

# **Knowledge of Scientific and Environmental Facts: A Comparison of Six Countries**

*Philip Gendall, Tom W Smith and Deborah Russell*

The International Social Survey Programme (ISSP) involves leading academic institutions in 22 countries, including New Zealand, in an annual survey of economic and social policy issues. Part of the questionnaire used in the 1993 environment survey asked respondents their opinion on a series of statements describing basic scientific and environmental facts. From the answers to these questions it was possible to determine respondents' level of knowledge of these facts. This paper examines comparisons of this level of knowledge in six countries - East Germany, West Germany, Great Britain, Norway, New Zealand and the USA. If the evidence of the International Social Survey Programme is any indication, New Zealanders have a level of scientific and environmental knowledge which is at least as good, and often better than, that in other comparable countries. This level of knowledge has relatively little to do with age or sex, but has everything to do with education; people with higher levels of education have a greater understanding of science and environmental issues. This suggests that our schools and universities must be doing something right.

Keywords: ISSP, social survey

## **Introduction**

The International Social Survey Programme (ISSP) involves leading academic institutions in 22 countries, including New Zealand, in an annual survey of economic and social policy issues. New Zealand is represented in the ISSP by Massey University. Each year the ISSP member countries carry out a 30-minute survey using the same questionnaire. The data from these surveys are deposited in a central archive in Cologne, where they are freely available to all members. This collection of data enables researchers to examine similarities and differences between countries, and to monitor changes over time.

The ISSP addresses a different topic each year in a five-year cycle. Previous topics have included the role of government, religion, attitudes to work and leisure, and social inequality. In 1993, the topic was the environment.

Members of the ISSP use a range of survey methodologies to collect the data required. In some countries the surveys are conducted face-to-face, in others the ISSP survey is a self completion module left with respondents interviewed in person for a national social survey, while in others, including New Zealand, the survey is administered by mail. Sample sizes achieved also vary among ISSP countries but all are at least 1000 valid cases.

## **Knowledge of scientific and environmental facts**

Part of the questionnaire used in the environment survey asked respondents their opinion on a series of statements describing basic scientific and environmental facts. From the answers to these questions it was possible to determine respondents' level of knowledge of these facts. Comparisons of this level of knowledge in six countries - East Germany, West Germany, Great Britain, Norway, New Zealand and the USA - are shown in Tables 1 and 2.

Overall, New Zealanders' knowledge of basic scientific and environment facts is as good as that of the general public in Great Britain and Norway, and better than their counterparts in East and West Germany and the USA. Paradoxically, despite this level of knowledge, New Zealanders (and the British) are more willing to accept that astrology has some scientific truth than those in Germany, Norway or the USA..

The comparison of basic scientific and environmental knowledge in these six countries also revealed several other interesting differences. For example, in East and West Germany only 30% to 40% of respondents knew that antibiotics can kill bacteria but not viruses. This compares with 60% to 70% correct understanding in the other four countries. Similarly, in both Germanies understanding of the causes and nature of cancer was much lower than in the

**Table 1. Knowledge of scientific facts in six countries**

Statement	Percent Correctly Understanding <sup>1</sup>					
	New Zealand	East Germany	West Germany	Great Britain	Norway	USA
Antibiotics can kill bacteria, but not viruses (correct)	72	42	32	61	71	67
Human beings developed from earlier species of animals (correct)	66	81	73	74	64	45
All radioactivity is made by humans (incorrect)	55	46	45	56	45	57
All man-made chemicals can cause cancer if you eat enough of them (incorrect)	49	23	24	50	43	45
Astrology - the study of star signs - has some scientific truth (incorrect)	48	37	36	49	35	44
Mean number correct	2.9	2.3	2.2	2.9	2.6	2.5
Additive scale <sup>2</sup>	13.0	14.0	14.1	12.7	13.2	14.0

1. "Correct" or "incorrect" judged by generally agreed standards. Percent correctly understanding is the proportion consistent with this judgement who answered Definitely true/false or Probably true/false.
2. Items scored as 1 = Definitely correct to 5 = Definitely incorrect. Scores range from 5 for those who gave all correct responses and were definite about each, to 25 for those who gave all incorrect answers and were definite about each (i.e., the lower the score the higher the level of knowledge).

**Source:** Gendall, Hosie & Russell (1994), Smith (1994)

other countries. By contrast, knowledge of the theory of evolution was highest in the two Germanies, at well over 90%, and lowest in the USA, at only 45%. The latter figure illustrates the strong influence of religion on the educational content of the American school system. Religious fundamentalists have restricted the teaching of evolution in US public

schools and this has reduced the level of knowledge about evolution among Americans (Smith 1995).

**Table 2. Knowledge of environmental facts in six countries**

Statement	Percent Correctly Understanding <sup>1</sup>					
	New Zealand	East Germany	West Germany	Great Britain	Norway	USA
Some radioactive waste from nuclear power stations will be dangerous for thousands of years (correct)	94	81	84	80	77	87
Every time we use coal oil or gas we contribute to the greenhouse effect (correct)	81	76	78	79	80	64
Cars are not really an important cause of air pollution in New Zealand (East Germany/West Germany/etc) (incorrect)	75	74	69	73	65	74
Human beings are the main cause of plant and animal species dying out (correct)	70	71	80	71	75	64
If someone is exposed to any amount of radioactivity, they are certain to die as a result (incorrect)	66	59	56	62	69	69
All pesticides and chemicals used on food crops cause cancer in humans (incorrect)	61	45	33	60	60	58
The greenhouse effect is caused by a hole in the earth's atmosphere (incorrect)	23	19	14	19	31	26
Mean number correct	4.7	4.2	4.1	4.5	4.6	4.2
Additive scale <sup>2</sup>	16.7	17.4	17.6	16.9	16.1	17.5

1. "Correct" or "incorrect" judged by generally agreed standards. Percent correctly understanding is proportion consistent with this judgement who answered Definitely true/false or Probably true/false.
2. Items scored as 1 = Definitely correct to 5 = Definitely incorrect. Scores range from 5 for those who gave all correct responses and were definite about each, to 25 for those who gave all incorrect answers and were definite about each (i.e., the lower the score the higher the level of knowledge).

**Source:** Gendall, Hosie & Russell (1994); Smith (1994)

The ISSP surveys also revealed a consistent lack of understanding about the cause of the greenhouse effect. In all six countries only a relatively small minority of respondents correctly described the statement "The greenhouse effect is caused by a hole in the earth's atmosphere" as false. (The proportion ranged from 31% in Norway to 14% in West Germany.) Thus, confusion about the greenhouse effect and thinning of the ozone layer is apparently widespread.

However, global warming (the greenhouse effect) and ozone depletion are linked. Ozone and CFCs contribute to the greenhouse effect; carbon dioxide helps determine stratospheric temperature, which affects the rate of ozone depletion. Consequently, the statement used may have been an ambiguous measure of knowledge on this topic. Similarly, it may be inappropriate to use acceptance of the theory of evolution as a measure of scientific knowledge since this is, for many people, a theological issue.

It is also possible that some of the knowledge differences between countries are the result of misinterpretation or misunderstanding of the statements used. For example, "All man-made chemicals can cause cancer if you eat enough of them" (incorrect) could have been interpreted as "If you eat enough of anything, it can kill you" (possibly correct), and, to the extent that astrology is based on the positioning of planets (a scientific fact), it might be possible to argue that astrology has **some** scientific truth. However, there is no reason to suspect that, if such interpretations did occur, they would be more or less prevalent in any particular country.

### **Effect of age, sex and education**

In all six countries the effects of age, sex and education on scientific and environmental knowledge were similar. Men tended to have higher levels of knowledge than women, younger people tended to be more knowledgeable than older people, and the higher the level of education, the higher the level of knowledge. The age and sex effects are weak, however, and the most important determinant of level of scientific and environmental knowledge is education (see Appendix Tables 1 and 2).

It is very unlikely that these results mean that men are smarter than women or that young people are cleverer than their parents or grandparents. A more logical explanation of the knowledge difference between sexes is that more males take science subjects at school or university (perhaps because they are more interested in science or perhaps because of different expectations in society for males and females). Similarly, the fact that the items tested are biased towards what is current in science education and public discussion is a likely explanation for the tendency for younger cohorts to be better informed, particularly on environmental questions. What is clear, however, is that regardless of sex or age, scientific and environmental knowledge in all six countries increases as the level of education increases.

### **Conclusions**

If the evidence of the International Social Survey Programme is any indication, New Zealanders have a level of scientific and environmental knowledge which is at least as good, and often better than, that in other comparable countries. This level of knowledge has relatively little to do with age or sex, but has everything to do with education; people with

higher levels of education have a greater understanding of science and environmental issues. This suggests that our schools and universities must be doing something right.

The value of participation in international programmes like the ISSP is clearly illustrated by the results discussed here. On its own, evidence of New Zealanders' level of scientific and environmental knowledge is interesting, but it is only when this is compared with knowledge levels in other countries that it becomes meaningful. Furthermore, because the **same** questionnaire is used in all ISSP countries, the responses from different countries can be directly compared. This allows us to examine differences between countries with some certainty that they are not simply artefacts created by different survey instruments.

## References

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**Philip Gendall is Professor of Marketing and Head of the Department of Marketing, Massey University, Tom W Smith is Director, General Social Survey, National Opinion Research Center, University of Chicago, and Deborah Russell is a Research Assistant in the Department of Marketing, Massey University.**

**APPENDIX. Effect of age, sex and education on scientific and environmental knowledge****Table 1. Additive science and environmental scales by sex and education**

Statement	Highest level of education					
	New Zealand	East Germany	West Germany	Great Britain	Norway	USA
<b>A. Scientific knowledge</b>	Less than high school					
Men	14.2	14.5	14.1	13.1	14.1	15.7
Women	15.4	14.7	15.1	13.7	15.1	15.8
	High school					
Men	13.6	12.5	12.1	10.8	13.1	14.4
Women	14.0	13.2	12.4	12.0	14.4	14.9
	Some University					
Men	11.9	13.1	13.7	11.6	11.6	13.5
Women	12.5	13.7	13.4	12.0	13.5	14.2
	University graduate					
Men	9.5	10.8	11.3	9.6	9.8	11.4
Women	11.3	12.3	12.5	10.7	11.7	12.8
<b>B. Environmental knowledge</b>	Less than high school					
Men	18.2	17.6	18.2	17.0	17.9	18.7
Women	18.3	18.2	18.4	18.3	18.5	19.3
	High school					
Men	17.3	16.2	14.8	14.1	15.5	17.6
Women	17.5	16.4	15.6	15.8	17.0	18.5
	Some university					
Men	15.8	16.9	17.2	15.8	14.4	16.4
Women	16.4	16.6	17.0	16.1	15.9	17.5
	University graduate					
Men	13.6	14.5	14.5	13.2	13.5	15.1
Women	15.1	14.5	15.4	15.9	14.3	16.8

Note: Additive scales calculated by summing items scored as 1= Definitely correct to 5 = Definitely incorrect for each set of items. The lower the additive score, the higher the level of knowledge.

**Table 2. Additive science and environmental scales by age and education**

Statement	Highest level of education				Norway	USA
	New Zealand	East Germany	West Germany	Great Britain		
<b>A. Scientific knowledge</b>						
			Less than high school			
Less than 29	14.3	14.1	14.7	13.0	14.6	15.2
30-39	14.7	13.8	14.3	13.1	13.6	15.7
40-49	13.4	14.3	14.7	12.8	14.6	15.5
50-64	14.8	15.0	14.5	13.6	15.0	16.6
65 or older	15.1	14.6	15.2	14.3	14.7	15.9
			High school			
Less than 29	14.0	13.0	12.6	11.3	13.6	14.9
30-39	13.5	(7)	11.9	11.0	13.9	14.5
40-49	14.1	(6)	(5)	10.7	13.8	14.9
50-64	13.5	(3)	(4)	(12)	13.4	14.7
65 or older	14.1	(1)	(3)	(10)	14.2	14.5
			Some University			
Less than 29	13.1	(16)	(8)	11.6	12.8	13.9
30-39	11.9	13.4	12.8	11.1	12.7	14.0
40-49	11.8	13.0	(19)	11.5	12.2	13.3
50-64	12.0	13.4	14.2	12.4	12.1	14.6
65 or older	13.1	14.0	(13)	13.1	11.2	14.0
			University graduate			
Less than 29	11.2	(8)	(9)	9.6	11.1	12.7
30-39	9.8	10.7	(11)	10.9	10.6	12.3
40-49	10.5	(14)	11.7	9.5	11.0	11.5
50-64	10.7	12.2	12.4	(14)	9.6	11.6
65 or older	9.9	(10)	(8)	(4)	10.9	12.3

<b>B. Environmental Knowledge</b>						
	Less than high school					
Less than 29	17.4	17.5	18.1	17.3	18.9	17.6
30-39	17.6	17.0	17.9	17.2	17.8	18.9
40-49	17.1	18.3	18.1	17.1	17.6	19.5
50-64	19.2	17.9	18.5	17.9	18.1	19.9
65 or older	18.0	18.8	18.8	19.1	18.7	19.3
	High school					
Less than 29	17.2	15.9	15.3	14.7	15.7	18.7
30-39	16.6	(7)	14.4	15.0	16.4	17.7
40-49	17.6	(6)	(5)	14.4	16.0	17.7
50-64	17.8	(3)	(5)	(12)	17.2	18.4
65 or older	18.2	(1)	(3)	(10)	18.3	18.8
	Some university					
Less than 29	16.2	(16)	(8)	14.9	14.4	16.9
30-39	15.5	16.5	16.3	15.4	14.7	17.2
40-49	15.6	17.7	(19)	15.4	16.5	17.3
50-64	16.4	16.4	18.0	16.9	15.7	16.9
65 or older	17.8	17.1	(13)	17.6	16.8	17.0
	University graduate					
Less than 29	14.7	(8)	(9)	13.3	13.4	15.8
30-39	13.4	13.9	(11)	14.2	13.8	15.6
40-49	13.7	(13)	14.0	13.6	14.7	15.9
50-64	15.1	15.8	15.1	(14)	13.8	16.2
65 or older	16.5	(10)	(8)	(4)	15.1	17.0

## Note:

1. Additive scales calculated by summing items scored as 1= Definitely correct to 5 = Definitely incorrect for each set of items. The lower the additive score, the higher the level of knowledge.
2. Values in parentheses are sample sizes for cells where the number of observations is fewer than 20.