (17): Gender Differnces on Environmental Awareness at the Authority and the National Levels for the 8th and 10th Grades Combined



On the two subscales (Biodiversity and General), however, the differences were not statistically significant at the .05 a level. In the MOE sample also males did better than females on the same six scale/subscales while on the other (same two) subscales the differences did not attain statistical significance.

In the UNRWA sample, in addition to total scale score, on three other subscales gender differences are significant in favour of the males. Two of the three subscales (viz., ATP and SOWA) are the same as in case of the MOE and the national sample but the third subscale is General (GEN) instead of Global Warming (GLW) for the MOE.

In the case of Private schools, six of the seven differences were statistically significant, all in favour of the male students. Only on the Atmospheric Pollution subscale the male/female difference did not reach statistical significance at the .05 α level. In both MOE and UNRWA schools, nevertheless, the gender difference on the ATP subscale is highly significant ($p < .000$).

Location Differences Within Each Education Authority and at the National Level

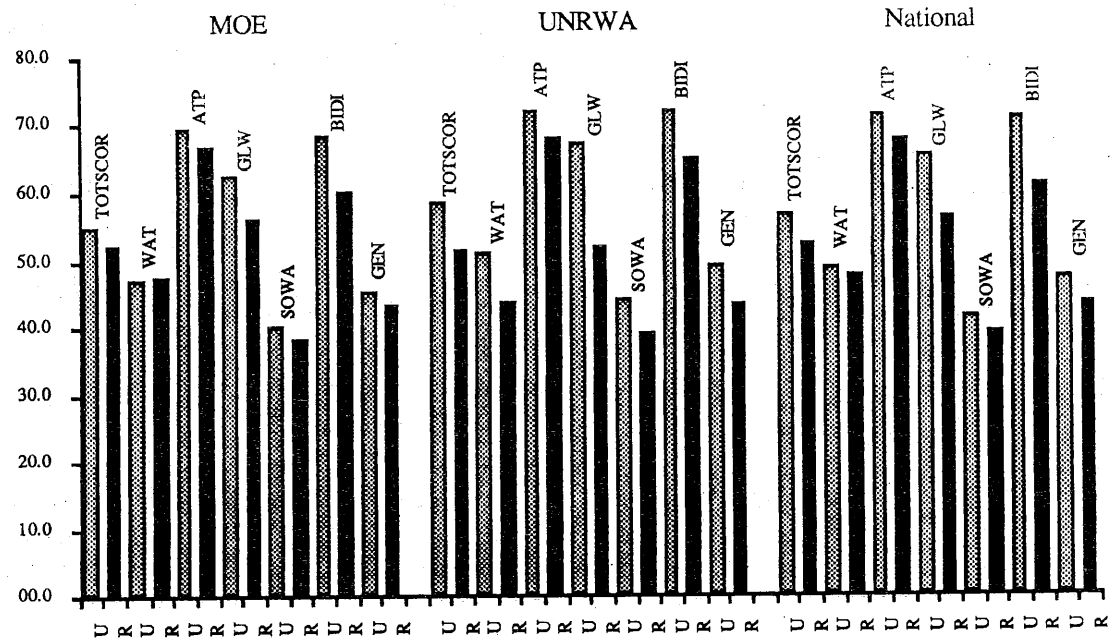
Location differences were studied on the total test score and the six subscale scores within each of the MOE and the UNRWA schools as well as in the national sample. The results are presented in Table (23) and their graphic display is given in Figure (18). Most private schools are located in the urban areas and most of the MOD schools are in the rural areas.

Table (23): Urban/Rural Differences on Environmental Awareness at Authority and National Levels for 8th and 10th Grades Combined

		MOE N=4263		N=815 UNRWA		National N=5762	
Scale	Sta.	Urban N=1975	Rural N=2288	Urban N=600	Rural N=215	Urban N=3063	Rural N=2699
TOTSCOR	Sig		+***		+***		+***
	M	54.90	52.00	58.50	51.50	56.60	52.30
	SD	16.20	15.40	16.20	15.10	16.20	15.40
WAT	Sig				+***	+***	+*
	M	47.20	47.40	51.00	43.60	48.60	47.50
	SD	18.80	18.50	19.30	19.30	18.90	18.70
ATP	Sig		+***		+*		+***
	M	69.40	66.80	71.80	67.90	70.80	67.40
	SD	23.60	24.20	22.70	21.90	23.10	24.00
GLW	Sig		+***		+***		+***
	M	62.50	56.10	67.10	51.90	65.10	56.00
	SD	35.00	35.30	34.80	36.40	34.70	35.60
SOWA	Sig						+**
	M	39.90	38.20	43.80	38.80	41.20	38.70
	SD	34.60	34.20	33.80	33.70	34.70	34.10
BIDI	Sig		+***		+***		+***
	M	68.20	60.10	71.70	64.60	70.40	60.80
	SD	28.20	27.60	26.60	26.40	27.70	27.50
GEN	Sig		+***		+***		+***
	M	45.30	43.00	49.20	43.10	47.10	43.20
	SD	22.30	20.80	22.50	21.20	22.80	21.00

In the national sample differences on all the tests (total test, and the six subscales) are statistically significant consistently in favour of the urban schools. Within both the MOE and the UNRWA rural/urban schools, on the total test score and on all the subscale scores except one (Water) the urban schools have scored significantly better than the rural schools. This lends further credibility to the notion that, on the whole, urban students are more exposed to a variety of mass media, they have more information sources accessible to them and thus, they are better informed.

Figure (18): Urban/Rural Differences on Environmental Awareness at Authority and National levels for 8th and 10th Grades Combined



D. LINEAR RELATIONS BETWEEN ENVIRONMENTAL AWARENESS AND ACHIEVEMENT IN ARABIC, MATH AND SCIENCE

As referred to earlier this study was conducted conjointly with a comprehensive survey, the National Assessment of Instructional Quality, designed and carried out by the NCERD in collaboration with the MOE. The plan of the instructional quality study encompassed, along with other measures, assessment of the 4th, 5th, and 8th grade students' achievement in Arabic, Math, and Science. We recall that although the Environmental Awareness Scale was administered to both 8th and 10th grade students in our sampled schools, the Arabic, Math and Science achievement tests, according to the plan of the instructional quality study, were administered only to the Grade 8 students. While all the students in a class took the Arabic test, only half the class took the Science test and the other half took the Math test. We computed linear correlation of each environment scale variable with every achievement test. The value of correlation coefficient between each pair of variables and the probability of its occurrence by chance along with the sample size on which a particular coefficient was computed are given in Table (24).

From Table (24) we make the following observations about the relationship between environmental awareness and student achievement in three other subjects.

1. Eighth grade students' performance on every one of the environment subscale was positively associated with their achievement in all the three major school subjects (Arabic, Math and Science) at the statistical level of significance ($p < .000$).

2. Although each environment subscale and scale score is significantly correlated with every one of the three achievement scores, the rank order of these correlation coefficients, according to the absolute magnitude of correlation is invariably the same. Correlation of each scale/subscale is highest with the

Science test and lowest with the Math test, with Arabic test being in the middle.

3. The magnitude of various environment scale/subscale correlation coefficients with the Science test score ranges from .19 to .55. The lowest correlation is between Solid Waste and Science scores, and the highest is between the total environment and Science scores.

4. The range of correlation between the Arabic test and environment scale/subscales is from .13 to .47; the lowest being with Solid Waste (SOWA) and the highest with the total environment test score.

5. With the Math test, the relationship of various environment scale/subscales ranges from .12 to .38; again the former is with SOWA and the latter with total test score.

6. On the whole, the association of environmental awareness with academic achievement is rather modest.

7. There seems a little more in common between Science test and Environment test performances than between Environment and Math test performances of the 8th grade students in Jordan. All correlations between Environment Scale/Subscales and Science test are consistently higher than those between Environment and Arabic or between Environment and Math.

It looks that some sort of general ability is shared more across Environment, Science, and Arabic than between Environment and Mathematics. The lowest correlations between Environment and Math scores could be, prima facie, attributed to two factors, both inherent in the Math test. One is inherent in the nature of mathematical ability being rather too special, and the other is the difficulty level of the Math test, the high difficulty level of the Math test severely restricted the range of Math test score which in turn adversely affected the linear correlation coefficient between Math and Environment test scores.

Table (24): Linear Correlation Coefficients Between Environment and Academic Achievement and Probabilities of Statistical Significance

Content	Arabic	Math	Science
Water	.2577	.2140	.2730
	(3359)	(1681)	(1674)
	P=.000	P=.000	P=.000
Atmospheric Polluition	.2821	.2136	.3563
	(3359)	(1681)	(1674)
	P=.000	P=.000	P=.000
Global Warming	.2808	.2482	.3521
	(3359)	(1681)	(1674)
	P=.00	P=.000	P=.000
Biodiversity	.4477	.3518	.5081
	(3359)	(1681)	(1674)
	P=.000	P=.000	P=.000
General Information	.2660	.2069	.2972
	(3359)	(1681)	(1674)
	P=.000	P=.000	P=.000
Solid Waste	.1341	.1164	.1903
	(3359)	(1681)	(1674)
	P=.000	P=.000	P=.000
Environment Scale	.4716	.3818	.5462
	(3359)	(1681)	(1674)
	P=.000	P=.000	P=.000

Conclusions and Recommendations

The test measured student knowledge and awareness on a wide variety of topics ranging from very general to very specific and from academic to experience-based. The following conclusions can be reached on the basis of the results of this study.

1. Environmental knowledge and awareness of the 8th and 10 grade students varies widely across the content areas, and issues.

2. On the whole, the knowledge and awareness of the basic school students about environmental issues is rather modest (54.5% correct on the average).

3. Student performance varies widely across problems according to the nature of the problems. On specific questions their scores range from 11% correct to 85% correct.

4. Student performance varies significantly with respect to gender, male students, in general, scored higher than female students.

5. Student performance also varies according to school location, urban students scored higher than rural students.

6. Student gender and area (rural/urban) interact with the nature of the content. While urban students and male students, in general, did relatively better than their respective counterparts on theoretical questions, the performance of students on experience-based localized items varied significantly according to the experiences of the students of different sex in specific social and physical environments. For example, on 'pollutant of underground water' and 'hazard caused by plastic waste', rural males did better than others while on 'main hazard of misuse of chemical detergents', rural females did better than rural males.

7. Student knowledge and awareness of the environmental problems varies across Governorates. Amman's performance is at the top followed by Irbid and Karak, Zarqa and Aqaba come next, then Balqa followed by Tafileh and Mafraq.

8. Among the education authorities, Private school students' performance comes at the top, UNRWA comes 2nd, MOD third and MOE the last.

9. In terms of the association between environmental knowledge and awareness and achievement in Science, Arabic and Math there seems to be more in common between environment and science and environment and Arabic than between environment and Math.

10. Since the differences in performance over academic questions can be explained by general ability and socioeconomic status of the students, and availability of educational and informational resources, and differential performance over experience-based items can be accounted for by real life encounters of students with specific environmental problems as they occur in particular localities, it leads to the conclusion that, so far, the impact of environmental and ecological component in basic science curriculum is hardly noticeable. Below the baseline performance on general knowledge and global issues further lends support to hytothesis of lack of curricular impact on environmental knowledge and awareness of the students.

11. The lower performance of urban students on four crucial items, despite their overall superiority, lends support to the global hypothesis that city people living in technologically supported smug environments are little aware of irreparable damage done to natural ecologies and life-supporting elements, like underground water resources in the rural areas, to sustain the comforts of city life.

12. Both lack of awareness, in general, and differential knowledge of different groups of students over different content areas call for closer attention of the agencies concerned with spreading environmental and ecological education in Jordan.

13. In particular, the findings of this study implicate that divergent knowledge-bases and needs of different communities in different regions require diversified curricular content and emphasis appropriately designed for different target populations

ANNEX I

PSYCHOMETRIC PROPERTIES OF THE ENVIRONMENT AWARENESS SCALE

The environment awareness scale contains a variety of diverse issues and material contents. Table (IA) presents the substance tested by each item. Glancing over the item contents in Table (IA) one can see that although all items belong to the universe of environmental awareness yet they are quite heterogeneous because items were designed to tap the knowledge and awareness of the students on a wide variety of specific problems from diverse content domains.

This means that most items are heavily saturated with specific content and have little in common with one another, apart from the fact that all of them have been derived from the same universe. As a concrete example, the knowledge of a student about the major pollutant of King Talal Dam might have little to do with his/her knowing, what is the cause for the rising sea level. Since students' performance on one item is independent of their performance on the other, the correlation between two such items may be negligible. Occurrence of such a phenomenon would eventually lead to a low index of internal consistency reliabiliy or homogeneity of the test. On the other hand, common factor analysis of such a set of items would produce one principal factor and a lot of specific factors, the number of items in the test is the limit.

Realibility analyses were conducted for each subscale, for the total test, and for the six-subscales where each subscale score was considered as a variable like an item of a test. The α coefficients for each test or subtest, computed on each of the three samples (8th grade, 10th grade, and total), are given in Table (IB).

Table (IA): Item Scale, Item Content, Difficulty Index and Discrimination Index in the Three Samples

No.	Scale	Content	8th Grade N=3453		10 Grade N=2309		Total N=5762	
			M	DISC.	M	DISC.	M	DISC
1	WAT	The main source of water in Jordan	0.54	0.19	0.71	0.22	0.61	0.25
2	WAT	Main pollutant of water in King Tala Reservior	0.25	0.12	0.26	0.27	0.25	0.25
3	WAT	Effect of population growth on water supply	0.19	0.08	0.41	0.18	0.28	0.12
4	GEN	Place of environment conference in July 1992	0.09	0.03	0.13	0.11	0.11	0.09
5	WAT	Consequence of over use of ground water in Jordan	0.17	0.16	0.23	0.30	0.19	0.23
6	WAT	Environmental consideration in choosing a dam site	0.71	0.21	0.78	0.11	0.74	0.19
7	WAT	Pollutant of underground water	0.65	0.14	0.68	0.10	0.66	0.13
8	WAT	Way to control water consumption at home	0.65	0.16	0.76	0.15	0.69	0.19
9	GEN	Effect of excessive use of chemical fertilizers	0.48	0.22	0.52	0.17	0.50	0.20
10	ATP	Main reason for air pollution	0.32	0.11	0.43	0.15	0.37	0.16
11	ATP	Effective method of reducing car pollution	0.77	0.31	0.85	0.17	0.80	0.28
12	ATP	Major cause of pollution in the Gulf of Aqaba	0.81	0.22	0.91	0.19	0.85	0.24
13	GLW	Effect of gases produced by fuel in the factories	0.32	0.30	0.58	0.42	0.42	0.40
14	GLW	Importance of ozone layer	0.74	0.34	0.86	0.00	0.00	0.00
15	WAT	Cause of drought in Jordan	0.41	0.14	0.45	0.14	0.43	0.14
16	BIDI	Reason for plant protection	0.59	0.36	0.75	0.32	0.65	0.37
17	GEN	Reason for energy conservation	0.36	0.18	0.54	0.18	0.43	0.22
18!	GEN	Main oil substitute in Jordan	0.35	0.02	0.35	0.03	0.35	0.00
19!	SOWA	Harm done by plastic wastes	0.39	0.01	0.41	0.03	0.40	0.01
20!	ATP	Major cause of led pollution in the air	0.36	0.29	0.29	0.33	0.33	0.04
21	GEN	Effect of chemical and detergent over use	0.41	0.23	0.57	0.28	0.47	0.29
22	BIDI	Cause of decreasing number of elephants	0.62	0.34	0.78	0.23	0.69	0.34
23	ATP	Cause of acid rain	0.68	0.31	0.85	0.25	0.75	0.34
24	BIDI	Effect of oil leak in the seas	0.80	0.34	0.91	0.28	0.84	0.35
25	BIDI	Reason for sanctuaries	0.62	0.40	0.84	0.30	0.70	0.41
26	GEN	Factory polluted harbour	0.72	0.11	0.80	0.10	0.75	0.13
27	SOWA	Effective method for disposal of solid house waste	0.48	0.24	0.62	0.19	0.53	0.25
28	BIDI	Protection of wild animals for ecological balance	0.34	0.37	0.51	0.38	0.41	0.41
29	SOWA	Reason for careful handling of expired batteries	0.24	0.13	0.31	0.22	0.27	0.18
30!	GLW	Cause of sea level increase	0.14	0.05	0.20	0.19	0.16	0.08
α	Coefficient (30 Items)		0.64		0.65		0.69	
α	Coemcient (26 items)		0.69		0.67		0.72	

Table (IB): α Reliability Coefficients of Environment Awareness Scale and Subscales in the Three Samples

Scale	No. of Items	Grade 8 N=3453	Grade 10 N=2309	Grades 8&10 N=5762
WAT	8	0.23	0.32	0.31
ATP	4	0.26	0.18	0.28
GLW	2	0.32	0.35	0.37
BIDI	5	0.58	0.51	0.60
GEN	5	0.16	0.15	0.20
SOWA	2	0.10	0.12	0.13
Whole Test	26	0.69	0.67	0.72
All Sub Scales	6	0.64	0.64	0.69

The α coefficient which is an index of consistency of performance over various items in a test varies from .67 to .72 for the 26-item test over the three samples.

When computed on 6 subscales as test variables, the α coefficient varies from .64 to .69 across the three samples. Referring to our preceding description of the content structure of the test these results seem reasonable. For the whole 26-item or 6-subscale-test the homogeneity indices in all the three samples are moderate. This is because different items and different scales tap different aspects of the environmental issues.

Given the homogeneity of test items, one property of the coefficient α is that it increases with the increasing test length. That is, the reliability coefficient increases as new items are added to the test provided they meet the homogeneity assumption, i.e, the interitem correlations among all items are positive. It follows that other things being similar a test or subscale containing more items should produce higher reliability coefficient than the one containing less items. This can be seen from the fact the α coefficient computed on all the 26 items is the highest of all in all the three samples.

This, however, does not hold over different subscales in our test. For instance, we examine the reliability coefficients of the six subscales in the 8th grade sample. Reliability coefficient of the 8-item Water (WAT) subscale is only .23 while that of the 5-item Biodiversity (BIDI) subscale is .58. Again compare the reliability coefficients of the two equilength subscales viz., Biodiversity (BIDI) and General (GEN), each 5-items-long, the value of the former (BIDI) is .58 while that of the latter (GEN) is only .16. This happens because the biodiversity is a more unified concept and all the five items have more in common with one another. In contrast General (GEN) scale consists of miscellaneous items hardly related to one another.

Factorial Validity of the Environment Awareness Scale

The 26 - items of the environment awareness scale were subjected to Principal Axis Common Factor Analysis. Three separate analyses were conducted, one for each of the three samples (8th, 10th, and both grades combined). The purpose of these analyses was not so much to discover a parsimonious set of latent factors underlying the 26 test items as to confirm the existence of a large number of rather unique factors and a weak general factor loosely stringing the items together.

The initial statistics, Kaiser-Meyer-Olkin indices, and the screeplots of the eigen-values all demonstrate that the individual test items are tapping various rather unrelated aspects of the general environmental domain. Table (IC1) in Annex I presents the initial communality of each item. The eigenvalue of each factor and the percentage of total variance explained by each eigenvalue are given in Table (IC2). The initial communality of an item is the squared multiple correlation Ri^2 of item i with the rest of the (n-1) items where n is the number of items in the test. In the three samples the largest Ri^2 value is .22 and the smallest is .02.

The following example will clarify the meaning of initial communalities Ri^2 s. Suppose we wish to predict the response variance of an item in terms of the remaining (n-1) items in a test. The value Ri^2 is the percentage of variance in item i that can be explained by the remaining (n-1) items in the test. In our case the predictibility of various items ranges from 2% to 22% across the three samples. This is another way to show how different each item is from all the rest.

This characteristic of the test items is further demonstrated by the relative magnitude of the eigenvalues and the percentage amount of total test variance explained by each latent factor. When item variance has been standardized the total test variance is the same as the number of items in the analysis. In our case the total test variance is 26. The first latent factor accounts for 3.28 that is 12.6% of the total test variance (26). This is our weak general factor. The remaining 87.4% of the test variance is distributed among 25 other latent factors, each accounting for the amount of variance ranging from 4.9% (the maximum) to 2.5% (the minimum) portions of the total test variance. This means that after the extraction of the general factor there remains no other predominant factor. In other words each factor is defined by one or two items. This phenomenon is clearly captured by the screeplots shown in Figure (IC).

When the six subscales were factor analyzed only the first factor had eigenvalue greater than 1. The first factor with its 2.46 eigenvalue explained 41% of the total variance. The remaining 59% of the total variance was distributed among the other five factors each defined by a single subscale.

Again the similar factor structure emerged from each of the three analyses performed on the six subscales. One general factor followed by a trail of specific factors each defined by a single variable. The results are given in Tables (ID and ID2) and the scree plots in Figure ID.