

Chapter 7

PUBLIC UNDERSTANDING OF S&T

7.0 INTRODUCTION

In going about our daily life either privately or publicly, we cannot deny that our life is affected or influenced by S&T. Therefore our ability to understand the basic set of S&T terms and concepts may enable us to comprehend various scientific aspects underlying everyday events, as well as serious S&T issues of national importance. A person with an understanding of S&T would also be able to participate productively in discussions and debates on S&T matters.

7.1 UNDERSTANDING OF SCIENTIFIC TERMS AND CONCEPTS

In order to measure public understanding of selected scientific terms and concepts, the present study has once again use the same set of 16 true-false questions which were asked in the 1996 and 1998 studies. The public understanding of basic scientific concepts such as the composition of matter, the nature of the universe, the basic processes that have shaped the planet, and the basic biology that supports life on earth can thus be gauged based on responses to the 16 questions asked.

Therefore by analyzing the percentage of correct answers to the said questions by the various categories of respondents, understanding of scientific terms and concepts can be measured.

7.2 PUBLIC UNDERSTANDING OF S&T

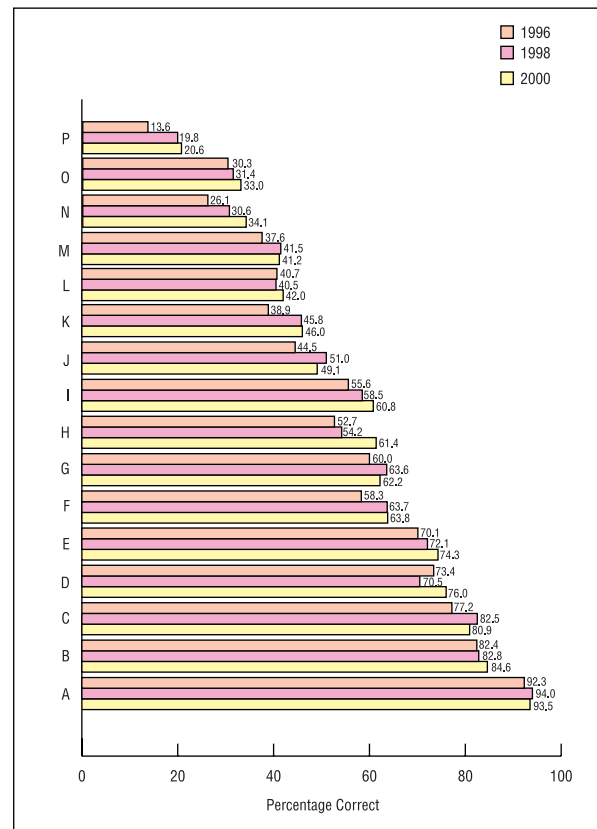
Malaysians' understanding of S&T has improved over the years. This is reflected by the increasing mean percentages of correct answers: 53.4% (1996), 56.4% (1998) and 57.7% (2000). However, results from the three studies showed a wide range of understanding of these concepts, from 13.6% in questions on antibiotics (1996) to 94.0% in those on lung cancer (1998). **Figure 7.1** demonstrates that the vast majority of Malaysians (more than 70%) continue to understand the following concepts:

- cigarette smoking causes lung cancer
- oxygen comes from plants
- the earth goes round the sun
- light travels faster than sound
- the center of the earth is very hot

Meanwhile an equal number of respondents (ie. almost half) tend to agree that the earliest humans did not live at the same time as the dinosaurs; and that it is the father's gene which determines the gender of a child. Forty percent of the respondents understood that electrons were smaller than atoms; and that the universe did not begin with an explosion. Furthermore about 30% disagreed with the statements that all radioactivity was man-made, or that lasers work by focusing sound waves. However, only 20% knew that antibiotics could not kill viruses.

When the level of understanding of S&T among the Malaysian public is compared over the years, it was found that there is a slight increase ie. by 3.0% over the period from 1996 to 1998, and by 1.3% over the period from 1998 to 2000 (**Table A7.1**).

Figure 7.1: Public Understanding of Scientific Terms and Concepts



Key:

- A. *Cigarette smoking causes lung cancer (True)*
- B. *The oxygen we breathe comes from plants (True)*
- C. *The earth goes round the sun (True)*
- D. *Which travels faster: light or sound? (Light)*
- E. *The center of the earth is very hot (True)*
- F. *Radioactive milk can be made safe by boiling it (False)*
- G. *The continents on which we live have been moving their locations for millions of years and will continue to move in the future (True)*
- H. *How long does it take for the earth to go around the sun: one day, one month or one year? (One year)*
- I. *Human beings, as we know them today, developed from earlier species of animals (False)*
- J. *The earliest humans lived at the same time as the dinosaurs (False)*
- K. *It is the father's gene which decides whether the baby is a boy or a girl (True)*
- L. *Electrons are smaller than atoms (True)*
- M. *The universe began with a huge explosion (False)*
- N. *Lasers work by focusing sound waves (False)*
- O. *All radioactivity is man-made (False)*
- P. *Antibiotics kill viruses as well as bacteria (False)*

Note: See Appendix Table A7.1

7.2.1 Understanding of S&T by Age Group

In the present study, the levels of understanding of S&T among the public and among the various age groups were once again determined in order to gauge whether there are marked differences in the levels over the years.

The result shows a slight but continuous improvement in S&T among adults youths and children (Figure 7.2). The children were able to maintain a continuous increase of more than 2% over each two-year period, while the other two groups experienced a decrease in improvement of S&T understanding.

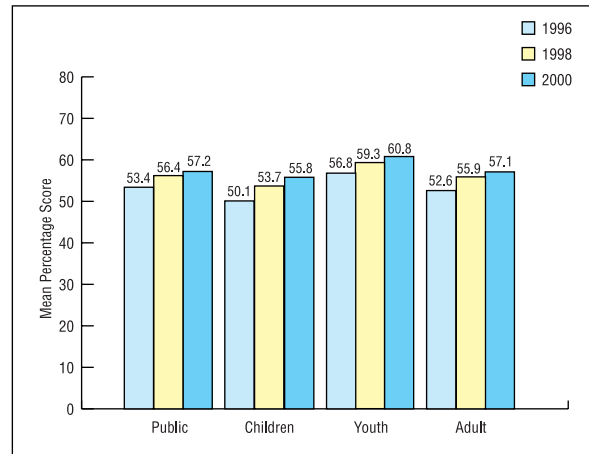
Malaysians of all age groups scored slightly higher in most of the questions from one study period to another. However while youths and adults recorded an overall better understanding of S&T, children outscored adults on the questions: the oxygen we breathe comes from plants, lasers work by focusing sound waves, the universe did not begin with an explosion, light travels faster than sound and the earth takes one year to go round the sun. All the groups have excellent understanding (more than 80% answered correctly) of plants give out oxygen and cigarette smoking can cause lung cancer.

The current study records that youths continue to demonstrate a greater understanding of S&T compared to adults, who in turn score higher than the children (Figure 7.2 and Table A7.2). The youths are found to be more knowledgeable in S&T and this may be attributed to the fact that the youths have a higher level of education (tertiary and secondary) than the adults in all the three studies.

7.2.2 Understanding of S&T by Educational Level

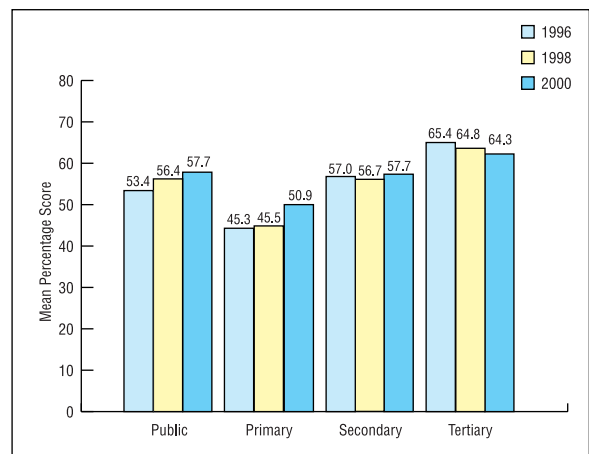
Other than age, the respondents' understanding of S&T is also influenced by the level of formal education that they have received (Figure 7.3). The three studies show that respondents with tertiary education scored higher than the average Malaysian. The scores of those with tertiary education were similar over the last four years, while respondents with secondary and primary education exhibited an increase of 1.0% and 5.4% respectively during the last two-year period (1998-2000).

Figure 7.2: Understanding of S&T by Age Group



Note: Data represent mean percentage score of correct answers on sixteen questions. (See Table A7.2 for exact scores on each question).

Figure 7.3: Understanding of S&T by Educational Level



Note: Data represent mean percentage score of correct answers on sixteen questions. (See Table A7.3 for exact scores on each question).

7.2.3 Understanding of S&T by School Stream

The number of science and mathematics courses/subjects taken by an individual may have an influence over his or her level of understanding of S&T (Figure 7.4 and Table A7.4). This study revealed that respondents with science stream background displayed a higher level of understanding of the basic scientific terms and concepts than their non-science stream counterparts.

However, when the mean scores of various groups of respondents were compared for the last two-year period (1998-2000), it was observed that there was a decrease in the level of S&T understanding among respondents from the science stream, while the other three groups were able to maintain similar scores.

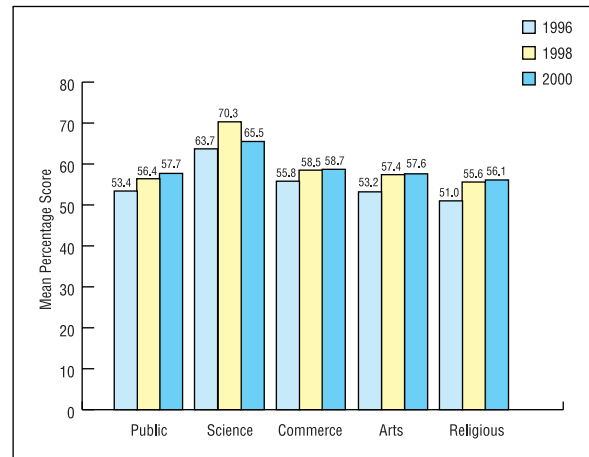
7.2.4 Understanding of S&T by Locality

As in the previous studies, the urban and rural respondents are compared to determine if there are any significant differences in the respondents' understanding of S&T. The three studies indicate that the level of understanding of S&T has increased in both urban and rural respondents (Figure 7.5). However, the level of understanding continues to be higher among the urban respondents in all the three studies. On top of that, both the urban and rural population showed a much smaller increase in the understanding of S&T (1.3% and 1.2% respectively) between the last two studies. At the same time, it was also found that the disparity between the findings during the last two-year period for urban-rural population remained the same.

7.2.5 Understanding of S&T by Gender

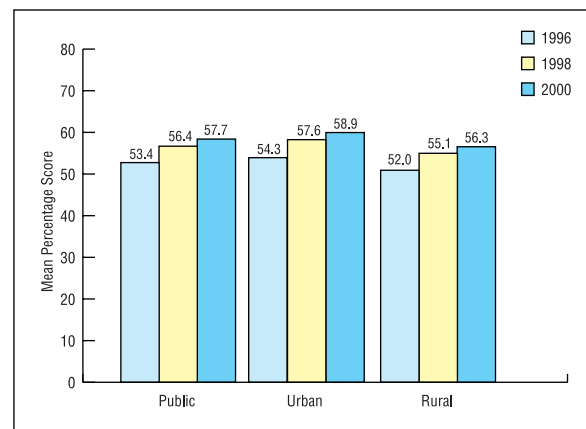
An analysis of the understanding of S&T by gender reveals that the male respondents continue to demonstrate a slightly better understanding of S&T as shown in Figure 7.6. The data show that male respondents recorded a slightly higher mean percentage score of correct answers in each of the studies. However, over the four-year period (1996-2000), the male and female levels of understanding about S&T have increased by 4.0% and 4.8% respectively.

Figure 7.4: Understanding of S&T by School Stream



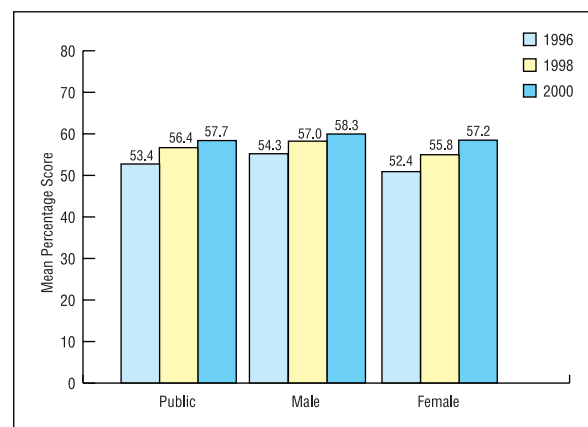
Note: Data represent mean percentage score of correct answers on sixteen questions. (See Table A7.4 for exact scores on each question).

Figure 7.5: Understanding of S&T by Locality



Note: Data represent mean percentage score of correct answers on 16 questions. (See Table A7.5 for exact scores on each question).

Figure 7.6: Understanding of S&T by Gender



Note: Data represent mean percentage score of correct answers on 16 questions. (See Table A7.6 for exact scores on each question).

Like the two previous studies, this study also revealed an interesting point. Except for questions relating to human biology and medical science (sex determination and the effect of cigarette smoking on lungs), it is observed that men had scored slightly higher than women in most of the other questions asked. For these questions relating to human biology and medical science, women outscored men by 6.0% and 4.0% respectively. These figures have increased by more than 40% during the last two-year period. Thus it can be inferred from this result that women are more health conscious than men. The fact that women more than the men tend to pay more attention to their families' well being may also be attributed to their reading of women's magazines, many of which contain articles on health-related issues such as cancer.

7.3 AWARENESS AND UNDERSTANDING OF ENVIRONMENTAL TERMS

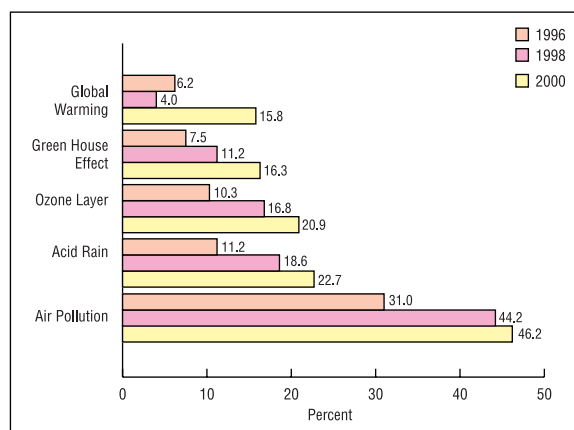
In order to measure the subjective and objective levels of understanding of selected environmental terms and concepts, the present study continues to address the same issues and put forth the set of true-false questions as in the previous two studies. However the present study excluded the issues of and questions on solar eclipse, toxic waste and water shortage which were addressed in the previous two studies (due to situational phenomena occurring at that time).

In measuring the subjective understanding of selected environmental terms and concepts, the percentage of respondents who claimed that they understood the respective environmental issues is used. As for objective understanding, the measurement used is the percentage of those who gave correct answers to a set of measurable questions. For comparison purposes, these mean percentage scores of correct answers were analyzed according to the various categories of the sampling.

7.4 PUBLIC SUBJECTIVE UNDERSTANDING OF ENVIRONMENTAL TERMS AND CONCEPTS

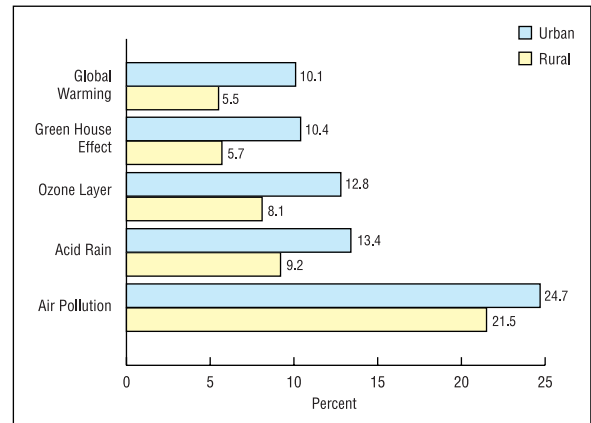
Results from the present study show that public understanding of the more noticeable environmental phenomena, such as air pollution, which is frequently experienced at home, is better than their understanding of those, which are more complex. The percentages of those who claim to understand the more complex issues are much less in all the studies. Such issues include acid rain, the hole in the ozone layer and global warming. This public subjective understanding of the issues is shown in **Figure 7.7a**.

Figure 7.7a: Subjective Understanding of Environmental Terms and Concepts



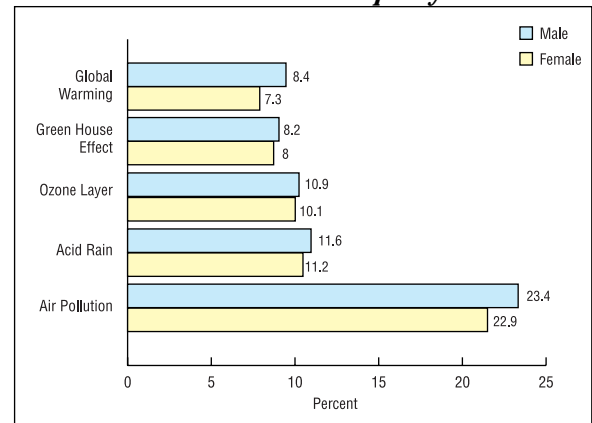
7.4.1 Subjective Understanding by Locality
 As in the earlier section, the urban and rural respondents are compared to determine if there are any significant differences in the respondents' subjective understanding of environmental terms and concepts. The current study indicates that urban respondents recorded higher understanding in all environment-related issues when compared to their rural counterparts (**Figure 7.7b**). The differences in their understanding of various issues ranged from a low of 3.2% in the issue of air pollution to a high of 4.2% in green house and ozone layer effect.

Figure 7.7b: Comparison Between Subjective Understanding of Environmental Terms and Concepts by Locality



7.4.2 Subjective Understanding by Gender
 The current study observes different level of subjective understanding of environmental terms and concepts among male and female respondents (**Figure 7.7c**). The former recorded higher understanding in all environment-related issues than the latter. When each term and concept was examined, it was noted that the differences in their levels of understanding were marginal with global warming showing the highest difference of 1.1% while green house effect showing the least difference of 0.2%.

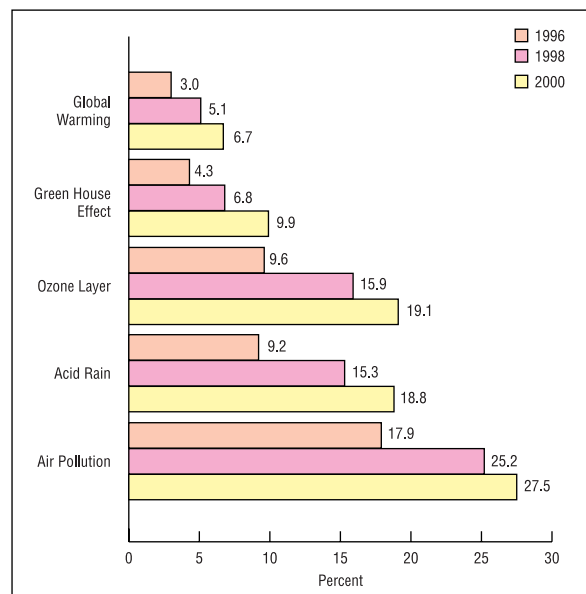
Figure 7.7c: Comparison Between Subjective Understanding of Environmental Terms and Concepts by Gender



7.5 PUBLIC OBJECTIVE UNDERSTANDING OF ENVIRONMENTAL TERMS AND CONCEPTS

The public objective understanding of the issues are similar to the results of the subject understanding. Air pollution is the most understood problem with a high percentage of the respondents providing the correct answer for questions on this problem (**Figure 7.7d**). The mean score for this issue has continued to improve from 17.9% in 1996, to 25.2% in 1998, to 27.5 % in the latest study. The widespread publicity given by the media to the issue of air pollution may provide one explanation for the respondents' relatively higher understanding of the said issue.

Figure 7.7d: Objective Understanding of Environmental Terms and Concepts

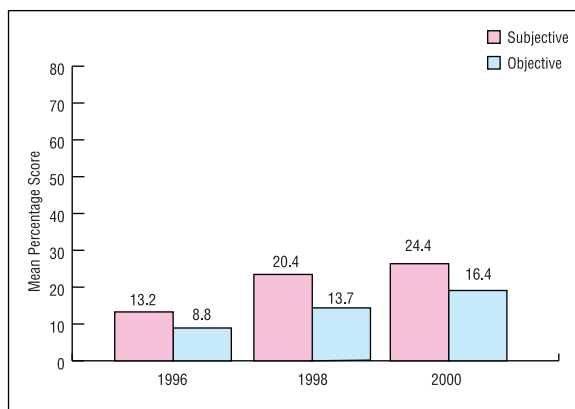


Results from the present and previous two studies have also shown that public understanding of the more complex issues such as green house effect and global warming is much less, but continues to improve.

7.5.1 Comparison Between Subjective and Objective Understanding of Environmental Terms and Concepts

As can be seen from **Figure 7.8**, there is a continuous increase in the level of subjective and objective understanding of environment-related issues among Malaysians during the 1996-2000 period. The mean percentage scores for subjective understanding are 13.2%, 20.4% and 24.4% for 1996, 1998 and 2000 respectively, while the objective understanding mean scores are 8.8%, 13.7% and 16.4% for 1996, 1998 and 2000 respectively. Comparison between the subjective and objective understanding shows that the latter recorded a much lower score (two-third) than the former in all the three studies.

Figure 7.8: Comparison Between Subjective and Objective Understanding of Environmental Terms and Concepts



Note: Data represent percentage of respondents claiming they understood the issues (subjective) and mean score of correct answers on the same issues (objective). (See Table A7.7 for exact scores on each issue).

7.5.2 Objective Understanding by Age Group

This study again made a comparison of level of understanding of environmental terms and concepts by age groups.

As **Figure 7.9a** reveals, youths consistently scored better than the adults and children on environment-related issues in all the studies. In the present study, youths showed a significantly higher level of understanding (11.2% in 1996, 17.4% in 1998 and 19.8% in 2000) than that of adults (7.2% in 1996, 13.8% in 1998 and 16.1% in 2000) (**Figure 7.9b**). Children again scored the lowest (4.0% in 1996, 7.1% in 1998 and 10.6% in 2000).

Figure 7.9a: Comparison Between Objective Understanding of Environmental Terms and Concepts by Age Group

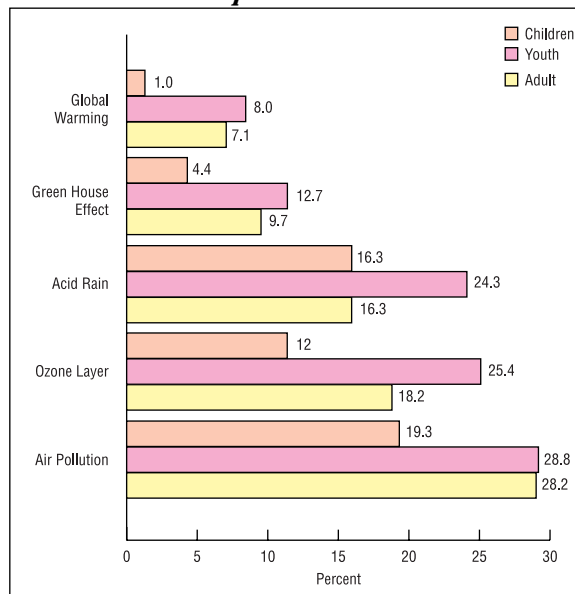
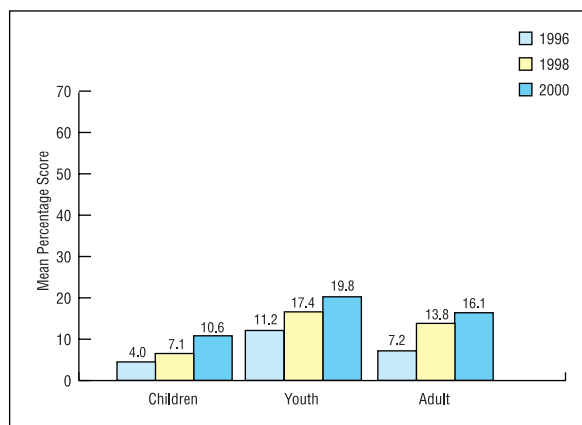


Figure 7.9b: Objective Understanding of Environmental Terms and Concepts by Age Group



Note: Data represent mean percentage score of correct answers on five question (See Table A7.8 for exact scores on each question).

When the findings of the 1996 to 2000 studies are compared, it can be seen that the levels of understanding of adults, youths and children on environment-related issues have increased by 8.9%, 8.6% and 6.6% respectively. The wider coverage of this issue by the Malaysian media could provide the explanation for the continuous increase of environmental knowledge among these different groups of respondents.

7.5.3 Objective Understanding by Educational Level

The 1998 and 2000 studies continue to show significant differences in the levels of understanding of environmental terms and concepts when comparisons were made between groups with different educational backgrounds (Figure A7.1 and Table A7.9). The highest score of 29.7% was achieved by respondents with tertiary education. This is followed by those with secondary education with a score of 15.1%. Respondents with primary education scored the lowest ie. 5.3%. These encouraging results provide the evidence of the effectiveness of the country’s schooling system with respect to the number of years students stay in education. The results also concur with the previous findings.

7.5.4 Objective Understanding by School Stream

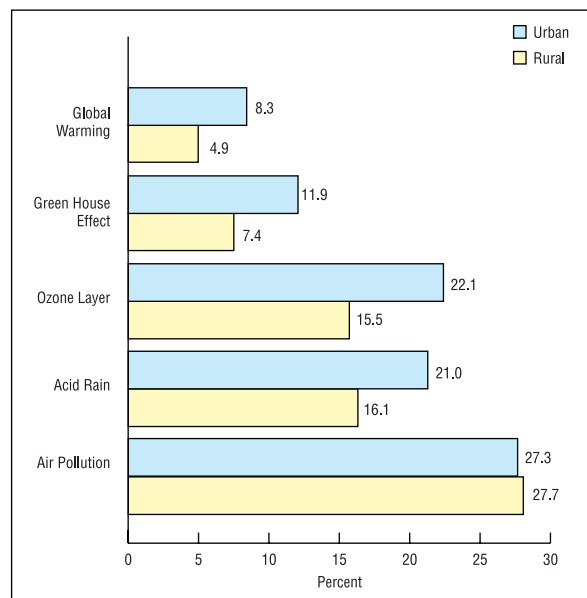
The three studies also indicate that the average level of understanding of environment-related issues of respondents from the science stream was significantly higher than those from the Commerce, Arts and Religious studies streams (Figure A7.2 and Table A7.10). However within the Arts and Religious studies groups there were marginal differences in their understanding of those issues.

When the three studies were compared, the 2000 study showed an increase in the level of understanding of environment-related issues among respondents from various school stream backgrounds. The mean increase of 3% or more over the two-year period for all the streams (except for the Arts) was quite significant.

7.5.5 Objective Understanding by Locality

In terms of locality, the current study also revealed that urban population recorded higher level of understanding in all environment-related issues except on air pollution when compared to their rural counterparts. As for subjective understanding, results from the present study also show that urban and rural population’s understanding of the more noticeable environmental phenomena such as air pollution, acid rain and ozone layer is better than their understanding of those, which are more complex. The trend of understanding the issues among urban and rural respondents were similar with air pollution ranking highest (27.3% for urban and 27.7% for rural). Ozone layer was the second most-understood issue (21% urban and 16.1% rural), followed by acid rain (22.1% urban and 15.5% rural). Level of understanding in other environmental issues was relatively low, ranging from 4.9% to 11.9% in both localities (Figure 7.10a).

Figure 7.10a: Comparison Between Objective Understanding of Environmental Terms and Concepts by Locality



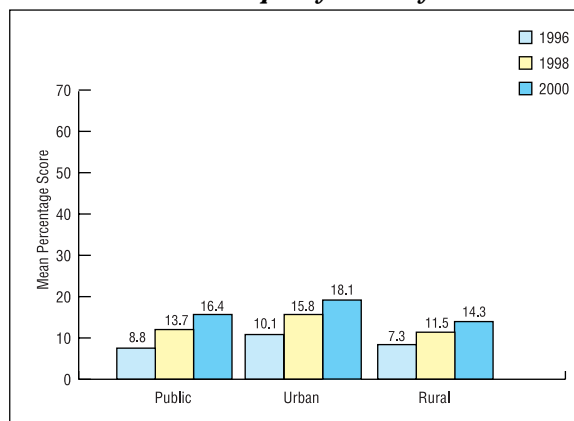
Comparison between the urban and the rural population on their level of understanding of environmental terms and concepts was also carried out in order to determine whether there were marked differences in the results from the three studies.

The result revealed that the urban population, on average, had a better understanding of environmental terms and concepts as compared to those from the rural areas (Figure 7.10b and Table A7.11). The results also revealed that the environmental knowledge of the urban and the rural population over the four-year period (1996-2000) has substantially improved (ie. by 8.0% and 7.0% respectively)(Figure A7.3).

7.5.6 Objective Understanding by Gender

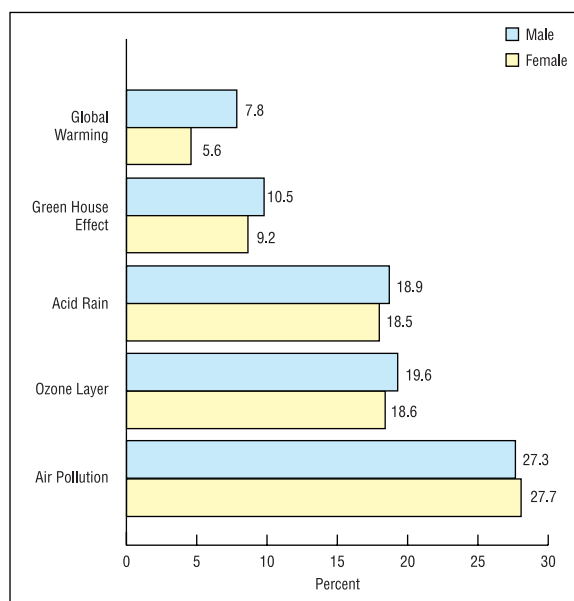
As for subjective understanding, results from the present study also show that male respondents recorded higher level of understanding in all environment-related issues except on air pollution than the female respondents (Figure 7.11a). Air pollution is the most understood issue with 27.3% of males and 27.7% of females providing the correct answer for questions on this issue respectively. Ozone layer was the second most understood issue (19.6% male and 18.6% female), followed by acid rain (18.9% male and 18.5% female). Other issues, which include green house effect and global warming, ranked much lower at between 5.6% to 10.5% for both genders.

Figure 7.10b: Objective Understanding of Environmental Terms and Concepts by Locality



Note: Data represent mean percentage score of correct answers on five questions. (See Table A7.11 for exact scores on each question).

Figure 7.11a: Comparison Between Objective Understanding of Environmental Terms and Concepts by Gender

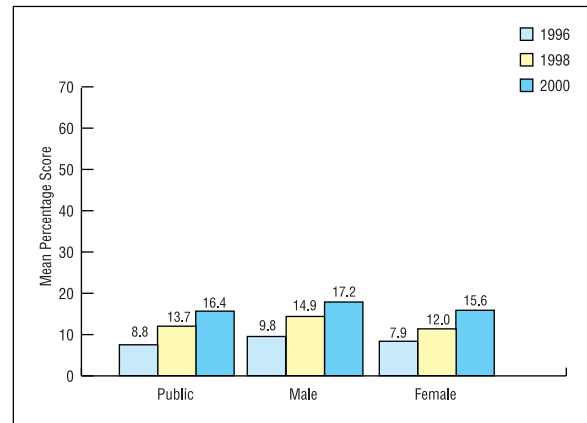


When the results from the three studies were compared, it was found that the environmental knowledge of both the male and the female population had increased by more than 7% during the four-year period (**Figure 7.11b**). **Table A7.12** shows that the males outscored females in all the questions asked. Overall, the males scored 17.2%, which is 1.6% higher than the score of the females.

7.6 SUMMARY

- The level of understanding of S&T (4.3%) and basic environmental terms and concepts (7.6%) among the Malaysian public have somewhat improved during the 1996-2000 period.
- Comparison between the public subjective and objective understanding of environmental terms and concepts shows that the latter recorded a much lower score (two-third) than the former in all the three studies.
- Youths (60.8%) as compared to adults (57.1%) continue to demonstrate a greater understanding of S&T. This finding could be due to the greater percentage of youth respondents with tertiary and secondary education. During the 1996-2000 period, adults, youths and children's understanding of S&T showed a slight but continuous improvement (i.e. by 4.5%, 4.0% and 5.7% respectively).
- Youths (19.8%) also showed a higher level of awareness and understanding of environmental terms and concepts than the adults (16.1%) and children (10.6%). The overall levels of environmental knowledge among adults, youth and children have increased by 8.9%, 8.6% and 6.6% respectively during the 1996-2000 period.
- The level of formal education that Malaysians received dictates their level of understanding of S&T and environmental terms and concepts. Respondents with tertiary education continue to score high (64.3%) on the understanding of S&T. This is followed by those with secondary (57.7%) and primary (50.9%) education. However, scores by all the three groups for environmental knowledge are very much lower (ie. 29.7%, 15.1% and 5.3% respectively)
- As compared to their non-science counterparts, individuals with science stream background tend to report a higher level of understanding of S&T and environmental terms and concepts. However, these respondents with science stream background have experienced a decrease in the level of S&T understanding (4.8%) during the 1996-2000 period. Overall, there has been a considerable increase in S&T understanding (3.6%) and environmental knowledge (7.7%) for all respondents with science stream as well as non-science stream backgrounds during the 1996-2000 period.

Figure 7.11b: Objective Understanding of Environmental Terms and Concepts by Gender



Note: Data represent mean percentage score of correct answers on five questions. (See Table A7.12 for exact scores on each question).

- Like the two previous studies (1996 and 1998), this study reports that the urban population has better knowledge of S&T and environmental terms and concepts than their rural counterparts. The study also observes that during the 1996-2000 period the urban population has demonstrated an increase of 4.6% and 8.0% in their understanding of S&T and environmental terms and concepts respectively. The figures for the rural population on S&T and environmental knowledge are 4.3% and 7.0% respectively.
- Generally males have a slightly better understanding of S&T than females. But the latter are more knowledgeable on issues related to medical sciences and human biology. This study and the previous two studies have made similar observations in terms of males being more knowledgeable about basic environmental issues and concepts than the females. Males and females have shown an increase of 4.0% and 4.8% respectively in their knowledge of S&T during the 1996-2000 period, whereas in the case of environmental knowledge, both have increased by slightly more than 7%.