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ABSTRACT

The purpose of this study was to analyze the effectiveness and use of a free educational resource, the ENVIRONMENTAL QUALITY NEWSLETTER. Four issues ranging in dates from Fall 1973 to Fall 1976 were selected for review. Data were gathered from elementary school teachers over a three year period of time. The analysis indicated teachers were using the newsletter, valued the learnings gained, committed time to using it, and perceived it as an effective educational resource. (RH)

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"A Quantitative Analysis of the Effectiveness and Use of the Environmental Quality Newsletter: A Comparative Study of Free and Inexpensive Educational Materials"

by Neil V. Weber

I. Introduction

Free and inexpensive educational materials have been distributed to teachers and school systems for many years. The sources of the materials are as diverse as the kinds of materials themselves. Some of the materials have been evaluated as being useful, timely, and of incalculable aid to the classroom teacher (Addicott and Netzer); others have been received as sheer "propaganda" and "cheap advertising material" (Columbia University Press and Burk).

A search of the literature indicates that the status of free and inexpensive materials has changed over the last twenty-five years (DuVall, 1974, 13-19). Although there are nonprofessional materials being distributed under the guise of "creative educational resources", research suggests that there are numerous valuable educational materials distributed in this fashion, providing useful classroom resource material otherwise unavailable to many schools in the United States.

Whatever the nature and scope of individual types of free or inexpensive educational materials, ongoing research suggests that the vast majority of school districts (90% of districts studied) permit the use of these materials, whereas an extremely small percentage (less than 3% of the districts studied) specifically prohibit their use (DuVall, 1972, 21-33). It is apparent that these materials are getting into many, if not most, of the schools in the

United States. Careful review and evaluation of free or inexpensive materials (before, during, and after their use - which is hopefully done with all educational materials) is essential in guaranteeing that only the useful and properly designed materials reach and stay in the hands of the students.

#### Purpose

The purpose of this study is to analyze the effectiveness and use of a free educational resource (i.e., the Environmental Quality Newsletter) which is presently being distributed to the upper elementary teachers in northcentral Indiana and southern Michigan.\* Furthermore, it is the intent of this research to place this resource in a comparative mode with other free educational materials that have been distributed all over the United States.

The study is designed to evaluate the relative usefulness of four issues of the Environmental Quality Newsletter, ranging in publication dates from the Fall of 1973 to the Fall of 1976. The data used in this study have been compiled from opinionnaires returned by teachers in receipt of the four issues of the Environmental Quality Newsletter. Tables 1-4 summarize the quantitative responses from the opinionnaire and Appendix A contains a sample copy of the opinionnaire.

It should be mentioned at this time that due to limited finances, as well as the desire to seek out the most expedient and frugal means

\*For a detailed description of the Environmental Quality Newsletter see - - Weber, Neil v., "An Example of Using the Community as an Environmental Resource and Laboratory," November, 1976, Environmental Education Curriculum Service, Natural Science for Youth Foundation, Mystic, Connecticut (Code J.176-1).

of distribution, newsletter packets (going to each fourth, fifth, and sixth grade teacher in the immediate area), accompanied by an evaluation form, were sent to the schools via central mailing systems at the respective school corporation offices. Completed evaluations were, in turn, returned to the appropriate administrative official via the same mail system (please note Appendix A). This, of course, gave the evaluator limited control over the size of the sample and rate of return. It is, however, significant to note that when one takes into account the limiting factors stated above, the sample size(s) does test statistically acceptable and uniform over the three year period. The "q" values at 1- $\alpha$  equalling .99 were as follows - - Water Cycle Issue (Vol. 2, No. 1) = .925; Ecology Issue (Vol. 3, No. 2) = .847; Land Use Issue (Vol. 3, No. 3) = .830; Solid Waste Issue (Vol. 3, No. 4) = .825; Total Sample = .965 (Conover, 116-21).

#### Problems Investigated

Although all twelve questions on the opinionnaire (Appendix A) lend themselves to relevant analysis and comparative generalization about the respondents' perceptions, this study focuses attention on four questions (i.e., questions VI, VII, VIII, IX) which this writer feels are of particular concern to a volunteer, not-for-profit group of environmentalists. When it comes to soliciting funds and human resources for an ongoing program like the publication of the Environmental Quality Newsletter, the editorial board has great interest in knowing whether or not teachers perceive the Newsletter as being effective, important, and worth giving classroom time and preparation toward presentation.

Specifically, the following eight problems are presented for investigation, analysis, and comment:

1. Are the teacher responses regarding "using the Newsletter again" statistically conformable among issues; if so, what is the pattern of response; if not, why are some issues, formats, etc. better accepted than others?
2. Are the teacher responses regarding "the effectiveness of the material" statistically conformable among issues; if so, what is the pattern of response; if not, why not?
3. Are the teacher responses regarding "how important were the learnings gained" statistically conformable among issues; if so, what is the pattern of response; if not, why not?
4. Are the teacher responses regarding "time your class spent using this material" statistically conformable among issues; if so, what is the pattern of response; if not, why not?
5. Are the responses regarding "using the Newsletter again" statistically conformable with the standard responses for free educational materials; if not, why not?
6. Are the responses for the Newsletter regarding "the effectiveness of the material" statistically conformable with the standard responses for free educational materials; if not, why not?
7. Are the responses for the Newsletter regarding "how important were the learnings gained" statistically conformable with the standard responses for free educational materials; if not, why not?

8. Are the responses for the Newsletter regarding "time your class spent using this material" statistically conformable with the standard responses for free educational materials; if not, why not?

Phase I of the study deals with the first four problems; Phase II deals with problems five through eight.

## II. Data Gathering and Analysis Techniques

Data for this study were gathered over a three year period (1973-76) from opinionnaires voluntarily submitted from teachers receiving the Environmental Quality Newsletter. The data were compiled and statistically summarized by a standard percent frequency analysis computer program. Summary tables of these analyses are found in Tables 1-4 of this paper.

Phase I of this study dealt with testing the conformality of the cumulative frequency responses among four issues of the Environmental Quality Newsletter; whereas Phase II of this study dealt with testing the conformality of the Newsletter responses with those of nationally distributed free educational materials (DuVall, 1974, 30-40).

### Test Description

The statistical test used in this study is the Kolmogorov-Smirnov Two-Sample Test (Siegel, 127-35). This particular test was selected for three specific reasons: (1) the types of grouped data used in this study lend themselves to straightforward nonparametric testing; (2) the Kolmogorov-Smirnov test is easily manipulated, allowing a single operator to make all calculations directly on a standard desk calculator; and (3) when compared with other goodness-of-fit tests (e.g.,  $\chi^2$  and the median test), the Kolmogorov-Smirnov test has significantly higher power-efficiency.

The Kolmogorov-Smirnov two-sample test is a test of whether or not two independent samples have been drawn from the same population (or from populations with the same distribution). This test is concerned with the agreement between two cumulative distributions.

If the two samples have been drawn from the same population distribution, the cumulative distributions of the two samples may be expected to be fairly close to each other, inasmuch as they both should show only random deviations from the population distribution. If the two sample cumulative distributions are "too far apart" at any point, this suggests that the samples come from different populations. Thus a large enough deviation between the two sample distributions is evidence for rejecting the null hypothesis ( $H_0$ ).

The method of determining the critical value for significance of the maximum observed deviation ( $D$ ) depends on the size of the samples and the nature of the alternate hypothesis ( $H_1$ ). For a two-tailed test, when  $n_1$  and  $n_2$  are both larger than twenty (such as the samples used in this study) (Roscoe, 276-77), the following formula is used to compute the critical value of the maximum deviation ( $K_D$ ). Given a .01 level of significance, the formula reads:

$$K_D = 1.63 \sqrt{\frac{n_1 + n_2}{n_1 n_2}}$$

The following statistic is used to compute the Kolmogorov-Smirnov maximum observed deviation ( $D$ ).

$$D = \text{maximum} \quad | S_{n1}(x) - S_{n2}(x) |$$

where-

$D$  = maximum deviation

$S_{n1}(x)$  = observed cumulative frequency distribution  
of the first random sample of  $n$  observations

$S_{n2}(x)$  = observed cumulative frequency distribution  
of the second random sample of  $n$  observations

### Analysis

In Phase I each of the Newsletter issues (i.e., Water Cycle, Ecology, Land Use, Solid Waste) was separately tested against all other issues. A total of twenty-four tests were run - six tests for each of the four questions analyzed (i.e., opinionnaire questions VI, VII, VIII, and IX). A sample of one of the twenty-four null hypotheses tested in Phase I reads as follows:

Null Hypothesis I (H I) states that there is no significant difference between the observed cumulative frequency response for the Water Cycle Issue and the Ecology Issue regarding "using the Newsletter again."\*

Under Phase II of the analysis, four separate tests were run - one for each of the four questions. Using mean observed cumulative frequency responses for the four issues tested in Phase I, a composite index was established and utilized to statistically compare the Environmental Quality Newsletter with the Standard Index (i.e., mean response) for nationally distributed free educational materials. (DuVall, 1974, 30-40). The following four null hypotheses were statistically tested:

Hypothesis XXV (H<sup>o</sup> XXV) states that there is no significant difference between the mean observed cumulative frequency response for the Environmental Quality Newsletter and the Standard Index for free educational materials regarding "using the material again."

\*For a statistical statement of all twenty-four of the null hypotheses refer to Tables 5-8 in the data testing section of this paper.

Hypothesis XXVI ( $H_{0XXVI}$ ) states that there is no significant difference between the mean observed cumulative frequency response for the Environmental Quality Newsletter and the Standard Index for free educational materials regarding "the effectiveness of the material."

Hypothesis XXVII ( $H_{0XXVII}$ ) states that there is no significant difference between the mean observed cumulative frequency response for the Environmental Quality Newsletter and the Standard Index for free educational materials regarding "how important were the learnings gained."

Hypothesis XXVIII ( $H_{0XXVIII}$ ) states that there is no significant difference between the mean observed cumulative frequency response for the Environmental Quality Newsletter and the Standard Index for free educational materials regarding "time your class spent using this material."

### III. Data Testing

#### Phase I

Under Phase I of the data testing stage, twenty-four separate tests were run to check for possible conformity among separate issues of the Environmental Quality Newsletter (See Tables 5-8).

#### Question VI

The first six tests dealt with opinionnaire Question VI - "using the Newsletter again" (See Table 5). The maximum D values ranged from a low of .06 to a high of .13, whereas the  $K_D$  values ranged from a low of .31 to a high of .39. In all cases the maximum deviations observed were far below the critical deviation level at the .01 level of significance. One can, therefore, conclude that there are no significant differences among the respondent's preferences regarding "using the Newsletter again." By far the dominant case response in all instances was number 1 - "yes, I will use the material again."

#### Question VII

Null hypotheses VII through XII tested for significant differences

for Question VII of the opinionnaire (see table 6). The maximum D values were all substantially lower than their respective  $K_D$  values; the conclusion being that the issues analyzed showed similar distribution tendencies (i.e., the respondents showed similar response patterns relative to "How effective was the material"). The dominant case response fell in number 2 - effective.

#### Question VIII

For Question VIII ("How important were the learnings gained"- Table 7) three of the tests (i.e.,  $H_{O_{XIII}}$ ,  $H_{O_{XIV}}$ ,  $H_{O_{XV}}$ ) tested significant differences at the .01 level of significance, whereas the other three (i.e.,  $H_{O_{XVI}}$ ,  $H_{O_{XVII}}$ ,  $H_{O_{XVIII}}$ ) tested no significant difference. It should be noted that the three null hypotheses rejected found the response pattern for the Water Cycle issue significantly different from the other three issues for Question VIII, whereas the other three issues tested conformable among themselves for the same opinionnaire question. Furthermore, in  $H_{O_{XIII}}$ ,  $H_{O_{XIV}}$ , and  $H_{O_{XV}}$  the "no response" case for the Water Cycle has nearly one-half (i.e., 44%) of all the responses for this question, whereas the other three issues have 10%, 0%, and 6% for the "no response" case. It is apparent that the rejection is based on the strong and discrepant weighting of "no response" for the Water Cycle issue.

A careful study of the Water Cycle opinionnaires revealed that the response line was omitted from that form for this question, whereas all lines were present for the other issues. It is, therefore, the conclusion of this writer (based on the general conformality of this issue with the others in all other questions) that were it not for the format flaw in Question VIII of the Water Cycle opinionnaire, this issue would test non-significantly different from the others just

as in  $H_0$ XVI,  $H_0$ XVII, and  $H_0$ XVIII.

#### Question IX

The tests for Question IX ("Time your class spent using this material" - Table 8) had the same results as those for Questions VI and VII - namely, that in all instances the null hypotheses were accepted at the .01 level of significance. All four issues analyzed found the dominant case responses rather consistently split between number 1 (less than one hour) and number 2 (one to two hours).

The analysis suggests that the respondents for all four issues of the Environmental Quality Newsletter are from populations having the same distribution characteristics. With the possible exception of Question VIII, all of the hypotheses were accepted with maximum D values well below the critical  $K_D$  levels. Mean cumulative frequency responses for the four issues were, therefore, used as index for the Environmental Quality Newsletter to be used in Phase II -- a means of comparing this educational resource with the "Standard Index" to free or inexpensive educational materials.

#### Phase II

Under Phase II of the data testing stage, four separate tests were run to test for significant differences between the cumulative frequency responses for the Environmental Quality Newsletter and the Standard Index for free educational materials ( $H_0$ XXV- $H_0$ XXVI). A summary of these tests is found in Table 9.

It is interesting to note that in all cases the maximum D values were below the critical  $K_D$  value; the implication is that for the four opinionnaire questions analyzed in this study, the two samples tested have come from the same or similar populations (i.e., the patterns of response for the materials tested are not significantly different).

Although there is some variability among the patterns of response, the variability is not enough to be tested significant at the .01 level.

In Question VI, the largest individual case variability (i.e., 17%) was for the "yes" response on using the material again, with about one-quarter more Newsletter recipients responding "yes" to Question VI than the Standard Index recipients.

Although no clear-cut patterns emerge for comparison in Question VII, it might be said that there is a tendency for Newsletter recipients to evaluate the resource as being slightly more effective than Standard Index respondents. Likewise in Question VIII, although the test showed no significant difference, the data suggest a tendency for Newsletter recipients to view more highly the importance of the learnings gained.

A general comparison among case responses under  $H_0$  XXVIII- (although again testing no significant statistical difference) suggests a general tendency for more evasive responses from the Standard Index (i.e., 11% greater response for "cannot be determined" and 7% greater response for "no response"); whereas, Newsletter recipients favor using the materials through shorter time intervals (i.e., 35% responding "less than one hour" with a 12% greater response for this case, and 39% for "one to two hours" with a 10% greater response in this case).

It should be noted that for all four questions analyzed under Phase II (see summary in Table 9), the standard index respondents had a higher percent of "no response" (i.e., Question VI - 17% greater; Question VII - 9% greater; Question VIII - 3% greater; and Question IX - 7% greater). Although these deviations did not cause

the statistics to test significantly different, the predicatability of the pattern does appear apparent.

#### IV. Conclusions and Recommendations

The purpose of this study was to quantitatively analyze the effectiveness and use of the Environmental Quality Newsletter. More specifically, it was the intent of this research to (1) statistically test for consistency among issues of the Newsletter, and (2) to statistically compare the Newsletter with the "Standard Index" of free educational materials. Results from data testing suggest that the response pattern for the Newsletter does not significantly differ from that of the "Standard Index"; that is, they are from populations having the same cumulative frequency distribution. Although there is some variability among individual case responses (see Data Testing), the pattern of response is fully compatible with educational materials distributed all over the United States.

The teachers do use the Newsletter, and value the learnings gained. They are committing classroom time to the Newsletter, and perceive it as being an effective educational resource.

Having been carefully scrutinized for academic credibility, effectiveness, and usefulness, it is the recommendation of this writer that the Environmental Quality Newsletter continue to be distributed to the upper elementary teachers of north-central Indiana and southern Michigan; and that an ongoing evaluation process be maintained to allow objective and honest feedback from administrators, teachers, and students.

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TABLE 1

PERCENT FREQUENCY RESPONSE OF QUANTITATIVE  
 PORTION OF OPINIONNAIRE UTILIZED TO EVALUATE  
 WATER CYCLE ISSUE OF THE ENVIRONMENTAL QUALITY NEWSLETTER

Question Number	<u>Percent Response</u>								
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>no response</u>
1.	82.05	3.85	11.54	1.28	-	-	-	-	1.28
2.	76.92	20.51	-	-	-	-	-	-	2.56
3.	21.79	24.36	33.33	5.13	-	-	-	-	15.38
5.	52.00	21.00	14.00	15.00	06.00	05.00	42.00	01.00	(multiple response)
6.	82.05	10.26	1.28	-	-	-	-	-	6.41
7.	20.51	38.46	19.23	1.28	-	-	-	-	20.51
8.	14.10	33.33	7.69	1.28	-	-	-	-	43.59
9.	30.77	34.62	3.85	0.00	7.69	-	-	-	23.08

TABLE 2

PERCENT FREQUENCY RESPONSE OF QUANTITATIVE  
 PORTION OF OPINIONNAIRE UTILIZED TO EVALUATE  
 ECOLOGY ISSUE OF THE ENVIRONMENTAL QUALITY NEWSLETTER

Question Number	<u>Percent Response</u>								
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>no response</u>
1.	82.93	12.20	4.88	0.00	-	-	-	-	0.00
2.	85.37	14.63	-	-	-	-	-	-	0.00
3.	14.63	39.02	29.27	4.88	-	-	-	-	12.20
5.	48.78	12.20	21.95	17.07	9.76	2.44	46.34	7.32	(multiple response)
6.	80.49	12.20	4.88	-	-	-	-	-	2.44
7.	14.63	53.66	24.39	0.00	-	-	-	-	7.32
8.	17.07	51.22	21.95	0.00	-	-	-	-	9.76
9.	41.46	26.83	12.20	0.00	7.32	-	-	-	12.20

TABLE 3

PERCENT FREQUENCY RESPONSE OF QUANTITATIVE  
 PORTION OF OPINIONNAIRE UTILIZED TO EVALUATE  
 LAND USE ISSUE OF THE ENVIRONMENTAL QUALITY NEWSLETTER

Question Number

	<u>Percent Response</u>								
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>no response</u>
1.	72.97	13.51	2.70	10.81	-	-	-	-	0.00
2.	97.30	2.70	-	-	-	-	-	-	0.00
3.	21.62	21.62	48.65	8.11	-	-	-	-	0.00
5.	8.78	2.36	2.36	2.70	2.36	0.34	7.43	0.00	(multiple response)
6.	94.59	5.41	0.00	-	-	-	-	-	0.00
7.	10.81	64.86	24.32	0.00	-	-	-	-	0.00
8.	16.22	64.86	18.92	0.00	-	-	-	-	0.00
9.	35.14	51.35	8.11	0.00	5.41	-	-	-	0.00

TABLE 4

PERCENT FREQUENCY RESPONSE OF QUANTITATIVE  
 PORTION OF OPINIONNAIRE UTILIZED TO EVALUATE  
 SOLID WASTE ISSUE OF THE ENVIRONMENTAL QUALITY NEWSLETTER

Question Number

	<u>Percent Response</u>								
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>no response</u>
1.	76.47	2.94	8.82	11.76	-	-	-	-	0.00
2.	88.24	11.76	-	-	-	-	-	-	0.00
3.	23.53	26.47	20.59	20.59	-	-	-	-	8.82
5.	8.09	1.84	0.74	2.94	2.21	0.00	7.72	0.37	(Multiple response)
6.	91.18	0.00	5.88	-	-	-	-	-	2.94
7.	29.41	58.82	5.88	0.00	-	-	-	-	5.88
8.	26.47	52.94	14.71	0.00	-	-	-	-	5.88
9.	29.41	44.12	11.76	0.00	5.88	-	-	-	8.82

TABLE 5

KOLMOGOROV-SMIRNOV TWO-SAMPLE TEST\*  
 $H_{0I}$ ,  $H_{0II}$ ,  $H_{0III}$ ,  $H_{0IV}$ ,  $H_{0V}$ ,  $H_{0VI}$   
 "Using the Newsletter Again" (Question VI)

Response	Cumulative	Frequency	Deviation	Response	Cumulative	Frequency	Deviation
$H_{0I}$ $K_D=.31$	Water Cycle	Ecology	D	$H_{0II}$ $K_D=.33$	Water Cycle	Land Use	D
No response	.06	.02	.04	No response	.06	.00	.06
Yes	.88	.82	<u>.06</u>	Yes	.88	.95	<u>.07</u>
Not sure	.98	.94	.04	Not sure	.98	1.00	.02
No	.99	.99	.00	No	.99	1.00	.01
$H_{0III}$ $K_D=.33$	Water Cycle	Solid Waste	D	$H_{0IV}$ $K_D=.37$	Ecology	Land Use	D
No response	.06	.03	.03	No response	.02	.00	.02
Yes	.88	.94	<u>.06</u>	Yes	.82	.95	<u>.11</u>
Not sure	.98	.94	.04	Not sure	.94	1.00	.06
No	.99	1.00	.01	No	.99	1.00	.01
$H_{0V}$ $K_D=.38$	Ecology	Solid Waste	D	$H_{0VI}$ $K_D=.39$	Land Use	Solid Waste	D
No response	.02	.03	.01	No response	.00	.03	.03
Yes	.82	.94	<u>.12</u>	Yes	.95	.94	.01
Not sure	.94	.94	.00	Not sure	1.00	.94	.06
No	.99	1.00	.01	No	1.00	1.00	.00

\* The maximum value for D for each test of the null hypothesis is underlined.

TABLE 6

KOLMOGOROV-SMIRNOV TWO-SAMPLE TEST\*  
 $H_0$ VII,  $H_0$ VIII,  $H_0$ IX,  $H_0$ X,  $H_0$ XI,  $H_0$ XII  
 "How effective was the material" (Question VII)

Response	Cumulative	Frequency	Deviation	Response	Cumulative	Frequency	Deviation
$H_0$ VII $K_D$ = .31	Water Cycle	Ecology	D	$H_0$ VIII $K_D$ = .33	Water Cycle	Land Use	D
No response	.21	.07	.14	No response	.21	.00	.21
Very effective	.42	.22	<u>.20</u>	Very effective	.42	.11	<u>.31</u>
Effective	.80	.76	.04	Effective	.80	.76	.04
Somewhat effective	.99	1.00	.01	Somewhat effective	.99	1.00	.01
No value	1.00	1.00	.00	No value	1.00	1.00	.00
$H_0$ IX $K_D$ = .33	Water Cycle	Solid Waste	D	$H_0$ X $K_D$ = .37	Ecology	Land Use	D
No response	.21	.06	<u>.15</u>	No response	.07	.00	.07
Very effective	.42	.35	<u>.07</u>	Very effective	.22	.11	<u>.11</u>
Effective	.80	.94	.06	Effective	.76	.76	.00
Somewhat effective	.99	1.00	.01	Somewhat effective	1.00	1.00	.00
No value	1.00	1.00	.00	No value	1.00	1.00	.00
$H_0$ XI $K_D$ = .38	Ecology	Solid Waste	D	$H_0$ XII $K_D$ = .39	Land Use	Solid Waste	D
No response	.07	.06	.01	No response	.00	.06	.06
Very effective	.22	.35	.13	Very effective	.11	.35	<u>.24</u>
Effective	.76	.94	<u>.18</u>	Effective	.76	.94	.18
Somewhat effective	1.00	1.00	.00	Somewhat effective	1.00	1.00	.00
No value	1.00	1.00	.00	No value	1.00	1.00	.00

\* The maximum value for D for each test of the null hypothesis is underlined.

TABLE 7

KOLMOGOROV-SMIRNOV TWO-SAMPLE TEST\*  
 $H_0$ XIII,  $H_0$ XIV,  $H_0$ XV,  $H_0$ XVI,  $H_0$ XVII,  $H_0$ XVIII  
 "How important were the learnings gained"(Question VIII)

Response	Cumulative	Frequency	Deviation	Response	Cumulative	Frequency	Deviation
$H_0$ XIII KD=.31	Water Cycle	Ecology	D	$H_0$ XIV KD=.33	Water Cycle	Land Use	D
No response	.44	.10	<u>.34</u>	No response	.44	.00	<u>.44</u>
Very important	.58	.27	<u>.31</u>	Very important	.58	.16	<u>.42</u>
Generally important	.91	.78	.13	Generally important	.91	.81	.10
Somewhat important	.99	1.00	.01	Somewhat important	.99	1.00	.01
Not at all important	1.00	1.00	.00	Not at all important	1.00	1.00	.00
$H_0$ XV KD=.33	Water Cycle	Solid Waste	D	$H_0$ XVI KD=.37	Ecology	Land Use	D
No response	.44	.06	<u>.38</u>	No response	.10	.00	.10
Very important	.58	.32	<u>.26</u>	Very important	.27	.16	<u>.11</u>
Generally important	.91	.85	.06	Generally important	.78	.81	<u>.03</u>
Somewhat important	.99	1.00	.01	Somewhat important	1.00	1.00	.00
Not at all important	1.00	1.00	.00	Not at all important	1.00	1.00	.00
$H_0$ XVII KD=.38	Ecology	Solid Waste	D	$H_0$ XVIII KD=.39	Land Use	Solid Waste	D
No response	.10	.06	.04	No response	.00	.06	.06
Very important	.27	.32	.05	Very important	.16	.32	<u>.16</u>
Generally important	.78	.85	<u>.07</u>	Generally important	.81	.85	<u>.04</u>
Somewhat important	1.00	1.00	.00	Somewhat important	1.00	1.00	.00
Not at all important	1.00	1.00	.00	Not at all important	1.00	1.00	.00

\* The maximum value for D for each test of the null hypothesis is underlined.

TABLE 8

KOLMOGOROV-SMIRNOV TWO-SAMPLE TEST\*  
 $H_0$ XIX,  $H_0$ XX,  $H_0$ XXI,  $H_0$ XXII,  $H_0$ XXIII,  $H_0$ XXIV  
 "Time your class spent using this material" (Question IX)

Response	Cumulative	Frequency	Deviation	Response	Cumulative	Frequency	Deviation
$H_0$ XIX KD=.31	Water Cycle	Ecology	D	$H_0$ XX KD=.33	Water Cycle	Land Use	D
No response	.23	.12	<u>.11</u>	No response	.23	.00	<u>.23</u>
Less than 1 hr.	.54	.53	.01	Less than 1 hr.	.54	.35	<u>.19</u>
1-2 hours	.89	.80	.09	1-2 hours	.89	.86	<u>.03</u>
3-5 hours	.93	.92	.01	3-5 hours	.93	.94	<u>.01</u>
More than 5 hrs.	.93	.92	.01	More than 5 hrs.	.93	.94	<u>.01</u>
Cannot be determined	1.01	.99	.02	Cannot be determined	1.01	.99	<u>.02</u>
$H_0$ XXI KD=.33	Water Cycle	Solid Waste	D	$H_0$ XXII KD=.37	Ecology	Land Use	D
No response	.23	.09	<u>.14</u>	No response	.12	.00	<u>.12</u>
Less than 1 hr.	.54	.38	<u>.16</u>	Less than 1 hr.	.53	.35	<u>.18</u>
1-2 hours	.89	.82	.07	1-2 hours	.80	.86	<u>.06</u>
3-5 hours	.93	.94	.01	3-5 hours	.92	.94	<u>.02</u>
More than 5 hrs.	.93	.94	.01	More than 5 hrs.	.92	.94	<u>.02</u>
Cannot be determined	1.01	1.00	.01	Cannot be determined	.99	.99	<u>.00</u>
$H_0$ XXIII KD=.38	Ecology	Solid Waste	D	$H_0$ XXIV KD=.39	Land Use	Solid Waste	D
No response	.12	.09	<u>.03</u>	No response	.00	.09	<u>.09</u>
Less than 1 hr.	.53	.38	<u>.15</u>	Less than 1 hr.	.35	.38	<u>.04</u>
1-2 hours	.80	.82	.02	1-2 hours	.86	.82	<u>.04</u>
3-5 hours	.92	.94	.02	3-5 hours	.94	.94	<u>.00</u>
More than 5 hrs.	.92	.94	.02	More than 5 hrs.	.94	.94	<u>.00</u>
Cannot be determined	.99	1.00	.01	Cannot be determined	.99	1.00	<u>.01</u>

\* The maximum value for D for each test of the null hypothesis is underlined.

TABLE 9

KOLMOGOROV-SMIRNOV TWO SAMPLE TEST\*  
 $H_0XXV$ ,  $H_0XXVI$ ,  $H_0XXVII$ ,  $H_0XXVIII$

$H_0XXV$  "Using the material again"(Question VI)

Response	Cumulative Frequencies		Deviations
	Environmental Quality Newsletter	Standard Index	D
No response	.03	.20	.17
Yes	.90	.80	.10
Not sure	.97	.97	.00
No	1.00	1.00	.00

$H_0XXVI$  "How effective was the material"(Question VII)

Response	Cumulative Frequencies		Deviations
	Environmental Quality Newsletter	Standard Index	D
No response	.08	.17	.09
Very effective	.27	.31	.04
Effective	.81	.76	.05
Somewhat effective	.99	.99	.00
No value	1.00	1.00	.00

$H_0XXVII$  "How important were the learnings gained"(Question VIII)

Response	Cumulative Frequencies		Deviations
	Environmental Quality Newsletter	Standard Index	D
No response	.15	.18	.03
Very important	.34	.28	.06
Generally important	.83	.71	.12
Somewhat important	.99	.99	.00
Not at all important	1.00	1.00	.00

$H_0XXVIII$  "Time your class spent using this material"(Question VIII)

Response	Cumulative Frequencies		Deviations
	Environmental Quality Newsletter	Standard Index	D
No response	.11	.18	.07
Less than 1 hr.	.46	.41	.05
1-2 hours	.85	.70	.15
3-5 hours	.94	.80	.14
More than 5 hrs.	.94	.83	.11
Cannot be determined	1.00	1.00	.00

\* The maximum values of D were computed to be  $H_0XXV$  = .17,  $H_0XXVI$  = .09,  $H_0XXVII$  = .12,  $H_0XXVIII$  = .15, whereas the critical values of  $K_D$  were  $H_0XXV$  = .26,  $H_0XXVI$  = .26,  $H_0XXVII$  = .26, and  $H_0XXVIII$  = .26.

APPENDIX A

ENVIRONMENTAL QUALITY NEWSLETTER OPINIONNAIRE

Fellow Teacher:

The purpose of the "Environmental Quality Newsletter" is to provide you and your class with current and relevant information regarding our environment. Please take a few moments to complete this opinionnaire and return it via school mail or postal mail service (see reverse side). Your assistance is appreciated.

Please answer the following questions concerning yourself and your school. Place the number of the most appropriate response in the blank to the right.

1. I teach in:  
1) South Bend  
2) Penn-Harris-Madison  
3) Mishawaka  
4) Other, please specify: \_\_\_\_\_
  
2. Did you use the materials in your class?  
1) Yes  
2) No \_\_\_\_\_
  
3. If you answered "yes" to the above question, indicate the grade level in which you used the material.  
1) Fourth  
2) Fifth  
3) Sixth  
4) Other, please specify \_\_\_\_\_
  
4. If you answered "no" to question 2, please give reason(s):  
\_\_\_\_\_  
\_\_\_\_\_
  
5. What use did you make of the material after you received it?  
1) As supplementary material  
2) As basic material for an instructional unit  
3) As teacher reference material  
4) As part of a display  
5) As material for more capable students  
6) As material for less capable students  
7) As material for the entire class  
8) Other, please specify \_\_\_\_\_



Please place my name on your "SPECIAL REQUEST" mail list.

Name: \_\_\_\_\_ School: \_\_\_\_\_

Number of Students: \_\_\_\_\_

Please fold and return via school mail to the appropriate administrator.

Mr. John Davis                      South Bend Community Schools

Dr. Terry Jackson                  Mishawaka Schools

Mr. Fred Menchinger                Penn-Harris-Madison Schools

If your school is not in the South Bend, Mishawaka, or Penn-Harris-Madison school system, return the opinionnaire by mailing to:

Neil V. Weber  
Department of Earth Sciences  
Indiana University at South Bend  
South Bend, Indiana 46615