

https://dspace.org/

Chemical reactivity: teaching and learning problems and attempted solutions

Bapoo, Abdool Hamid

2016-06-10
http://hdl.handle.net/10539/20457

Downloaded from a DSpace repository. https://dspace.org/

APPENDIX G1

COMPARISON OF STANDARD 10 STUDENTS RESULTS FOR THE REACTIVITY AND RATE AND EQUILIBRIUM QUESTIONNAIRE

Students t-test

Std 10 responses to Std 8 & 10 questionnaires

for the same students

Ttest procedure

Variable: Mark

Std	N	Mean	Std Dev	Std Error
Eight	82	1.68292683	1.21592366	0.13427631
Ten	82	1.76829268	1.29861066	0.14340756

Variances	T	DF	Prob> Abs.T
Unequal	-0.4345	161.3	0.6645
Equal	-0.4345	162.0	0.6645

For H0: Variances are equal, F' = 1.14 DF = (81,81)
Prob>F' = 0.5551

APPENDIX G1

School: School no.6, Std 10
Question 6

Answer	Frequency	Percent
A	4	16.0
B	5	20.0
C	2	8.0
D	9	36.0
*E	5	20.0

School: School no.6, Std 10
Question 7

Answer	Frequency	Percent
A	4	16.0
B	3	12.0
*C	9	36.0
D	4	16.0
E	5	20.0

School: School no.6, Std 10
Question 1

Answer	Frequency	Percent
A	8	32.0
B	3	12.0
C	3	12.0
D	5	20.0
*E	6	24.0

School: School no.6, Std 10
Question 2

Answer	Frequency	Percent
A	1	4.0
B	6	24.0
*C	6	24.0
D	10	40.0
E	1	4.0
X	1	4.0

School: School no.6, Std 10
Question 3

Answer	Frequency	Percent
A	3	12.0
B	7	28.0
C	4	16.0
*D	8	32.0
E	3	12.0

School: School no.6, Std 10
Question 4

Answer	Frequency	Percent
A	3	12.0
B	1	4.0
C	9	36.0
D	2	8.0
*E	10	40.0

School: School no.6, Std 10
Question 5

Answer	Frequency	Percent
A	12	48.0
B	1	4.0
D	8	32.0
F	4	16.0

School: School no.5, Std 10
Question 3

Answer	Frequency	Percent
A	1	2.3
B	9	20.5
C	6	13.6
*D	9	20.5
E	19	43.2

School: School no.5, Std 10
Question 4

Answer	Frequency	Percent
A	13	29.5
B	7	15.9
C	12	27.3
D	2	4.5
*E	9	20.5
X	1	2.3

School: School no.5, Std 10
Question 5

Answer	Frequency	Percent
A	19	43.2
B	4	9.1
*C	4	9.1
D	4	9.1
E	13	29.5

School: School no.5, Std 10
Question 6

Answer	Frequency	Percent
A	15	34.1
B	6	13.6
C	5	11.4
D	14	31.8
*E	4	9.1

School: School no.5, Std 10
Question 7

Answer	Frequency	Percent
A	7	15.9
B	5	11.4
*C	22	50.0
D	8	18.2
E	2	4.5

School: School no.4, Std 10
Question 5

Answer	Frequency	Percent
A	21	48.8
B	4	9.3
*C	2	4.7
D	11	25.6
E	5	11.6

School: School no.4, Std 10
Question 6

Answer	Frequency	Percent
A	10	23.3
B	3	7.0
C	4	9.3
D	16	37.2
*E	9	20.9
X	1	2.3

School: School no.4, Std 10
Question 7

Answer	Frequency	Percent
A	8	18.6
B	21	48.8
*C	8	18.6
D	4	9.3
E	2	4.7

School: School no.5, Std 10
Question 1

Answer	Frequency	Percent
A	16	36.4
B	8	18.2
C	6	13.6
D	3	6.8
*E	11	25.0

School: School no.5, Std 10
Question 2

Answer	Frequency	Percent
A	2	4.5
B	16	36.4
*C	12	27.3
D	11	25.0
E	3	6.8

School: School no.3, Std 10
Question 7

Answer	Frequency	Percent
A	12	37.5
B	9	28.1
*C	9	28.1
D	1	3.1
E	1	3.1

School: School no.4, Std 10
Question 1

Answer	Frequency	Percent
A	17	39.5
B	5	11.6
C	4	9.3
D	4	9.3
*E	13	30.2

School: School no.4, Std 10
Question 2

Answer	Frequency	Percent
A	2	4.7
B	14	32.6
*C	13	30.2
D	10	23.3
E	4	9.3

School: School no.4, Std 10
Question 3

Answer	Frequency	Percent
A	2	4.7
B	13	30.2
C	5	11.6
*D	15	34.9
E	8	18.6

School: School no.4, Std 10
Question 4

Answer	Frequency	Percent
A	13	30.2
B	4	9.3
C	11	25.6
D	1	2.3
*E	13	30.2
X	1	2.3

School: School no.3, Std 10
Question 2

Answer	Frequency	Percent
A	3	9.4
B	11	34.4
*C	11	34.4
D	6	18.8
E	1	3.1

School: School no.3, Std 10
Question 3

Answer	Frequency	Percent
A	2	6.3
B	6	18.8
C	2	6.3
*D	12	37.5
E	10	31.3

School: School no.3, Std 10
Question 4

Answer	Frequency	Percent
A	10	31.3
B	5	15.6
C	1	3.1
D	7	21.9
*E	9	28.1

School: School no.3, Std 10
Question 5

Answer	Frequency	Percent
A	6	18.8
B	7	21.9
*C	2	6.3
D	11	34.4
E	6	18.8

School: School no.3, Std 10
Question 6

Answer	Frequency	Percent
A	7	21.9
B	6	18.8
C	6	18.8
D	7	21.9
*E	6	18.8

School: School no.2, Std 10
Question 4

Answer	Frequency	Percent
A	17	32.7
B	11	21.2
C	10	19.2
D	1	1.9
*E	13	25.0

School: School no.2, Std 10
Question 5

Answer	Frequency	Percent
A	9	17.3
B	8	15.4
*C	4	7.7
D	22	42.3
E	9	17.3

School: School no.2, Std 10
Question 6

Answer	Frequency	Percent
A	13	25.0
B	7	13.5
C	3	5.8
D	20	38.5
*E	9	17.3

School: School no.2, Std 10
Question 7

Answer	Frequency	Percent
A	9	17.3
B	11	21.2
*C	23	44.2
D	6	11.5
E	3	5.8

School: School no.3, Std 10
Question 1

Answer	Frequency	Percent
A	16	50.0
B	4	12.5
C	5	15.6
D	5	15.6
*E	2	6.3

School: School no.1, Std 10
Question 6

Answer	Frequency	Percent
A	13	33.3
B	1	2.6
C	10	25.6
D	2	5.1
*E	10	25.6
X	3	7.7

School: School no.1, Std 10
Question 7

Answer	Frequency	Percent
A	2	5.1
B	22	56.4
*C	8	20.5
D	4	10.3
E	3	7.7

School: School no.2, Std 10
Question 1

Answer	Frequency	Percent
A	23	44.2
B	3	5.8
C	5	9.6
D	12	23.1
*E	9	17.3

School: School no.2, Std 10
Question 2

Answer	Frequency	Percent
A	6	11.5
B	25	48.1
*C	10	19.2
D	11	21.2

School: School no.2, Std 10
Question 3

Answer	Frequency	Percent
A	5	9.6
B	18	34.6
C	12	23.1
*D	13	25.0
E	3	5.8
X	1	1.9

Std 10's responses per school.

School: School no.1, Std 10
Question 1

Answer	Frequency	Percent
A	4	10.3
B	13	33.3
D	5	12.8
*E	17	43.6

School: School no.1, Std 10
Question 2

Answer	Frequency	Percent
A	15	38.5
B	10	25.6
*C	1	2.6
D	5	12.8
E	8	20.5

School: School no.1, Std 10
Question 3

Answer	Frequency	Percent
A	1	2.6
B	17	43.6
C	4	10.3
*D	13	33.3
E	4	10.3

School: School no.1, Std 10
Question 4

Answer	Frequency	Percent
A	10	25.6
B	1	2.6
C	5	12.8
D	1	2.6
*E	22	56.4

School: School no.1, Std 10
Question 5

Answer	Frequency	Percent
A	16	41.0
B	1	2.6
*C	1	2.6
D	8	20.5
E	13	33.3

Std 10 responses to std 8 questionnaire: All schools

Question 4

Answer	Frequency	Percent
*A	94	40.0
B	40	17.0
C	27	11.5
D	42	17.9
E	31	13.2
X	1	0.4

Question 5

Answer	Frequency	Percent
A	61	26.0
B	13	5.5
C	27	11.5
D	102	43.4
*E	30	12.8
X	2	0.9

Question 6

Answer	Frequency	Percent
A	17	7.2
B	27	11.5
C	105	44.7
*D	42	17.9
E	43	18.3
X	1	0.4

Question 7

Answer	Frequency	Percent
A	26	11.1
B	106	45.1
*C	42	17.9
D	30	12.8
E	30	12.8
X	1	0.4

Std 10 responses to Std 8 questionnaire: All schools

Question 8

Answer	Frequency	Percent
A	20	8.5
B	79	33.6
C	23	9.8
D	89	37.9
*E	23	9.8
X	1	0.4

OBS	EIGHTH1	EIGHTH2	EIGHTH3	EIGHTH4	EIGHTH5	EIGHTH6	EIGHTH7	EIGHTH8	MQ81	MQ82	MQ83	MQ84	MQ85	MQ86	MQ87	MQ88	TOTEIGHTH	SCHOOL	STD
133	A	B	D	A	D	C	B	B	0	1	0	1	0	0	0	0	2	School no.2	8
134	A	B	D	A	D	D	C	D	0	1	0	1	0	1	1	0	4	School no.2	8
135	A	B	C	E	D	C	A	D	0	1	0	0	0	0	0	0	1	School no.2	8
136	A	B	E	A	D	B	B	B	0	1	1	1	0	0	0	0	3	School no.2	8
137	A	B	C	E	D	B	A	D	0	1	0	0	0	0	0	0	1	School no.2	8
138	E	E	B	D	X	B	B	D	0	0	0	0	0	0	0	0	0	School no.2	8
139	A	B	C	C	A	B	B	D	0	1	0	0	0	0	0	0	1	School no.2	8
140	A	B	C	A	D	C	A	D	0	1	0	1	0	0	0	0	2	School no.2	8
141	A	C	A	A	C	C	D	D	0	0	0	1	0	.	0	0	1	School no.2	8
142	A	B	D	D	D	C	B	B	0	1	0	0	0	0	0	0	1	School no.2	8
143	A	B	C	D	C	D	C	D	0	1	0	0	0	1	1	0	3	School no.2	8
144	A	B	D	A	C	D	C	D	0	1	0	1	0	1	1	0	4	School no.2	8
145	A	E	C	E	A	C	B	A	0	0	0	0	0	0	0	0	0	School no.2	8
146	A	B	C	C	A	A	C	D	0	1	0	0	0	0	1	0	2	School no.2	8
147	A	D	C	A	D	C	B	B	0	0	0	1	0	0	0	0	1	School no.2	8
148	A	D	A	C	E	E	B	B	0	0	0	0	1	0	0	0	1	School no.2	8
149	A	A	C	E	D	C	A	D	0	0	0	0	0	0	0	0	0	School no.2	8
150	A	A	C	C	A	C	A	A	0	0	0	0	0	0	0	0	0	School no.2	8
151	D	B	C	A	A	B	B	B	1	1	0	1	0	0	0	0	3	School no.2	8
152	E	B	C	A	D	B	B	B	0	1	0	1	0	0	0	0	2	School no.2	8
153	A	B	E	X	A	D	B	D	0	1	1	0	0	1	0	0	3	School no.2	8
154	D	B	E	C	D	A	D	D	1	1	1	0	0	0	0	0	3	School no.2	8
155	C	A	C	B	B	B	D	E	0	0	0	0	0	0	0	1	1	School no.2	8
156	D	E	E	E	A	E	C	A	1	0	1	0	0	0	1	0	3	School no.2	8
157	D	B	C	E	D	A	C	D	1	1	0	0	0	0	1	0	3	School no.2	8
158	E	A	C	B	D	B	B	A	0	0	0	0	0	0	0	0	0	School no.2	8
159	E	E	D	E	E	D	C	D	0	0	0	0	1	1	1	0	3	School no.2	8
160	E	A	C	A	D	C	B	D	0	0	0	1	0	0	0	0	1	School no.2	8
161	C	B	C	A	E	D	C	D	0	1	0	1	1	1	1	0	5	School no.2	8
162	D	A	C	A	A	B	E	A	1	0	0	1	0	0	0	0	2	School no.2	8
163	B	B	C	B	D	D	B	B	0	1	0	0	0	1	0	0	2	School no.2	8
164	D	B	E	C	E	D	C	D	1	1	1	0	1	1	1	0	6	School no.2	8
165	C	A	E	A	D	C	C	A	0	0	1	1	0	0	1	0	3	School no.2	8
166	D	B	D	E	A	D	C	B	1	1	0	0	0	1	1	0	4	School no.2	8
167	E	E	E	E	D	D	C	D	0	0	1	0	0	1	1	0	3	School no.2	8
168	E	B	E	D	D	C	E	D	0	1	1	0	0	0	0	0	2	School no.2	8
169	D	E	C	C	D	D	C	A	1	0	0	0	0	1	1	0	3	School no.2	8
170	E	E	D	E	D	A	C	B	0	0	0	0	0	0	1	0	1	School no.2	8
171	E	B	E	A	C	D	C	D	0	1	1	1	0	1	1	0	5	School no.2	8
172	C	B	B	E	D	D	A	D	0	1	0	0	0	1	0	0	2	School no.2	8
173	D	E	C	B	C	C	B	D	1	0	0	0	0	0	0	0	1	School no.2	8
174	D	B	E	A	D	E	B	B	1	1	1	1	0	0	0	0	4	School no.2	8
175	D	B	C	X	A	A	B	B	1	1	0	0	0	0	0	0	2	School no.2	8
176	D	A	C	C	A	A	B	B	1	0	0	0	0	0	0	0	1	School no.2	8
177	E	B	A	B	A	C	B	D	0	1	0	0	0	0	0	0	1	School no.2	8
178	A	A	C	C	A	C	A	A	0	0	0	0	0	0	0	0	0	School no.2	8
179	D	D	C	A	D	B	B	D	1	0	0	1	0	0	0	0	2	School no.2	8

	E	E	E	E	E	E	E	E								T O T		S C H O O L		S T D
	I	I	I	I	I	I	I	I	M	M	M	M	M	M	M	E				
	G	G	G	G	G	G	G	G	C	C	C	C	C	C	C	I				
O	H	H	H	H	H	H	H	H	Q	Q	Q	Q	Q	Q	Q	G				
B	T	T	T	T	T	T	T	T	8	8	8	8	8	8	8	H				
S	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	T			
88	A	B	C	D	C	B	B	B	0	1	0	0	0	0	0	0	1	School	no.4	8
89	D	E	C	C	C	B	E	A	1	0	0	0	0	0	0	0	1	School	no.4	8
90	E	B	C	A	A	C	C	B	0	1	0	1	0	0	1	0	3	School	no.4	8
91	A	B	C	B	E	C	D	A	0	1	0	0	1	0	0	0	2	School	no.4	8
92	D	B	E	C	D	B	B	C	1	1	1	0	0	0	0	0	3	School	no.4	8
93	E	D	C	B	A	B	C	D	0	0	0	0	0	0	1	0	1	School	no.4	8
94	A	B	B	C	E	C	A	D	0	1	0	0	1	0	0	0	2	School	no.4	8
95	A	E	C	B	D	C	A	E	0	0	0	0	0	0	0	1	1	School	no.4	8
96	A	B	B	C	D	E	E	C	0	1	0	0	0	0	0	0	1	School	no.4	8
97	A	B	C	A	D	C	C	D	0	1	0	1	0	0	1	0	3	School	no.4	8
98	A	B	D	A	D	C	B	E	0	1	0	1	0	0	0	1	3	School	no.4	8
99	E	B	D	E	D	B	A	B	0	1	0	0	0	0	0	0	1	School	no.4	8
100	A	B	C	A	A	C	E	D	0	1	0	1	0	0	0	0	2	School	no.4	8
101	A	B	D	A	E	D	B	D	0	1	0	1	1	1	0	0	4	School	no.4	8
102	A	B	D	A	D	C	E	A	0	1	0	1	0	0	0	0	2	School	no.4	8
103	E	A	C	E	A	C	C	E	0	0	0	0	0	0	1	1	2	School	no.4	8
104	A	A	C	C	D	E	A	B	0	0	0	0	0	0	0	0	0	School	no.4	8
105	D	A	E	C	A	C	B	D	1	0	1	0	0	0	0	0	2	School	no.4	8
106	A	B	D	C	D	C	E	A	0	1	0	0	0	0	0	0	1	School	no.4	8
107	A	A	D	A	D	C	B	A	0	0	0	1	0	0	0	0	1	School	no.4	8
108	A	B	C	A	D	C	B	D	0	1	0	1	0	0	0	0	2	School	no.4	8
109	A	A	C	C	A	C	B	D	0	0	0	0	0	0	0	0	0	School	no.4	8
110	A	B	A	A	D	C	B	B	0	1	0	1	0	0	0	0	2	School	no.4	8
111	A	B	C	A	D	C	B	D	0	1	0	1	0	0	0	0	2	School	no.4	8
112	A	B	C	A	D	C	B	D	0	1	0	1	0	0	0	0	2	School	no.4	8
113	A	B	C		D	C	E	B	0	1	0	0	0	0	0	0	1	School	no.4	8
114	A	A	C	A	D	C	A	B	0	0	0	1	0	0	0	0	1	School	no.4	8
115	A	B	C		A	C	B	B	0	1	0	0	0	0	0	0	1	School	no.4	8
116	A	B	C	B	A	C	B	B	0	1	0	0	0	0	0	0	1	School	no.4	8
117	A	B	D	A	D	A	D	B	0	1	0	1	0	0	0	0	2	School	no.4	8
118	A	A	C	A	A	C	B	B	0	0	0	1	0	0	0	0	1	School	no.4	8
119	A	B	D	A	E	C	B	B	0	1	0	1	1	0	0	0	3	School	no.4	8
120	A	A	C	B	E	D	C	D	0	0	0	0	1	1	1	0	3	School	no.4	8
121	A	B	D	A	D	B	C	D	0	1	0	1	0	0	1	0	3	School	no.4	8
122	D	A	C	C	B	E	B	B	1	0	0	0	0	0	0	0	1	School	no.4	8
123	A	A	A	E	A	B	A	D	0	0	0	0	0	0	0	0	0	School	no.2	8
124	A	E	A	B	A	B	E	D	0	0	0	0	0	0	0	0	0	School	no.2	8
125	D	D	A	B	A	B	D	E	1	0	0	0	0	0	0	1	2	School	no.2	8
126	A	E	C	A	D	D	C	A	0	0	0	1	0	1	1	0	3	School	no.2	8
127	A	D	D	B	D	C	E	B	0	0	0	0	0	0	0	0	0	School	no.2	8
128	A	B	C	C	D	B	B	D	0	1	0	0	0	0	0	0	1	School	no.2	8
129	A	D	C	C	A	A	B	D	0	0	0	0	0	0	0	0	0	School	no.2	8
130	A	D	C	D	D	E	C	D	0	0	0	0	0	0	1	0	1	School	no.2	8
131	A	B	D	D	A	B	B	D	0	1	0	0	0	0	0	0	1	School	no.2	8
132	A	B	D	E	D	B	B	E	0	1	0	0	0	0	0	1	2	School	no.2	8

OBS	EIG1	EIG2	EIG3	EIG4	EIG5	EIG6	EIG7	EIG8	MQ81	MQ82	MQ83	MQ84	MQ85	MQ86	MQ87	MQ88	TOTEIGH	SCHOOL	STD
43	A	B	C	C	A	B	C	B	0	1	0	0	0	0	1	0	2	School no.5	8
44	A	B	C	B	A	B	C	D	0	1	0	0	0	0	1	0	2	School no.5	8
45	E	D	C	E	A	B	C	B	0	0	0	0	0	0	1	0	1	School no.5	8
46	A	B	C	B	D	B	C	D	0	1	0	0	0	0	1	0	2	School no.5	8
47	E	B	A	E	A	D	C	C	0	1	0	0	0	1	1	0	3	School no.5	8
48	E	D	C	E	A	B	C	D	0	0	0	0	0	0	1	0	1	School no.5	8
49	E	B	D	A	D	D	C	D	0	1	0	1	0	1	1	0	4	School no.5	8
50	E	B	C	A	D	B	X	D	0	1	0	1	0	0	0	0	2	School no.5	8
51	A	B	C	D	A	D	E	B	0	1	0	0	0	1	0	0	2	School no.5	8
52	A	E	C	C	A	B	C	A	0	0	0	0	0	0	1	0	1	School no.5	8
53	A	B	C	A	D	D	B	E	0	1	0	1	0	1	0	1	4	School no.5	8
54	A	A	C	A	E	C	B	D	0	0	0	1	1	0	0	0	2	School no.5	8
55	E	B	C	A	D	C	B	E	0	1	0	1	0	0	0	1	3	School no.5	8
56	E	B	C	A	D	C	B	E	0	1	0	1	0	0	0	1	3	School no.5	8
57	E	B	C	A	D	C	B	E	0	1	0	1	0	0	0	1	3	School no.5	8
58	A	B	E	A	D	C	B	E	0	1	1	1	0	0	0	1	4	School no.5	8
59	A	B	C	C	E	B	E	D	0	1	0	0	1	0	0	0	2	School no.5	8
60	A	B	C	A	D	D	B	E	0	1	0	1	0	1	0	1	4	School no.5	8
61	A	B	C	A	D	C	B	E	0	1	0	1	0	0	0	1	3	School no.5	8
62	A	B	C	A	D	B	B	E	0	1	0	1	0	0	0	1	3	School no.5	8
63	A	B	A	C	D	C	B	E	0	1	0	0	0	0	0	1	2	School no.5	8
64	A	B	C	B	D	C	B	D	0	1	0	0	0	0	0	0	1	School no.5	8
65	A	B	A	A	D	E	B	E	0	1	0	1	0	0	0	1	3	School no.5	8
66	A	B	C	D	E	C	B	E	0	1	0	0	1	0	0	1	3	School no.5	8
67	A	B	C	A	D	D	B	E	0	1	0	1	0	1	0	1	4	School no.5	8
68	E	B	C	A	D	C	B	E	0	1	0	1	0	0	0	1	3	School no.5	8
69	A	B	C	A	D	D	C	E	0	1	0	1	0	1	1	1	5	School no.5	8
70	E	B	C	A	D	C	B	E	0	1	0	1	0	0	0	1	3	School no.5	8
71	E	B	C	A	A	C	B	A	0	1	0	1	0	0	0	0	2	School no.5	8
72	A	A	D	E	D	D	B	D	0	0	0	0	0	1	0	0	1	School no.5	8
73	A	B	E	A	D	C	B	E	0	1	1	1	0	0	0	1	4	School no.5	8
74	A	D	D	A	A	C	E	E	0	0	0	1	0	0	0	1	2	School no.5	8
75	A	C	A	A	A	B	A	B	0	0	0	1	0	0	0	0	1	School no.4	8
76	A	D	D	A	A	B	A	B	0	0	0	1	0	0	0	0	1	School no.4	8
77	A	A	C	D	C	E	C	B	0	0	0	0	0	0	1	0	1	School no.4	8
78	A	A	D	D	A	C	A	E	0	0	0	0	0	0	0	1	1	School no.4	8
79	A	B	C	D	D	E	B	A	0	1	0	0	0	0	0	0	1	School no.4	8
80	B	B	A	C	D	B	C	A	0	1	0	0	0	0	1	0	2	School no.4	8
81	A	A	A	B	E	C	E	D	0	0	0	0	1	0	0	0	1	School no.4	8
82	A	A	C	B	A	C	E	D	0	0	0	0	0	0	0	0	0	School no.4	8
83	A	A	C	C	C	B	D	B	0	0	0	0	0	0	0	0	0	School no.4	8
84	C	B	E	B	A	B	B	E	0	1	1	0	0	0	0	1	3	School no.4	8
85	B	D	B	C	A	C	E	C	0	0	0	0	0	0	0	0	0	School no.4	8
86	E	A	A	B	B	B	C	D	0	0	0	0	0	0	1	0	1	School no.4	8
87	A	A	D	B	B	B		A	0	0	0	0	0	0	0	0	0	School no.4	8

APPENDIX I1

INDIVIDUAL STUDENT RESPONSES TO THE REACTIVITY AND RATE AND EQUILIBRIUM QUESTIONNAIRES

Number of correct responses std 8 questionnaire: std 8 & 10

OBS	ITEM 1	ITEM 2	ITEM 3	ITEM 4	ITEM 5	ITEM 6	ITEM 7	ITEM 8	MCQ 1	MCQ 2	MCQ 3	MCQ 4	MCQ 5	MCQ 6	MCQ 7	MCQ 8	TOTAL	SCHOOL	STD
1	A	B	C	C	D	D	E	E	0	1	0	0	0	1	0	1	3	School no.5	8
2	A	B	C	C	B	D	B	A	0	1	0	0	0	1	0	0	2	School no.5	8
3	A	B	B	A	A	C	B	E	0	1	0	1	0	0	0	1	3	School no.5	8
4	A	B	C	A	C	C	D	E	0	1	0	1	0	0	0	1	3	School no.5	8
5	A	B	D	A	D	C	C	D	0	1	0	1	0	0	1	0	3	School no.5	8
6	A	B	D	B	D	B	C	D	0	1	0	0	0	0	1	0	2	School no.5	8
7	A	B	D	B	D	D	C	D	0	1	0	0	0	1	1	0	3	School no.5	8
8	A	B	C	A	B	C	C	E	0	1	0	1	1	0	1	1	5	School no.5	8
9	A	B	C	A	E	D	C	E	0	1	0	1	1	1	1	1	6	School no.5	8
10	A	B	E	E	D	D	B	D	0	1	1	0	0	1	0	0	3	School no.5	8
11	A	B	C	A	E	E	C	D	0	1	0	1	1	0	1	0	4	School no.5	8
12	A	B	C	A	C	E	B	D	0	1	0	1	0	0	0	0	2	School no.5	8
13	A	B	E	A	D	E	B	D	0	1	1	1	0	0	0	0	3	School no.5	8
14	A	B	C	A	D	D	E	A	0	1	0	1	0	1	0	0	3	School no.5	8
15	A	A	C	A	D	D	C	D	0	0	0	1	0	1	1	0	3	School no.5	8
16	A	B	C	A	D	B	B	E	0	1	0	1	0	0	0	1	3	School no.5	8
17	A	B	C	C	B	C	E	E	0	1	0	0	0	0	0	1	2	School no.5	8
18	A	B	D	B	D	E	B	D	0	1	0	0	0	0	0	0	1	School no.5	8
19	A	B	C	D	E	B	X	E	0	1	0	0	1	0	0	1	3	School no.5	8
20	A	B	C	A	A	C	D	A	0	1	0	1	0	0	0	0	2	School no.5	8
21	A	B	C	A	A	D	C	E	0	1	0	1	0	1	1	1	5	School no.5	8
22	A	B	D	A	A	A	B	D	0	1	0	1	0	0	0	0	2	School no.5	8
23	E	A	C	B	A	B	D	D	0	0	0	0	0	0	0	0	0	School no.5	8
24	A	A	C	A	A	E	B	B	0	0	0	1	0	0	0	0	1	School no.5	8
25	A	B	C	A	E	C	D	B	0	1	0	1	1	0	0	0	3	School no.5	8
26	A	B	C	A	C	B	B	D	0	1	0	1	0	0	0	0	2	School no.5	8
27	A	B	C	B	D	C	B	E	0	1	0	0	0	0	0	1	2	School no.5	8
28	A	B	C	B	E	D	C	E	0	1	0	0	1	1	1	1	5	School no.5	8
29	A	B	E	A	A	D	C	E	0	1	1	1	0	1	1	1	6	School no.5	8
30	A	B	C	C	A	A	A	E	0	1	0	0	0	0	0	1	2	School no.5	8
31	A	C	D	A	A	A	A	E	0	0	0	1	0	0	0	1	2	School no.5	8
32	A	E	C	A	A	D	C	E	0	0	0	1	0	1	1	1	4	School no.5	8
33	A	E	C	A	E	D	C	E	0	0	0	1	1	1	1	1	5	School no.5	8
34	D	B	C	A	A	D	B	C	1	1	0	1	0	1	0	0	4	School no.5	8
35	D	B	C	A	A	E	B	D	1	1	0	1	0	0	0	0	3	School no.5	8
36	A	A	C	A	C	D	B	C	0	0	0	1	0	1	0	0	2	School no.5	8
37	A	A	C	A	X	D	B	D	0	0	0	1	0	1	0	0	2	School no.5	8
38	D	A	A	C	C	D	D	C	1	0	0	0	0	1	0	0	2	School no.5	8
39	A	A	C	A	C	B	C	A	0	0	0	1	0	0	1	0	2	School no.5	8
40	A	D	C	A	A	E	E	E	0	0	0	1	0	0	0	1	2	School no.5	8
41	A	D	E	B	C	B	X	E	0	0	1	0	0	0	0	1	2	School no.5	8
42	A	B	C	D	E	D	C	C	0	1	0	0	1	1	1	0	4	School no.5	8

APPENDIX I1

STD 10 RATE AND EQUILIBRIUM QUESTIONNAIRE

Analysis Variable : Totten

School=School no.1

N	Mean	Std Dev	Minimum	Maximum
39	1.8461538	1.3286016	0	4.0000000

School=School no.2

N	Mean	Std Dev	Minimum	Maximum
52	1.5576923	1.0921011	0	5.0000000

School=School no.3

N	Mean	Std Dev	Minimum	Maximum
32	1.5937500	1.0115263	0	4.0000000

School=School no.4

N	Mean	Std Dev	Minimum	Maximum
43	1.6976744	1.2823877	0	5.0000000

School=School no.5

N	Mean	Std Dev	Minimum	Maximum
44	1.6136364	1.1455863	0	5.0000000

School=School no.6

N	Mean	Std Dev	Minimum	Maximum
25	1.7600000	1.3000000	0	6.0000000

COMPARISON OF DIFFERENT SCHOOL RESULTS FOR STD 10 RATE AND EQUILIBRIUM QUESTIONNAIRE

General Linear Models Procedure

T tests (LSD) for variable: Totten

Note: This test controls the type I comparisonwise error rate not the experimentwise error rate.

Alpha= 0.05 Confidence= 0.95 df= 229 MSE= 1.422202
Critical Value of T= 1.97038

Comparisons significant at the 0.05 level are indicated by '***'.

School Comparison	Lower Confidence Limit	Difference Between Means	Upper Confidence Limit
School no.1 - School no.6	-0.5159	0.0862	0.6882
School no.1 - School no.4	-0.3711	0.1485	0.6681
School no.1 - School no.5	-0.2843	0.2325	0.7493
School no.1 - School no.3	-0.3081	0.2524	0.8129
School no.1 - School no.2	-0.2093	0.2885	0.7862
School no.6 - School no.1	-0.6882	-0.0862	0.5159
School no.6 - School no.4	-0.5287	0.0623	0.6533
School no.6 - School no.5	-0.4422	0.1464	0.7349
School no.6 - School no.3	-0.4610	0.1662	0.7935
School no.6 - School no.2	-0.3696	0.2023	0.7742
School no.4 - School no.1	-0.6681	-0.1485	0.3711
School no.4 - School no.6	-0.6533	-0.0623	0.5287
School no.4 - School no.5	-0.4198	0.0840	0.5879
School no.4 - School no.3	-0.4447	0.1039	0.6525
School no.4 - School no.2	-0.3444	0.1400	0.6243
School no.5 - School no.1	-0.7493	-0.2325	0.2843
School no.5 - School no.6	-0.7349	-0.1464	0.4422
School no.5 - School no.4	-0.5879	-0.0840	0.4198
School no.5 - School no.3	-0.5260	0.0199	0.5658
School no.5 - School no.2	-0.4254	0.0559	0.5373
School no.3 - School no.1	-0.8129	-0.2524	0.3081
School no.3 - School no.6	-0.7935	-0.1662	0.4610
School no.3 - School no.4	-0.6525	-0.1039	0.4447
School no.3 - School no.5	-0.5658	-0.0199	0.5260
School no.3 - School no.2	-0.4919	0.0361	0.5640
School no.2 - School no.1	-0.7862	-0.2885	0.2093
School no.2 - School no.6	-0.7742	-0.2023	0.3696
School no.2 - School no.4	-0.6243	-0.1400	0.3444
School no.2 - School no.5	-0.5373	-0.0559	0.4254
School no.2 - School no.3	-0.5640	-0.0361	0.4919

APPENDIX H1

COMPARISON OF DIFFERENT SCHOOL RESULTS FOR STD 10 RATE AND EQUILIBRIUM QUESTIONNAIRE

General linear models procedure
Class level information

Class	Levels	Values
School	6	School no.1,School no.2,School no.3,School no.4 School no.5,School no.6

Number of observations in data set = 235

COMPARISON OF DIFFERENT SCHOOL RESULTS FOR STD 10 QUESTIONNAIRE

General Linear Models Procedure

Dependent Variable: Totten

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	2.4264565	0.4852913	0.34	0.8875
Error	229	325.6841818	1.4222017		
Corrected Total	234	328.1106383			

R-Square	C.V.	Root MSE	Totten Mean
0.007395	71.49281	1.1926	1.6681

Source	DF	Type I SS	Mean Square	F Value	Pr > F
School	5	2.4264565	0.4852913	0.34	0.8875

Source	DF	Type III SS	Mean Square	F Value	Pr > F
School	5	2.4264565	0.4852913	0.34	0.8875

APPENDIX H1

Students t-test

STD 10 RESPONSES TO STD 8 & 10 REACTIVITY AND RATE AND EQUILIBRIUM QUESTIONNAIRE FOR THE SAME STUDENTS

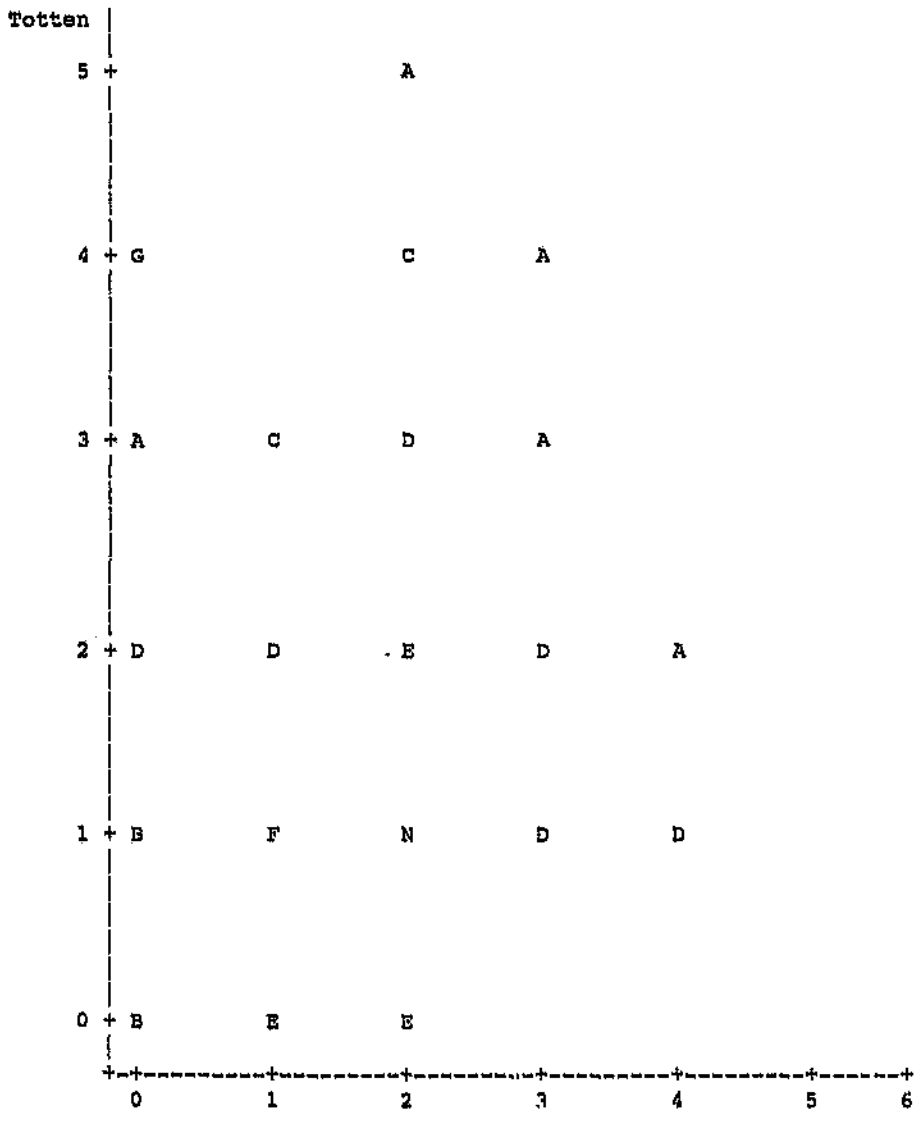
Paired Differences

Analysis Variable : Diff

N	Mean	Std Error	T	Prob>|T|
82	0.0853659	0.2083771	0.4096700	0.6831

COMPARISON OF DIFFERENT SCHOOL RESULTS FOR STD 8 REACTIVITY QUESTIONNAIRE-STD 8 AND STD 10 STUDENTS

Plot of Totten*Toteight. Legend: A = 1 OBS, B = 2 OBS, etc.



COMPARISON OF DIFFERENT SCHOOL RESULTS FOR STD 8 REACTIVITY QUESTIONNAIRE- STD 8 AND STD 10 STUDENTS

Correllation analysis

2 'VAR' Variables: Totten Toteight

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Totten	82	1.7683	1.2986	145.0	0	5.0000
Toteight	82	1.6829	1.2159	138.0	0	6.0000

Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0 / N = 82

	Totten	Toteight
Totten	1.00000 0.0	-0.12529 0.2621
Toteight	-0.12529 0.2621	1.00000 0.0

Number of correct responses to rate and eq. questionnaire: std 10's

OBS	TEN1	TEN2	TEN3	TEN4	TEN5	TEN6	TEN7	MCQ1	MCQ2	MCQ3	MCQ4	MCQ5	MCQ6	MCQ7	TOTE N	SCHOOL	STD
412	A	D	B	E	A	A	C	0	0	0	1	0	0	1	2	School no.5	10
413	C	B	E	A	B	E	B	0	0	0	0	0	1	0	1	School no.5	10
414	A	D	D	B	A	E	C	0	0	1	0	0	1	1	3	School no.5	10
415	C	D	C	E	E	A	E	0	0	0	1	0	0	0	1	School no.5	10
416	A	B	B	C	D	D	C	0	0	0	0	0	0	1	1	School no.5	10
417	E	B	D	C	B	D	B	1	0	1	0	0	0	0	2	School no.5	10
418	E	B	D	A	A	D	C	1	0	1	0	0	0	1	3	School no.5	10
419	D	B	E	C	A	D	A	0	0	0	0	0	0	0	0	School no.5	10
420	E	D	D	X	A	A	A	1	0	1	0	0	0	0	2	School no.5	10
421	C	C	E	A	A	B	A	0	1	0	0	0	0	0	1	School no.5	10
422	C	C	E	B	A	B	B	0	1	0	0	0	0	0	1	School no.5	10
423	E	C	D	E	D	D	C	1	1	1	1	0	0	1	5	School no.5	10
424	B	B	E	C	A	A	D	0	0	0	0	0	0	0	0	School no.5	10
425	C	D	E	A	E	A	C	0	0	0	0	0	0	1	1	School no.5	10
426	B	B	E	B	A	A	D	0	0	0	0	0	0	0	0	School no.5	10
427	A	B	E	C	A	D	B	0	0	0	0	0	0	0	0	School no.5	10
428	E	B	E	E	A	A	A	1	0	0	1	0	0	0	2	School no.5	10
429	A	D	B	C	C	A	C	0	0	0	0	1	0	1	2	School no.5	10
430	E	C	D	B	D	D	C	1	1	1	0	0	0	1	4	School no.5	10
431	E	B	A	B	E	A	C	1	0	0	0	0	0	1	2	School no.5	10
432	A	C	E	A	A	D	C	0	1	0	0	0	0	1	2	School no.5	10
433	D	C	E	A	A	B	D	0	1	0	0	0	0	0	1	School no.5	10
434	A	A	E	B	A	A	A	0	0	0	0	0	0	0	0	School no.5	10
435	A	C	B	C	A	B	B	0	1	0	0	0	0	0	1	School no.5	10
436	A	D	D	E	C	C	C	0	0	1	1	1	0	1	4	School no.5	10
437	C	C	B	A	B	A	D	0	1	0	0	0	0	0	1	School no.5	10
438	A	C	E	A	C	B	E	0	1	0	0	1	0	0	2	School no.5	10
439	E	A	E	E	E	A	D	1	0	0	1	0	0	0	2	School no.5	10
440	D	C	B	B	E	C	A	0	1	0	0	0	0	0	1	School no.5	10
441	A	B	C	D	E	D	C	0	0	0	0	0	0	1	1	School no.5	10
442	E	B	D	E	E	A	C	1	0	1	1	0	0	1	4	School no.5	10
443	B	B	B	A	E	C	C	0	0	0	0	0	0	1	1	School no.5	10
444	E	B	C	C	E	C	D	1	0	0	0	0	0	0	1	School no.5	10
445	A	E	D	E	B	C	D	0	0	1	1	0	0	0	2	School no.5	10
446	A	E	E	D	C	D	C	0	0	0	0	1	0	1	2	School no.5	10
447	B	D	E	C	E	E	C	0	0	0	0	0	1	1	2	School no.5	10
448	A	D	B	C	E	D	C	0	0	0	0	0	0	1	1	School no.5	10
449	E	E	C	A	E	D	C	1	0	0	0	0	0	1	2	School no.5	10
450	B	D	B	C	A	A	C	0	0	0	0	0	0	1	1	School no.5	10
451	B	B	E	A	A	D	C	0	0	0	0	0	0	1	1	School no.5	10
452	B	B	E	A	A	D	C	0	0	0	0	0	0	1	1	School no.5	10
453	B	C	E	E	E	A	C	0	1	0	1	0	0	1	3	School no.5	10
454	A	D	C	A	D	E	A	0	0	0	0	0	1	0	1	School no.5	10
455	A	C	C	C	A	B	D	0	1	0	0	0	0	0	1	School no.5	10
456	A	A	D	C	A	D	A	0	0	1	0	0	0	0	1	School no.4	10

OBS	EIGHT1	EIGHT2	EIGHT3	EIGHT4	EIGHT5	EIGHT6	EIGHT7	EIGHT8	MCQ81	MCQ82	MCQ83	MCQ84	MCQ85	MCQ86	MCQ87	MCQ88	TOTEIGHT	SCHOOL	STD
638	E	D	C	A	A	D	B	D	0	1	0	1	0	1	0	0	3	School no.6	10
639	A	E	C	A	D	E	C	B	0	0	0	1	0	0	1	0	2	School no.6	10
640	A	B	C	A	D	C	B	B	0	1	0	1	0	0	0	0	2	School no.6	10
641	A	D	C	E	D	B	C	D	0	0	0	0	0	0	1	0	1	School no.6	10
642	A	B	C	A	D	A	A	D	0	1	0	1	0	0	0	0	2	School no.6	10
643	A	E	C	A	A	D	C	E	0	0	0	1	0	1	1	1	4	School no.6	10
644	A	B	D	E	A	C	D	D	0	1	0	0	0	0	0	0	1	School no.6	10
645	A	B	C	E	D	B	B	E	C	1	0	0	0	0	0	1	2	School no.6	10
646	A	B	D	A	D	E	B	B	C	1	0	1	0	0	0	0	2	School no.6	10

O	E	E	E	E	E	E	E	E	M	M	M	M	M	M	M	M	T O T E G H O O L	S C H	S T D
B	I	I	I	I	I	I	I	I	Q	Q	Q	Q	Q	Q	Q	Q			
S	G	G	G	G	G	G	G	G	8	8	8	8	8	8	8	8			
	H	H	H	H	H	H	H	H	1	2	3	4	5	6	7	8			
	T	T	T	T	T	T	T	T											
	1	2	3	4	5	6	7	8											
595	E	A	D	B	C	E	D	B	0	0	0	0	0	0	0	0	0	School	no.1 10
596	A	B	D	A	A	C	B	D	0	1	0	1	0	0	0	0	2	School	no.1 10
597	E	A	D	B	C	E	D	B	0	0	0	0	0	0	0	0	0	School	no.1 10
598	E	A	D	B	C	E	D	B	0	0	0	0	0	0	0	0	0	School	no.1 10
599	A	C	D	A	A	D	E	D	0	0	0	1	0	1	0	0	2	School	no.1 10
600	A	B	D	A	D	C	B	D	0	1	0	1	0	0	0	0	2	School	no.1 10
601	L	A	C	A	D	E	B	C	1	0	0	1	0	0	0	0	2	School	no.1 10
602	E	A	C	B	D	C	B	C	0	0	0	0	0	0	0	0	0	School	no.1 10
603	C	A	C	B	D	E	B	C	0	0	0	0	0	0	0	0	0	School	no.1 10
604	A	B	E	C	B	D	B	A	0	1	1	0	0	1	0	0	3	School	no.1 10
605	D	A	C	A	D	E	B	C	1	0	0	1	0	0	0	0	2	School	no.1 10
606	A	B	D	A	E	C	A	D	0	1	0	1	1	0	0	0	3	School	no.1 10
607	E	B	D	A	D	A	C	E	0	1	0	1	0	0	1	1	4	School	no.1 10
608	E	B	D	A	D	A	C	E	0	1	0	1	0	0	1	1	4	School	no.1 10
609	E	B	D	A	D	A	C	E	0	1	0	1	0	0	1	1	4	School	no.1 10
610	A	C	D	D	C	B	E	C	0	0	0	0	0	0	0	0	0	School	no.1 10
611	A	B	D	B	A	B	B	D	0	1	0	0	0	0	0	1	School	no.1 10	
612	E	B	D	A	A	C	B	D	0	1	0	1	0	0	0	2	School	no.1 10	
613	A	B	D	B	A	B	B	D	0	1	0	0	0	0	0	1	School	no.1 10	
614	A	B	D	B	A	D	B	C	0	1	0	0	0	1	0	0	2	School	no.1 10
615	E	A	C	B	B	E	X	B	0	0	0	0	0	0	0	0	0	School	no.1 10
616	E	A	D	B	C	E	D	B	0	0	0	0	0	0	0	0	0	School	no.1 10
617	E	A	D	B	C	E	D	B	0	0	0	0	0	0	0	0	0	School	no.1 10
618	E	A	D	B	C	E	D	B	0	0	0	0	0	0	0	0	0	School	no.1 10
619	A	B	D	B	E	A	C	E	0	1	0	0	1	0	1	1	4	School	no.1 10
620	A	B	D	A	C	D	A	E	0	1	0	1	0	1	0	1	4	School	no.1 10
621	A	B	D	B	D	D	D	B	0	1	0	0	0	1	0	0	2	School	no.1 10
622	A	X	C	A	D	C	B	D	0	0	0	1	0	0	0	0	1	School	no.6 10
623	A	E	C	A	D	C	B	B	0	0	0	1	0	0	0	0	1	School	no.6 10
624	A	B	D	E	D	D	C	D	0	1	0	0	0	1	1	0	3	School	no.6 10
625	A	E	D	D	D	A	B	D	0	0	0	0	0	0	0	0	0	School	no.6 10
626	A	E	C	E	D	D	E	B	0	0	0	0	0	1	0	0	1	School	no.6 10
627	A	E	C	A	A	C	D	D	0	0	0	1	0	0	0	0	1	School	no.6 10
628	A	B	D	A	C	E	E	C	0	1	0	1	0	0	0	0	2	School	no.6 10
629	A	E	D	D	A	A	B	D	0	0	0	0	0	0	0	0	0	School	no.6 10
630	A	E	C	E	D	E	E	D	0	0	0	0	0	0	0	0	0	School	no.6 10
631	A	B	C	C	C	D	C	D	0	1	0	0	0	1	1	0	3	School	no.6 10
632	A	B	E	E	D	C	B	B	0	1	1	0	0	0	0	0	2	School	no.6 10
633	A	B	D	A	D	D	C	E	0	1	0	1	0	1	1	1	5	School	no.6 10
634	A	P	C	D	D	E	B	C	0	1	0	0	0	0	0	0	1	School	no.6 10
635	A	D	C	B	D	E	A	B	0	0	0	0	0	0	0	0	0	School	no.6 10
636	A	C	C	A	D	E	B	E	0	0	0	1	0	0	0	1	2	School	no.6 10
637	A	X	D	X	D	X	B	B	0	0	0	0	0	0	0	0	0	School	no.6 10

OBS	EIGHT1	EIGHT2	EIGHT3	EIGHT4	EIGHT5	EIGHT6	EIGHT7	EIGHT8	MCQ81	MCQ82	MCQ83	MCQ84	MCQ85	MCQ86	MCQ87	MCQ88	TOTEIGHT	SCHOOL	STD
547	A	B	C	C	D	C	C	B	0	1	0	0	0	0	1	0	2	School no.2	10
548	A	B	C	C	D	C	C	B	0	1	0	0	0	0	1	0	2	School no.2	10
549	D	D	C	E	D	C	C	B	1	0	0	0	0	0	1	0	2	School no.2	10
550	A	B	C	C	D	B	C	B	0	1	0	0	0	0	1	0	2	School no.2	10
551	D	D	B	A	A	C	C	B	1	0	0	1	0	0	1	0	3	School no.3	10
552	A	B	C	C	A	A	B	B	0	1	0	0	0	0	0	0	1	School no.3	10
553	A	E	C	C	D	E	B	D	0	0	0	0	0	0	0	0	0	School no.3	10
554	A	A	C	E	D	C	D	D	0	0	0	0	0	0	0	0	0	School no.3	10
555	A	E	D	B	D	E	D	B	0	0	0	0	0	0	0	0	0	School no.3	10
556	A	D	D	A	D	D	C	D	0	0	0	1	0	1	1	0	3	School no.3	10
557	A	B	C	E	E	D	B	C	0	1	0	0	1	1	0	0	3	School no.3	10
558	A	B	C	D	D	C	B	A	0	1	0	0	0	0	0	0	1	School no.3	10
559	A	B	D	B	C	C	E	D	0	1	0	0	0	0	0	0	1	School no.3	10
560	A	X	C	A	D	E	B	C	0	0	0	1	0	0	0	0	1	School no.3	10
561	D	A	C	B	C	C	D	B	1	0	0	0	0	0	0	0	1	School no.3	10
562	A	E	D	A	D	C	D	C	0	0	0	1	0	0	0	0	1	School no.3	10
563	B	A	C	D	A	B	E	B	0	0	0	0	0	0	0	0	0	School no.3	10
564	A	B	D	A	E	E	D	D	0	1	0	1	1	0	0	0	3	School no.3	10
565	A	B	C	D	E	C	E	D	0	1	0	0	1	0	0	0	2	School no.3	10
566	A	B	C	D	E	C	E	D	0	1	0	0	1	0	0	0	2	School no.3	10
567	A	B	C	D	E	C	E	D	0	1	0	0	1	0	0	0	2	School no.3	10
568	A	B	C	E	A	C	E	D	0	1	0	0	0	0	0	0	1	School no.3	10
569	A	B	C	C	A	C	E	A	0	1	0	0	0	0	0	0	1	School no.3	10
570	D	B	C	D	D	C	B	D	1	1	0	0	0	0	0	0	2	School no.3	10
571	A	B	C	D	X	C	E	D	0	1	0	0	0	0	0	0	1	School no.3	10
572	A	B	C	D	A	C	E	D	0	1	0	0	0	0	0	0	1	School no.3	10
573	A	B	C	D	A	C	E	D	0	1	0	0	0	0	0	0	1	School no.3	10
574	A	B	C	C	D	E	B	A	0	1	0	0	0	0	0	0	1	School no.3	10
575	A	E	C	A	C	A	B	E	0	0	0	1	0	0	0	1	2	School no.3	10
576	A	E	C	B	D	C	B	D	0	0	0	0	0	0	0	0	0	School no.3	10
577	A	E	C	E	D	C	B	D	0	0	0	0	0	0	0	0	0	School no.3	10
578	A	E	C	C	E	C	A	B	0	0	0	0	1	0	0	0	1	School no.3	10
579	A	E	C	B	E	C	D	A	0	0	0	0	1	0	0	0	1	School no.3	10
580	A	B	C	D	D	C	D	E	0	1	0	0	0	0	0	1	2	School no.3	10
581	A	B	C	D	E	C	E	D	0	1	0	0	1	0	0	0	2	School no.3	10
582	A	B	C	C	E	C	E	D	0	1	0	0	1	0	0	0	2	School no.3	10
583	E	A	C	A	D	E	B	C	0	0	0	1	0	0	0	0	1	School no.1	10
584	B	A	C	A	D	E	B	C	0	0	0	1	0	0	0	0	1	School no.1	10
585	A	A	D	A	A	D	E	D	0	0	0	1	0	1	0	0	2	School no.1	10
586	A	B	D	A	A	D	E	D	0	1	0	1	0	1	0	0	3	School no.1	10
587	E	A	C	B	D	C	B	C	0	0	0	0	0	0	0	0	0	School no.1	10
588	A	B	D	A	D	C	B	D	0	1	0	1	0	0	0	0	2	School no.1	10
589	E	A	C	B	D	E	B	C	0	0	0	0	0	0	0	0	0	School no.1	10
590	A	X	D	A	A	D	E	D	0	0	0	1	0	1	0	0	2	School no.1	10
591	A	B	D	C	A	C	B	E	0	1	0	0	0	0	0	1	2	School no.1	10
592	E	B	D	E	E	E	D	B	0	1	0	0	1	0	0	0	2	School no.1	10
593	E	A	D	A	D	C	A	D	0	0	0	1	0	0	0	0	1	School no.1	10
594	A	B	D	A	A	D	E	D	0	1	0	1	0	1	0	0	3	School no.1	10

OBS	EGH1	EGH2	EGH3	EGH4	EGH5	EGH6	EGH7	EGH8	MQS1	MQS2	MQS3	MQS4	MQS5	MQS6	MQS7	MQS8	TOTEIGHT	SCHOOL	STD
501	A	A	C	B		E	B	B	0	0	0	0	0	0	0	0	0	School no.2	10
502	A	A	C	D		B	C	D	0	0	0	0	0	0	1	0	1	School no.2	10
503	E	D	D	A	A	C	A	B	0	0	0	1	0	0	0	0	1	School no.2	10
504	D	B	A	B	D	C	A	D	1	1	0	0	0	0	0	0	2	School no.2	10
505	E	D	D	A	A	C	A	B	0	0	0	1	0	0	0	0	1	School no.2	10
506	A	B	C	B	C	B	B	D	0	1	0	0	0	0	0	0	1	School no.2	10
507	B	B	E	A	D	C	C	D	0	1	1	1	0	0	1	0	4	School no.2	10
508	A	A	B	B	C	E	B	B	0	0	0	0	0	0	0	0	0	School no.2	10
509	A	B	D	A	D	C	B	B	0	1	0	1	0	0	0	0	2	School no.2	10
510	E	B	C	B	E	C	D	B	0	1	0	0	1	0	0	0	2	School no.2	10
511	A	B	C	E	D	C	A	B	0	1	0	0	0	0	0	0	1	School no.2	10
512	A	E	A	A	D	A	C	D	0	0	0	1	0	0	1	0	2	School no.2	10
513	A	B	C	A	E	C	A	D	0	1	0	1	1	0	0	0	3	School no.2	10
514	A	E	D	A	D	D	B	D	0	1	0	1	0	1	0	0	3	School no.2	10
515	A	B	D	A	E	C	D	B	0	1	0	1	1	0	0	0	3	School no.2	10
516	A	B	C	A	C	D	A	D	0	1	0	1	0	1	0	0	3	School no.2	10
517	A	C	D	A	D	C	D	C	0	0	0	1	0	0	0	0	1	School no.2	10
518	B	D	C	A	D	B	C	E	0	0	0	1	0	0	1	1	3	School no.2	10
519	A	D	C	A	B	D	B	B	0	0	0	1	0	1	0	0	2	School no.2	10
520	D	B	C	A	D	C	B	D	1	1	0	1	0	0	0	0	3	School no.2	10
521	D	B	C	A	A	E	B	E	1	1	0	1	0	0	0	1	4	School no.2	10
522	D	B	C	A	D	E	B	D	1	1	0	1	0	0	0	0	3	School no.2	10
523	A	B	C	A	D	C	B	D	0	1	0	1	0	0	0	0	2	School no.2	10
524	A	B	C	A	D	C	B	D	0	1	0	1	0	0	0	0	2	School no.2	10
525	A	A	C	A	A	D	E	D	0	0	0	1	0	1	0	0	2	School no.2	10
526	A	E	C	A	C	C	D	C	0	0	0	1	0	0	0	0	1	School no.2	10
527	B	L	C	E	C	C	B	A	0	0	0	0	0	0	0	0	0	School no.2	10
528	B	B	C	A	D	E	B	D	0	1	0	1	0	0	0	0	2	School no.2	10
529	A	A	C	A	D	B	B	B	0	0	0	1	0	0	0	0	1	School no.2	10
530	A	D	C	C	E	D	A	C	0	0	0	0	1	1	0	0	2	School no.2	10
531	A	B	C	C	C	C	D	E	0	1	0	0	0	0	0	1	2	School no.2	10
532	A	A	C	A	A	D	C	B	0	0	0	1	0	1	1	0	3	School no.2	10
533	A	A	C	A	A	C	B	B	0	0	0	1	0	0	0	0	1	School no.2	10
534	A	B	D	D	A	C	B	B	0	1	0	0	0	0	0	0	1	School no.2	10
535	A	B	C	D	C	E	B	B	0	1	0	0	0	0	0	0	1	School no.2	10
536	A	D	C	A	E	C	B	B	0	0	0	1	1	0	0	0	2	School no.2	10
537	A	D	B	C	D	B	B	C	0	0	0	0	0	0	0	0	0	School no.2	10
538	A	D	D	D	A	C	B	B	0	0	0	0	0	0	0	0	0	School no.2	10
539	A	D	D	B	E	C	A	B	0	0	0	0	1	0	0	0	1	School no.2	10
540	A	B	C	A	B	C	D	E	0	1	0	1	0	0	0	1	3	School no.2	10
541	E	C	C	A	B	C	B	A	0	0	0	1	0	0	0	0	1	School no.2	10
542	E	A	D	E	C	D	C	X	0	0	0	0	0	1	1	0	2	School no.2	10
543	A	B	D	A	E	C	B	E	0	1	0	1	1	0	0	1	4	School no.2	10
544	A	B	E	A	E	C	B	B	0	1	1	1	1	0	0	0	4	School no.2	10
545	D	B	E	B	C	D	B	B	1	1	1	0	0	1	0	0	4	School no.2	10
546	A	B	E	A	D	D	C	B	0	1	1	1	0	1	1	0	5	School no.2	10

OBS	EXG1	EXG2	EXG3	EXG4	EXG5	EXG6	EXG7	EXG8	MCQ81	MCQ82	MCQ83	MCQ84	MCQ85	MCQ86	MCQ87	MCQ88	TOTEXGHT	SCHOOL	STD
453	A	E	D	D	D	B	A	B	0	0	0	0	0	0	0	0	0	School no.5	10
454	A	B	C	A	E	E	E	D	0	1	0	1	1	0	0	0	3	School no.5	10
455	A	E	C	C	E	D	B	A	0	0	0	0	1	1	0	0	2	School no.5	10
456	A	B	C	A	D	E	B	B	0	1	0	1	0	0	0	0	2	School no.4	10
457	A	E	C	B	D	B	E	A	0	0	0	0	0	0	0	0	0	School no.4	10
458	A	B	C	A	D	C	B	E	0	1	0	1	0	0	0	1	3	School no.4	10
459	A	B	E	A	D	A	A	B	0	1	1	1	0	0	0	0	3	School no.4	10
460	B	B	E	E	B	C	A	B	0	1	1	0	0	0	0	0	2	School no.4	10
461	E	C	C	E	D	C	B	D	0	0	0	0	0	0	0	0	0	School no.4	10
462	A	B	D	C	A	C	B	A	0	1	0	0	0	0	0	0	1	School no.4	10
463	A	B	C	C	D	C	B	D	0	1	0	0	0	0	0	0	1	School no.4	10
464	A	B	D	B	A	C	B	B	0	1	0	0	0	0	0	0	1	School no.4	10
465	A	B	C	E	D	C	B	B	0	1	0	0	0	0	0	0	1	School no.4	10
466	A	B	C	A	D	C	B	B	0	1	0	1	0	0	0	0	2	School no.4	10
467	E	B	C	C	B	C	A	D	0	1	0	0	0	0	0	0	1	School no.4	10
468	A	B	C	C	D	D	B	D	0	1	0	0	0	1	0	0	2	School no.4	10
469	A	B	C	D	A	C	B	D	0	1	0	0	0	0	0	0	1	School no.4	10
470	A	E	C	B	D	E	E	B	0	0	0	0	0	0	0	0	0	School no.4	10
471	A	B	E	A	D	C	B	B	0	1	1	1	0	0	0	0	3	School no.4	10
472	A	B	D	B	D	C	B	D	0	1	0	0	0	0	0	0	1	School no.4	10
473	A	B	C	E	D	C	B	A	0	1	0	0	0	0	0	0	1	School no.4	10
474	A	B	C	A	A	C	B	D	0	1	0	1	0	0	0	0	2	School no.4	10
475	A	C	C	A	B	D	D	D	0	0	0	1	0	1	0	0	2	School no.4	10
476	A	D	D	A	B	A	C	D	0	0	0	1	0	0	1	0	2	School no.4	10
477	A	B	C	A	D	B	L	B	0	1	0	1	0	0	0	0	2	School no.4	10
478	A	C	E	C	E	C	D	A	0	0	1	0	1	0	0	0	2	School no.4	10
479	A	B	C	E	A	B	C	B	0	1	0	0	0	0	1	0	2	School no.4	10
480	D	B	D	A	A	B	B	B	1	1	0	1	0	0	0	0	3	School no.4	10
481	E	D	C	E	A	C	B	D	0	0	0	0	0	0	0	0	0	School no.4	10
482	E	D	D	E	A	C	C	B	0	0	0	0	0	0	1	0	1	School no.4	10
483	A	C	A	A	A	C	D	C	0	0	0	1	0	0	0	0	1	School no.4	10
484	A	B	C	A	A	B	D	C	0	1	0	1	0	0	0	0	2	School no.4	10
485	A	B	D	C	D	E	D	C	0	1	0	0	0	0	0	0	1	School no.4	10
486	E	C	D	A	A	B	B	B	0	0	0	1	0	0	0	0	1	School no.4	10
487	A	C	D	A	A	B	B	B	0	0	0	1	0	0	0	0	1	School no.4	10
488	A	A	D	A	A	B	B	E	0	0	0	1	0	0	0	1	2	School no.4	10
489	A	B	C	E	D	C	B	E	0	1	0	0	0	0	0	1	2	School no.4	10
490	A	B	C	D	E	D	B	L	0	1	0	0	1	1	0	0	3	School no.4	10
491	B	B	E	E	D	C	B	D	0	1	1	0	0	0	0	0	2	School no.4	10
492	D	B	D	A	E	D	C	D	1	1	0	1	1	1	1	0	6	School no.4	10
493	A	B	C	A	D	C	B	D	0	1	0	1	0	0	0	0	2	School no.4	10
494	A	B	C	A	D	C	B	B	0	1	0	1	0	0	0	0	2	School no.4	10
495	A	B	C	A	D	C	D	B	0	1	0	1	0	0	0	0	2	School no.4	10
496	A	B	E	D	D	A	C	D	0	1	1	0	0	0	1	0	3	School no.4	10
497	A	B	D	D	D	B	C	D	0	1	0	0	0	0	1	0	2	School no.4	10
498	A	B	D	A	C	C	A	B	0	1	0	1	0	0	0	0	2	School no.4	10
499	D	D	D	A	D	A	E	A	1	0	0	1	0	0	0	0	2	School no.2	10
500	D	C	C	B	D	E	B	A	1	0	0	0	0	0	0	0	1	School no.2	10

OBS	EGHT1	EGHT2	EGHT3	EGHT4	EGHT5	EGHT6	EGHT7	EGHT8	MCQ81	MCQ82	MCQ83	MCQ84	MCQ85	MCQ86	MCQ87	MCQ88	OTEGHT	SCHOOL	STD
407	A	B	C	B	D	C	E	D	0	1	0	0	0	0	0	0	1	School no.6	8
408	A	C	C	A	C	E	E	D	0	0	0	1	0	0	0	0	1	School no.6	8
409	A	B	C	A	A	C	A	D	0	1	0	1	0	0	0	0	2	School no.6	8
410	A	C	C	B	C	E	A	D	0	0	0	0	0	0	0	0	0	School no.6	8
411	C	A	C	E	C	D	A	D	0	0	0	0	0	1	0	0	1	School no.6	8
412	A	B	C	A	E	D	C	D	0	1	0	1	1	1	1	0	5	School no.5	10
413	A	A	E	D	D	D	B	B	0	0	1	0	0	1	0	0	2	School no.5	10
414	A	A	D	D	D	C	B	A	0	0	0	0	0	0	0	0	0	School no.5	10
415	A	E	D	A	C	B	C	B	0	1	0	1	0	0	1	0	3	School no.5	10
416	A	B	D	B	D	C	C	D	0	1	0	0	0	0	1	0	2	School no.5	10
417	A	B	D	D	E	C	A	D	0	1	0	0	1	0	0	0	2	School no.5	10
418	A	A	C	A	D	A	C	D	0	0	0	1	0	0	1	0	2	School no.5	10
419	A	A	D	D	D	D	C	D	0	0	0	0	0	1	1	0	2	School no.5	10
420	A	B	C	D	A	C	B	B	0	1	0	0	0	0	0	0	1	School no.5	10
421	D	A	C	D	A	C	B	B	1	0	0	0	0	0	0	0	1	School no.5	10
422	A	B	D	E	D	A	C	D	0	1	0	0	0	0	1	0	2	School no.5	10
423	A	E	D	A	D	C	B	D	0	0	0	1	0	0	0	0	1	School no.5	10
424	A	B	D	E	D	B	B	B	0	1	0	0	0	0	0	0	1	School no.5	10
425	A	B	C	B	C	C	A	A	0	1	0	0	0	0	0	0	1	School no.5	10
426	A	B	C	C	D	C	A	D	0	1	0	0	0	0	0	0	1	School no.5	10
427	A	B	D	D	D	C	B	D	0	1	0	0	0	0	0	0	1	School no.5	10
428	A	D	C	C	A	D	C	D	0	0	0	0	0	1	1	0	2	School no.5	10
429	E	B	E	A	A	E	C	B	0	1	1	1	0	0	1	0	4	School no.5	10
430	A	D	C	C	E	C	C	A	0	1	0	0	1	0	1	0	3	School no.5	10
431	A	D	C	A	A	E	B	B	0	0	0	1	0	0	0	0	1	School no.5	10
432	A	B	D	E	A	A	A	B	0	1	0	0	0	0	0	0	1	School no.5	10
433	A	A	C	B	A	C	B	B	0	0	0	0	0	0	0	0	0	School no.5	10
434	A	E	C	D	A	D	C	D	0	0	0	0	0	1	1	0	2	School no.5	10
435	A	B	C	B	E	D	C	D	0	1	0	0	1	1	1	0	4	School no.5	10
436	A	B	C	C	C	C	B	A	0	1	0	0	0	0	0	0	1	School no.5	10
437	A	B	D	D	X	E	B	D	0	1	0	0	0	0	0	0	1	School no.5	10
438	E	B	D	B	E	D	C	D	0	1	0	0	1	1	1	0	4	School no.5	10
439	A	A	C	D	B	B	A	D	0	0	0	0	0	0	0	0	0	School no.5	10
440	E	B	D	D	A	C	B	B	0	1	0	0	0	0	0	0	1	School no.5	10
441	A	E	D	E	D	E	B	B	0	0	0	0	0	0	0	0	0	School no.5	10
442	A	E	D	D	B	E	E	D	0	0	0	0	0	0	0	0	0	School no.5	10
443	A	B	D	B	A	B	B	E	0	1	0	0	0	0	0	1	2	School no.5	10
444	A	B	C	D	C	D	A	E	0	1	0	0	0	1	0	1	3	School no.5	10
445	E	B	D	D	A	C	B	B	0	1	0	0	0	0	0	0	1	School no.5	10
446	A	B	C	D	A	B	C	B	0	1	0	0	0	0	1	0	2	School no.5	10
447	A	B	D	D	A	C	B	B	0	1	0	0	0	0	0	0	1	School no.5	10
448	A	B	C	D	D	C	D	C	0	1	0	0	0	0	0	0	1	School no.5	10
449	A	B	A	C	B	E	A	E	0	1	0	0	0	0	0	1	2	School no.5	10
450	A	C	C	E	A	D	B	D	0	0	0	0	0	1	0	0	1	School no.5	10
451	E	B	C	B	A	D	E	A	0	1	0	0	0	1	0	0	2	School no.5	10
452	A	B	C	D	A	D	E	A	0	1	0	0	0	1	0	0	2	School no.5	10

																T			
																O			
	E	E	E	E	E	E	E	E								T	S		
	I	I	I	I	I	I	I	I	M	M	M	M	M	M	M	M	C		
	G	G	G	G	G	G	G	G	C	C	C	C	C	C	C	C	H		
O	H	H	H	H	H	H	H	H	Q	Q	Q	Q	Q	Q	Q	Q	O		S
B	T	T	T	T	T	T	T	T	8	8	8	8	8	8	8	8	O		T
S	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	T	L	D
362	E	B	C	E	D	C	B	D	0	1	0	0	0	0	0	0	1	School	no.1 8
363	A	B	C	E	A	E	B	D	0	1	0	0	0	0	0	0	1	School	no.1 8
364	A	A	C	A	D	D	B	A	0	0	0	1	0	1	0	0	2	School	no.1 8
365	A	B	D	E	E	D	C	B	0	1	0	0	1	1	1	0	4	School	no.1 8
366	A	B	D	E	A	D	C	D	0	1	0	0	0	1	1	0	3	School	no.1 8
367	A	B	A	E	E	D	C	D	0	1	0	0	1	1	1	0	4	School	no.1 8
368	A	B	A	E	E	D	C	D	0	1	0	0	1	1	1	0	4	School	no.1 8
369	E	B	D	B	D	A	B	A	0	1	0	0	0	0	0	0	1	School	no.1 8
370	A	B	C	A	A	C	B	E	0	1	0	1	0	0	0	1	3	School	no.1 8
371	A	B	C	E	A	C	A	A	0	1	0	0	0	0	0	0	1	School	no.1 8
372	A	B	E	D	C	B	D	C	0	1	1	0	0	0	0	0	2	School	no.1 8
373	A	B	E	B	A	A	D	B	0	1	1	0	0	0	0	0	2	School	no.1 8
374	A	B	A	A	A	B	D	C	0	1	0	1	0	0	0	0	2	School	no.1 8
375	A	B	E	B	A	A	B	B	0	1	1	0	0	0	0	0	2	School	no.1 8
376	A	B	D	D	D	C	A	E	0	1	0	0	0	0	0	1	2	School	no.1 8
377	A	B	E	A	A	B	B	B	0	1	1	1	0	0	0	0	3	School	no.1 8
378		B	E	A	B	A	B	B	0	1	1	1	0	0	0	0	3	School	no.1 8
379	A	B	D	D	A	B	A	B	0	1	0	0	0	0	0	0	1	School	no.1 8
380	A	B	E	A	A	B	B	B	0	1	1	1	0	0	0	0	3	School	no.1 8
381	A	B	E	A	A	B	B	B	0	1	1	1	0	0	0	0	3	School	no.1 8
382	A	B	E	B	A	A	B	B	0	1	1	0	0	0	0	0	2	School	no.1 8
383	A	B	E	B	C	A	A	B	0	1	1	0	0	0	0	0	2	School	no.1 8
384	A	B	C	D	D	D	E	B	0	1	0	0	0	1	0	1	3	School	no.1 8
385	A	A	E	A	D	C	B	E	0	0	1	1	0	0	0	1	3	School	no.1 8
386	A	B	A	B	B	B	E	B	0	1	0	0	0	0	0	0	1	School	no.1 8
387	A	D	C	A	D	B	B	D	0	0	0	1	0	0	0	0	1	School	no.1 8
388	A	D	D	A	A	B	B	B	0	0	0	1	0	0	0	0	1	School	no.1 8
389	A	B	C	B	C	B	A	B	0	1	0	0	0	0	0	0	1	School	no.1 8
390	A	B	E	A	B	B	B	B	0	1	1	1	0	0	0	0	3	School	no.1 8
391	A	B	D	D	A	B	A	B	0	1	0	0	0	0	0	0	1	School	no.1 8
392	A	B	D	E	A	C	B	A	0	1	0	0	0	0	0	0	1	School	no.1 8
393	A	A	E	A	D	C	A	E	0	0	1	1	0	0	0	1	3	School	no.1 8
394	A	B	E	A	A	B	B	B	0	1	1	1	0	0	0	0	3	School	no.1 8
395	A	B	E	A	A	B	B	B	0	1	1	1	0	0	0	0	3	School	no.1 8
396	A	B	D	D	C	A	D	D	0	1	0	0	0	0	0	0	1	School	no.1 8
397	A	B	D	D	A	B	A	B	0	1	0	0	0	0	0	0	1	School	no.1 8
398	A	B	C	B	C	A	C	D	0	1	0	0	0	0	1	0	2	School	no.6 8
399	A	B	D	A	C	D	D	E	0	1	0	1	0	1	0	1	4	School	no.6 8
400	A	E	C	B	A	C	A	D	0	0	0	0	0	0	0	0	0	School	no.6 8
401	A	B	D	A	B	D	B	B	0	1	0	1	0	1	0	0	3	School	no.6 8
402	A	B	A	E	B	B	A	D	0	1	0	0	0	0	0	0	1	School	no.6 8
403	A	B	C	A	E	C	C	D	0	1	0	1	1	0	1	0	4	School	no.6 8
404	A	B	C	A	B	A	C	B	0	1	0	1	0	0	1	0	3	School	no.6 8
405	A	B	C	A	C	C	E	D	0	1	0	1	0	0	0	0	2	School	no.6 8
406	A	B	A	E	A	B	A	A	0	1	0	0	0	0	0	0	1	School	no.6 8

OBS	EHTG1	EHTG2	EHTG3	EHTG4	EHTG5	EHTG6	EHTG7	EHTG8	MQTG81	MQTG82	MQTG83	MQTG84	MQTG85	MQTG86	MQTG87	MQTG88	TOTEIGHT	SCHOOL	STD
317	A	A	D	D	C	B	D	A	0	0	0	0	0	0	0	0	0	School no.1	8
318	A	C	E	D	E	D	C	E	0	0	1	0	1	1	1	1	5	School no.1	8
319	A	A	C	B	B	C	D	B	0	0	0	0	0	0	0	0	0	School no.1	8
320	A	A	C	B	A	E	B	E	0	0	0	0	0	0	0	1	1	School no.1	8
321	A	B	C	A	D	B	B	B	0	1	0	1	0	0	0	0	2	School no.1	8
322	D	C	C	E	D	A	B	D	1	0	0	0	0	0	0	0	1	School no.1	8
323	A	A	C	D	C	D	B	A	0	0	0	0	0	1	0	0	1	School no.1	8
324	A	C	D	B	C	A	E	E	0	0	0	0	0	0	0	1	1	School no.1	8
325	A	B	C	B	A	B	A	B	0	1	0	0	0	0	0	0	1	School no.1	8
326	D	X	C	E	D	B	A	D	1	0	0	0	0	0	0	0	1	School no.1	8
327	C	B	C	X	D	C	B	D	0	1	0	0	0	0	0	0	1	School no.1	8
328	A	B	C	B	C	C	E	D	0	1	0	0	0	0	0	0	1	School no.1	8
329	A	B	C	D	D	A	A	D	0	1	0	0	0	0	0	0	1	School no.1	8
330	A	B	A	E	E	D	C	D	0	1	0	0	1	1	1	0	4	School no.1	8
331	A	B	C	B	C	D	B	D	0	1	0	0	0	1	0	0	2	School no.1	8
332	A	B	C	B	C	X	C	D	0	1	0	0	0	0	1	0	2	School no.1	8
333	A	B	C	B	C	D	B	D	0	1	0	0	0	1	0	0	2	School no.1	8
334	A	B	C	B	C	D	B	D	0	1	0	0	0	1	0	0	2	School no.1	8
335	A	B	C	B	C	D	B	D	0	1	0	0	0	1	0	0	2	School no.1	8
336	A	B	C	B	C	E	A	D	0	1	0	0	0	0	0	0	1	School no.1	8
337	A	B	C	B	C	D	A	D	0	1	0	0	0	1	0	0	2	School no.1	8
338	A	B	C	B	C	E	A	D	0	1	0	0	0	0	0	0	1	School no.1	8
339	A	B	C	B	C	E	A	D	0	1	0	0	0	0	0	0	1	School no.1	8
340	A	B	C	B	C	E	A	D	0	1	0	0	0	0	0	0	1	School no.1	8
341	A	B	C	C	B	D	D	D	0	1	0	0	0	1	0	0	2	School no.1	8
342	A	B	C	B	C	D	B	D	0	1	0	0	0	1	0	0	2	School no.1	8
343	A	B	C	B	C	D	B	D	0	1	0	0	0	1	0	0	2	School no.1	8
344	A	B	C	B	C	D	B	D	0	1	0	0	0	1	0	0	2	School no.1	8
345	A	B	C	B	C	D	C	D	0	1	0	0	0	1	1	0	3	School no.1	8
346	A	A	C	E	A	B	B	D	0	0	0	0	0	0	0	0	0	School no.1	8
347	A	B	C	B	A	B	B	D	0	1	0	0	0	0	0	0	1	School no.1	8
348	A	B	C	B	D	C	B	B	0	1	0	0	0	0	0	0	1	School no.1	8
349	A	B	C	C	E	D	C	D	0	1	0	0	1	1	1	0	4	School no.1	8
350	A	E	D	D	A	A	B	D	0	0	0	0	0	0	0	0	0	School no.1	8
351	A	B	C	B	D	E	B	E	0	1	0	0	0	0	0	1	2	School no.1	8
352	A	B	A	E	D	D	C	D	0	1	0	0	0	1	1	0	3	School no.1	8
353	E	B	D	E	D	A	A	D	0	1	0	0	0	0	0	0	1	School no.1	8
354	A	A	A	A	D	B	E	B	0	0	0	1	0	0	0	0	1	School no.1	8
355	A	B	A	E	D	B	X	D	0	1	0	0	0	0	0	0	1	School no.1	8
356	A	B	C	B	A	A	E	B	0	1	0	0	0	0	0	0	1	School no.1	8
357	A	E	C	D	B	C	D	C	0	0	0	0	0	0	0	0	0	School no.1	8
358	A	B	D	B	A	C	B	B	0	1	0	0	0	0	0	0	1	School no.1	8
359	A	A	C	A	D	B	A	D	0	0	0	1	0	0	0	0	1	School no.1	8
360	A	B	A	B	E	C	A	A	0	1	0	0	1	0	0	0	2	School no.1	8
361	A	B	C	D	A	E	D	D	0	1	0	0	0	0	0	0	1	School no.1	8

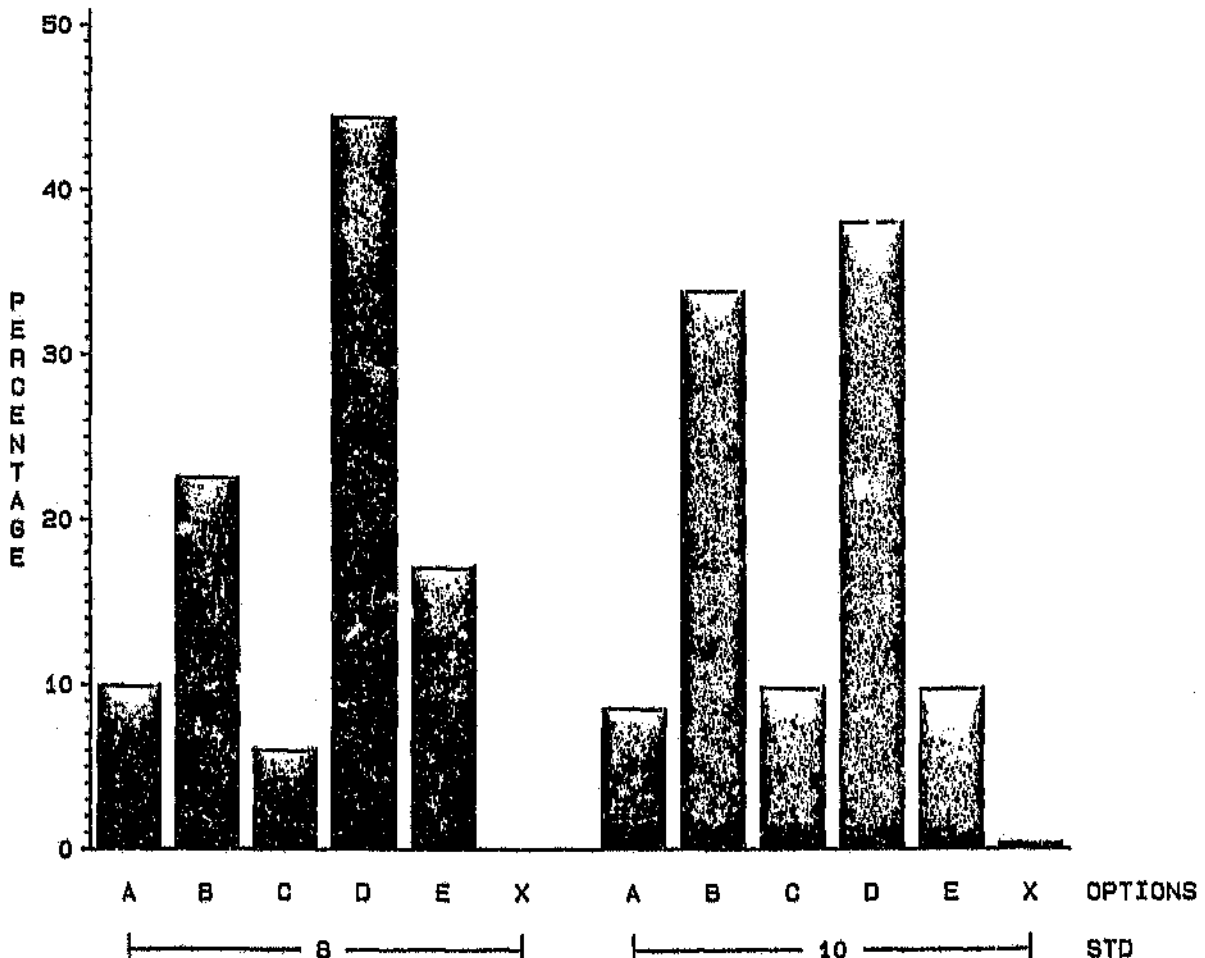
OBS	EIGHT1	EIGHT2	EIGHT3	EIGHT4	EIGHT5	EIGHT6	EIGHT7	EIGHT8	MQ1	MQ2	MQ3	MQ4	MQ5	MQ6	MQ7	MQ8	TOTEIGHT	SCHOOL	STD
271	E	B	E	E	B	D	D	D	0	1	1	0	0	1	0	0	3	School NO.1	8
272	A	B	C	B	C	D	C	D	0	1	0	0	0	1	1	0	3	School no.1	8
273	A	B	C	A	A	D	B	A	0	1	0	1	0	1	0	0	3	School no.1	8
274	A	A	C	A	A	D	B	A	0	0	0	1	0	1	0	0	2	School no.1	8
275	A	B	C	A	A	D	B	A	0	1	0	1	0	1	0	0	3	School no.1	8
276	D	B	C	B	E	D	C	D	1	1	C	.	.	.	.	.	5	School no.1	8
277	D	B	C	B	E	D	C	D	1	1	.	.	.	.	0	5	School no.1	8
278	D	B	C	B	E	D	C	D	1	1	0	.	.	.	0	5	School no.1	8
279	A	C	C	B	A	C	D	A	0	0	0	0	.	.	0	0	0	School no.1	8
280	A	C	C	B	A	C	D	A	0	0	0	0	0	.	0	0	0	School no.1	8
281	A	A	C	B	A	C	D	E	0	0	0	0	0	0	0	1	1	School no.1	8
282	A	A	C	B	A	C	D	E	0	0	0	0	0	0	0	1	1	School no.1	8
283	A	A	C	B	A	C	.	.	0	0	0	0	0	0	0	0	0	School no.1	8
284	A	A	C	B	A	D	C	A	0	0	0	0	0	1	1	0	2	School no.1	8
285	A	.	C	B	A	.	.	.	0	0	0	0	0	0	0	0	0	School no.1	8
286	A	A	C	B	A	C	D	E	0	0	0	0	0	0	0	1	1	School no.1	8
287	A	B	C	D	D	E	B	B	0	1	0	0	0	0	0	0	1	School no.1	8
288	A	B	C	B	D	D	B	D	0	1	0	0	0	1	0	0	2	School no.1	8
289	A	B	D	E	C	C	C	D	0	1	0	0	0	0	1	0	2	School no.1	8
290	C	B	D	D	A	B	C	B	0	1	0	0	0	0	1	0	2	School no.1	8
291	A	B	D	B	C	D	C	D	0	1	0	0	0	1	1	0	3	School no.1	8
292	A	B	C	B	A	D	B	D	0	1	0	0	0	1	0	0	2	School no.1	8
293	A	B	C	B	A	D	B	D	0	1	0	0	0	1	0	0	2	School no.1	8
294	A	B	D	B	E	D	C	D	0	1	0	0	1	1	1	0	4	School no.1	8
295	A	B	C	B	A	D	B	D	0	1	0	0	0	1	0	0	2	School no.1	8
296	A	B	C	B	C	D	C	D	0	1	0	0	0	1	1	0	3	School no.1	8
297	A	B	D	A	A	C	B	B	0	1	0	1	0	0	0	0	2	School no.1	8
298	D	B	D	B	D	C	B	B	1	1	0	0	0	0	0	0	2	School no.1	8
299	A	E	C	E	A	C	E	B	0	0	0	0	0	0	0	0	0	School no.1	8
300	A	A	C	D	D	C	B	B	0	0	0	0	0	0	0	0	0	School no.1	8
301	D	E	D	A	D	B	A	E	1	0	0	1	0	0	0	1	3	School no.1	8
302	A	B	C	E	A	E	C	B	0	1	0	0	0	0	1	0	2	School no.1	8
303	E	B	D	E	D	B	C	B	0	1	0	0	0	0	1	0	2	School no.1	8
304	A	B	E	A	A	E	A	D	0	1	1	1	0	0	0	0	3	School no.1	8
305	A	A	C	A	D	C	A	D	0	0	0	1	0	0	0	0	1	School no.1	8
306	E	A	C	A	D	B	D	C	0	0	0	1	0	0	0	0	1	School no.1	8
307	A	B	C	E	A	C	C	B	0	1	0	0	0	0	1	0	2	School no.1	8
308	D	C	C	C	C	C	C	C	1	0	0	0	0	0	1	0	2	School no.1	8
309	E	A	C	A	A	B	A	C	0	0	0	1	0	0	0	0	1	School no.1	8
310	E	B	C	A	D	B	D	C	0	1	0	1	0	0	0	0	2	School no.1	8
311	A	B	A	A	D	C	B	D	0	1	0	1	0	0	0	0	2	School no.1	8
312	E	B	C	C	A	C	A	E	0	1	0	0	0	0	0	1	2	School no.1	8
313	C	E	C	C	B	E	A	D	0	0	0	0	0	0	0	0	0	School no.1	8
314	D	D	D	B	C	C	E	C	1	0	0	0	0	0	0	0	1	School no.1	8
315	A	C	C	C	B	E	A	D	0	0	0	0	0	0	0	0	0	School no.1	8
316	A	B	D	E	A	D	B	D	0	1	0	0	0	1	0	0	2	School no.1	8

OBS	EIGHT1	EIGHT2	EIGHT3	EIGHT4	EIGHT5	EIGHT6	EIGHT7	EIGHT8	MCQ81	MCQ82	MCQ83	MCQ84	MCQ85	MCQ86	MCQ87	MCQ88	TOTEIGHT	SCHOOL	STD
226	A	B	D	A	D	B	B	D	0	1	0	1	0	0	0	0	2	School no.2	8
227	A	B	D	A	D	E	B	D	0	1	0	1	0	0	0	0	2	School no.2	8
228	A	B	D	A	D	C	B	D	0	1	0	1	0	0	0	0	2	School no.2	8
229	A	B	D	A	D	C	B	D	0	1	0	1	0	0	0	0	2	School no.2	8
230	A	A	D	E	A	C	D	B	0	0	0	0	0	0	0	0	0	School no.2	8
231	A	E	C	A	D	C	D	A	0	0	0	1	0	0	0	0	1	School no.2	8
232	A	B	C	A	A	E	D	C	0	1	0	1	0	0	0	0	2	School no.2	8
233	A	B	C	A	D	C	B	C	0	1	0	1	0	0	0	0	2	School no.2	8
234	A	B	E	C	D	C	B	D	0	1	1	0	0	0	0	0	2	School no.2	8
235	A	B	D	A	D	C	B	D	0	1	0	1	0	0	0	0	2	School no.2	8
236	A	A	D	E	A	C	E	B	0	0	0	0	0	0	0	0	0	School no.2	8
237	A	B	A	B	E	C	D	B	0	1	0	0	1	0	0	0	2	School no.2	8
238	A	B	A	E	D	C	B	B	0	1	0	0	0	0	0	0	1	School no.3	8
239	B	D	D	A	C	A	B	A	0	0	0	1	0	0	0	0	1	School no.3	8
240	A	A	C	C	D	B	C	D	0	0	0	0	0	0	1	0	1	School no.3	8
241	A	B	D	A	C	C	C	B	0	1	0	1	0	0	1	0	3	School no.3	8
242	A	B	D	D	A	C	B	D	0	1	0	0	0	0	0	0	1	School no.3	8
243	B	B	E	D	A	D	A	B	0	1	1	0	0	1	0	0	3	School no.3	8
244	A	B	D	A	A	C	A	D	0	1	0	1	0	0	0	0	2	School no.3	8
245	A	B	D	E	C	D	B	D	0	1	0	0	0	1	0	0	2	School no.3	8
246	A	D	C	A	C	D	E	E	0	0	0	1	0	1	0	1	3	School no.3	8
247	A	B	C	D	B	A	D	D	0	1	0	0	0	0	0	0	1	School no.3	8
248	E	C	B	B	C	E	A	D	0	0	0	0	0	0	0	0	0	School no.3	8
249	D	B	A	B	D	E	A	C	1	1	0	0	0	0	0	0	2	School no.3	8
250	A	B	C	E	A	B	B	D	0	1	0	0	0	0	0	0	1	School no.3	8
251	E	B	C	C	C	E	C	D	0	1	0	0	0	0	1	0	2	School no.3	8
252	A	D	D	B	C	D	B	B	0	0	0	0	0	1	0	0	1	School no.3	8
253	A	E	C	B	D	B	E	E	0	0	0	0	0	0	0	1	1	School no.3	8
254	A	A	C	D	A	B	B	E	0	0	0	0	0	0	0	1	1	School no.3	8
255	A	B	C	E	C	B	B	D	0	1	0	0	0	0	0	0	1	School no.3	8
256	A	A	D	C	D	C	B	D	0	0	0	0	0	0	0	0	0	School no.3	8
257	A	E	C	C	D	B	B	D	0	0	0	0	0	0	0	0	0	School no.3	8
258	A	B	C	E	C	B	B	D	0	1	0	0	0	0	0	0	1	School no.3	8
259	A	B	C	E	A	B	B	D	0	1	0	0	0	0	0	0	1	School no.3	8
260	A	B	C	A	B	C	B	D	0	1	0	.				0	2	School no.3	8
261	A	B	C	C	D	B	B	D	0	1	0	0				0	1	School no.3	8
262	A	B	C	C	A	B	B	D	0	1	0	0	.			0	1	School no.3	8
263	A	B	C	E	A	B	B	D	0	1	0	0	0	0	0	0	1	School no.3	8
264	A	D	C	E	D	C	D	B	0	0	0	0	0	0	0	0	0	School no.3	8
265	A	B	C	D	D	C	B	B	0	1	0	0	0	0	0	0	1	School no.3	8
266	A	B	C	B	C	C	B	E	0	1	0	0	0	0	0	1	2	School no.3	8
267	A	D	C	A	D	C	B	D	0	0	0	1	0	0	0	0	1	School no.3	8
268	A	B	C	D	D	C	C	E	0	1	0	0	0	0	1	1	3	School no.3	8
269	E	D	C	C	D	C	B	D	0	0	0	0	0	0	0	0	0	School no.3	8
270	A	B	D	A	E	B	B	D	0	1	0	1	1	0	0	0	3	School no.3	8

OBS	EIGHT1	EIGHT2	EIGHT3	EIGHT4	EIGHT5	EIGHT6	EIGHT7	EIGHT8	MCQ81	MCQ82	MCQ83	MCQ84	MCQ85	MCQ86	MCQ87	MCQ88	TOTEIGHT	SCHOOL	STD
180	A	E	C	D	A	C	B	B	0	0	0	0	0	0	0	0	0	School no.2	8
181	A	C	C	A	D	C	D	E	0	0	0	1	0	0	0	1	2	School no.2	8
182	A	X	D	A	C	E	B	B	0	0	0	1	0	0	0	0	1	School no.2	8
183	A	D	E	A	A	C	B	A	0	0	1	1	0	0	0	0	2	School no.2	8
184	A	C	C	A	C	E	D	B	0	0	0	1	0	0	0	0	1	School no.2	8
185	A	D	E	B	C	E	D	D	0	0	1	0	0	0	0	0	1	School no.2	8
186	A	D	C	B	A	E	C	D	0	0	0	0	0	0	1	0	1	School no.2	8
187	A	B	C	D	E	D	B	E	0	1	0	0	1	1	0	1	4	School no.2	8
188	A	B	C	D	C	D	D	C	0	1	0	0	0	1	0	0	2	School no.2	8
189	A	B	C	D	C	D	D	C	0	1	0	0	0	1	0	0	2	School no.2	8
190	A	B	C	B	C	D	B	C	0	1	0	0	0	1	0	0	2	School no.2	8
191	A	B	E	D	C	D	D	C	0	1	1	0	0	1	0	0	3	School no.2	8
192	A	B	B	C	E	A	B	E	0	1	0	0	1	0	0	1	3	School no.2	8
193	A	D	E	C	D	X	B	E	0	0	1	0	0	0	0	1	2	School no.2	8
194	A	B	B	D	C	A	E	D	0	1	0	0	0	0	0	0	1	School no.2	8
195	A	D	B	D	C	E	B	A	0	0	0	0	0	0	0	0	0	School no.2	8
196	A	A	C	C	B	D	C	E	0	0	0	0	0	1	1	1	3	School no.2	8
197	C	B	C	A	D	E	E	D	0	1	0	1	0	0	0	0	2	School no.2	8
198	A	B	C	B	D	A	B	B	0	1	0	0	0	0	0	0	1	School no.2	8
199	A	B	C	A	A	C	C	B	0	1	0	1	0	0	1	0	3	School no.2	8
200	A	A	C	A	D	C	B	B	0	0	0	1	0	0	0	0	1	School no.2	8
201	A	X	A	D	E	C	C	D	0	0	0	0	1	0	1	0	2	School no.2	8
202	A	D	E	A	C	E	B	D	0	0	1	1	0	0	0	0	2	School no.2	8
203	C	B	C	A	D	D	E	D	0	1	0	1	0	1	0	0	3	School no.2	8
204	A	E	C	C	D	D	B	C	0	0	0	0	0	1	0	0	1	School no.2	8
205	A	E	C	A	D	C	B	C	0	0	0	1	0	0	0	0	1	School no.2	8
206	A	B	C	E	D	C	E	D	0	1	0	0	0	0	0	0	1	School no.2	8
207	B	A	E	C	D	C	B	D	0	0	1	0	0	0	0	0	1	School no.2	8
208	A	B	D	A	A	B	B	B	0	1	0	1	0	0	0	0	2	School no.2	8
209	A	B	C	C	D	C	B	D	0	1	0	0	0	0	0	0	1	School no.2	8
210	A	B	D	C	D	C	A	D	0	1	0	0	0	0	0	0	1	School no.2	8
211	A	B	D	A	D	B	B	D	0	1	0	1	0	0	0	0	2	School no.2	8
212	A	B	D	A	D	B	B	D	0	1	0	1	0	0	0	0	2	School no.2	8
213	A	B	D	A	D	B	B	D	0	1	0	1	0	0	0	0	2	School no.2	8
214	A	B	D	E	A	C	B	B	0	1	0	0	0	0	0	0	1	School no.2	8
215	A	B	E	E	C	C	B	B	0	1	1	0	0	0	0	0	2	School no.2	8
216	A	B	C	C	D	C	B	B	0	1	0	0	0	0	0	0	1	School no.2	8
217	A	A	D	A	D	C	B	D	0	0	0	1	0	0	0	0	1	School no.2	8
218	A	B	C	A	D	C	B	D	0	1	0	1	0	0	0	0	2	School no.2	8
219	A	B	C	A	D	C	B	D	0	1	0	1	0	0	0	0	2	School no.2	8
220	A	B	C	A	D	C	B	D	0	1	0	1	0	0	0	0	2	School no.2	8
221	A	B	A	A	D	D	B	D	0	1	0	1	0	1	0	0	3	School no.2	8
222	A	B	C	C	C	C	B	B	0	1	0	0	0	0	0	0	1	School no.2	8
223	A	B	D	A	D	B	B	D	0	1	0	1	0	0	0	0	2	School no.2	8
224	A	B	D	A	D	C	B	E	0	1	0	1	0	0	0	1	3	School no.2	8
225	A	B	D	A	D	C	B	E	0	1	0	1	0	0	0	1	3	School no.2	8

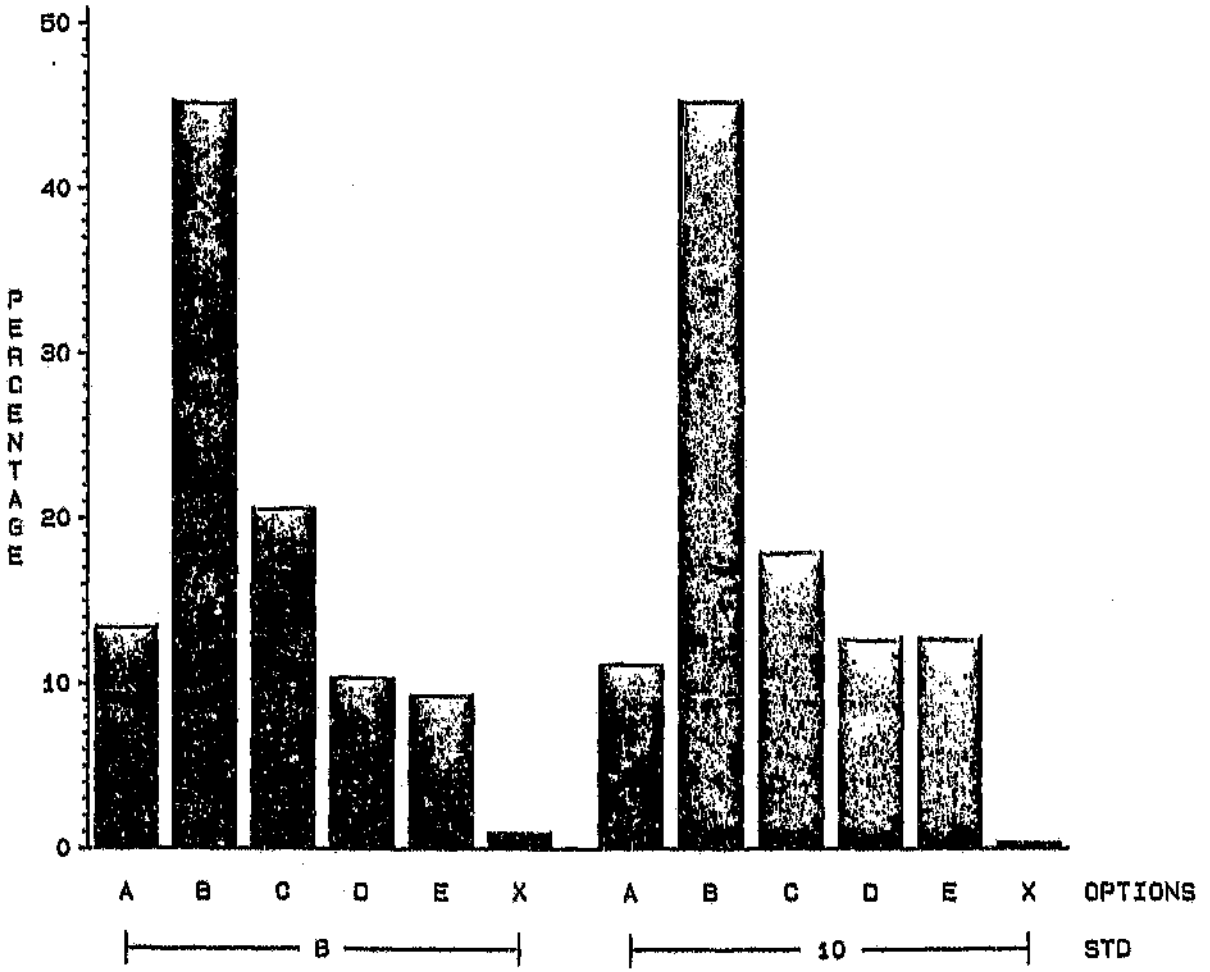
STD 8 QUESTIONNAIRE

QUESTION 8
CORRECT ANSWER IS E



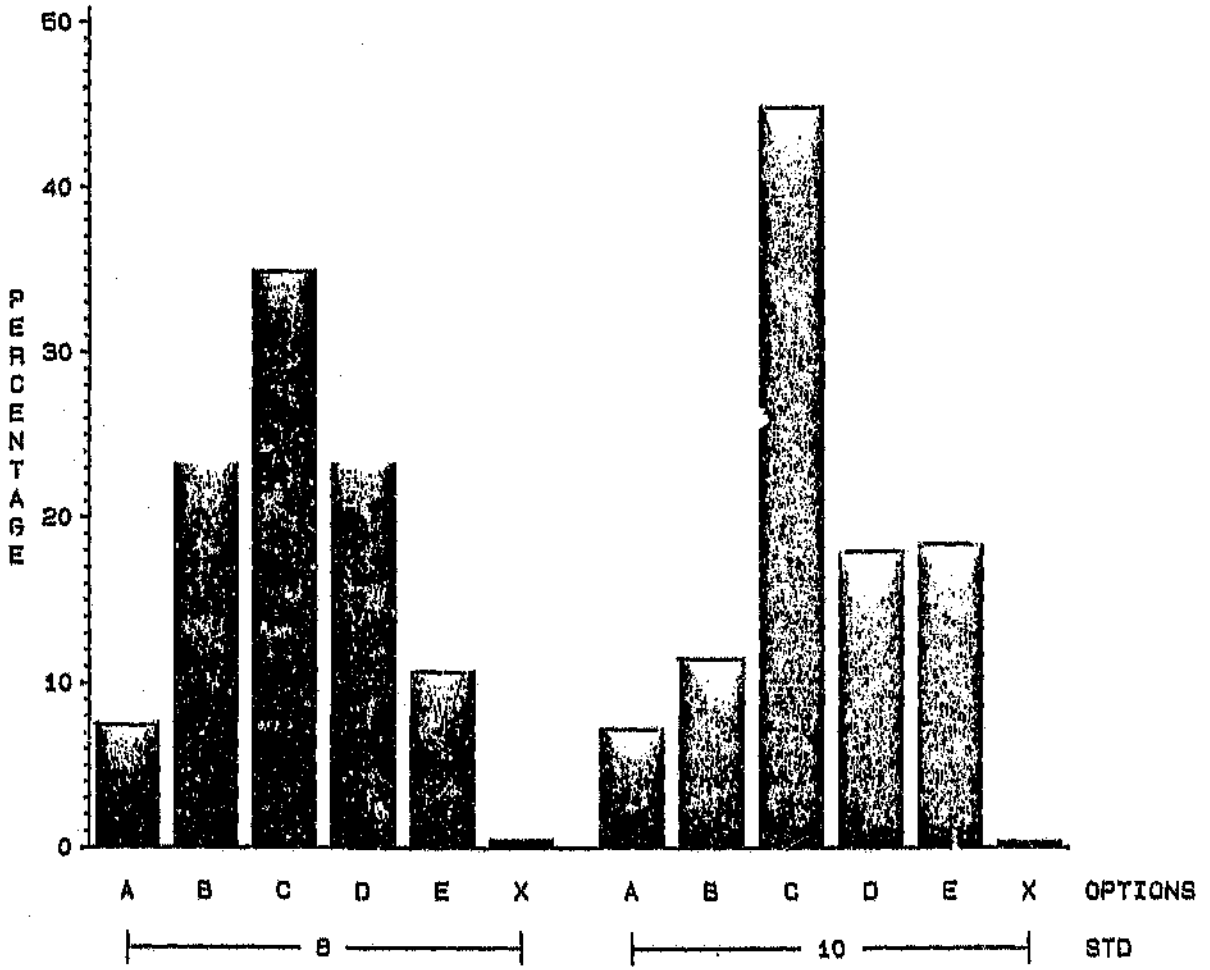
STD 8 QUESTIONNAIRE

QUESTION 7
CORRECT ANSWER IS C



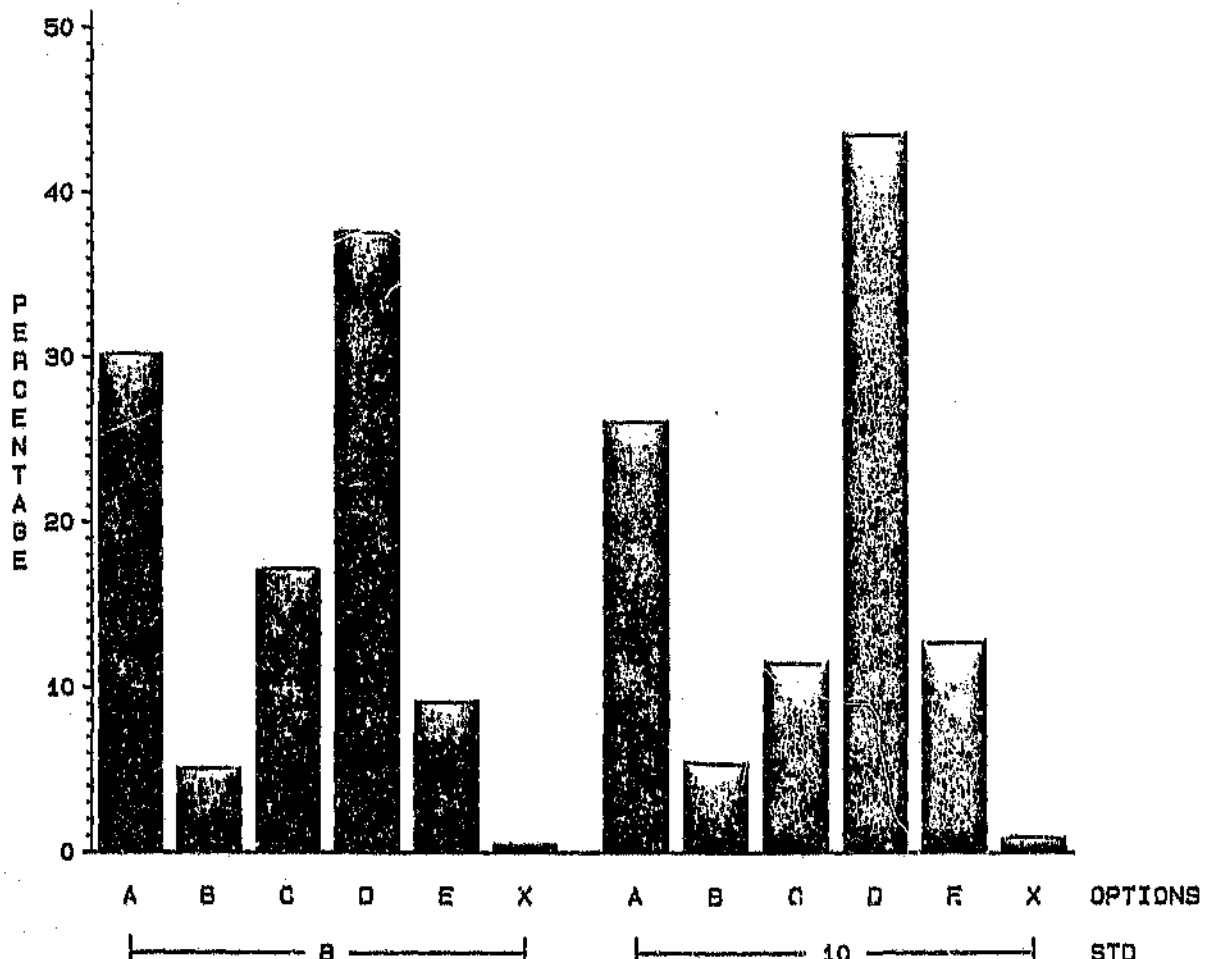
STD 8 QUESTIONNAIRE

QUESTION 6
CORRECT ANSWER IS D



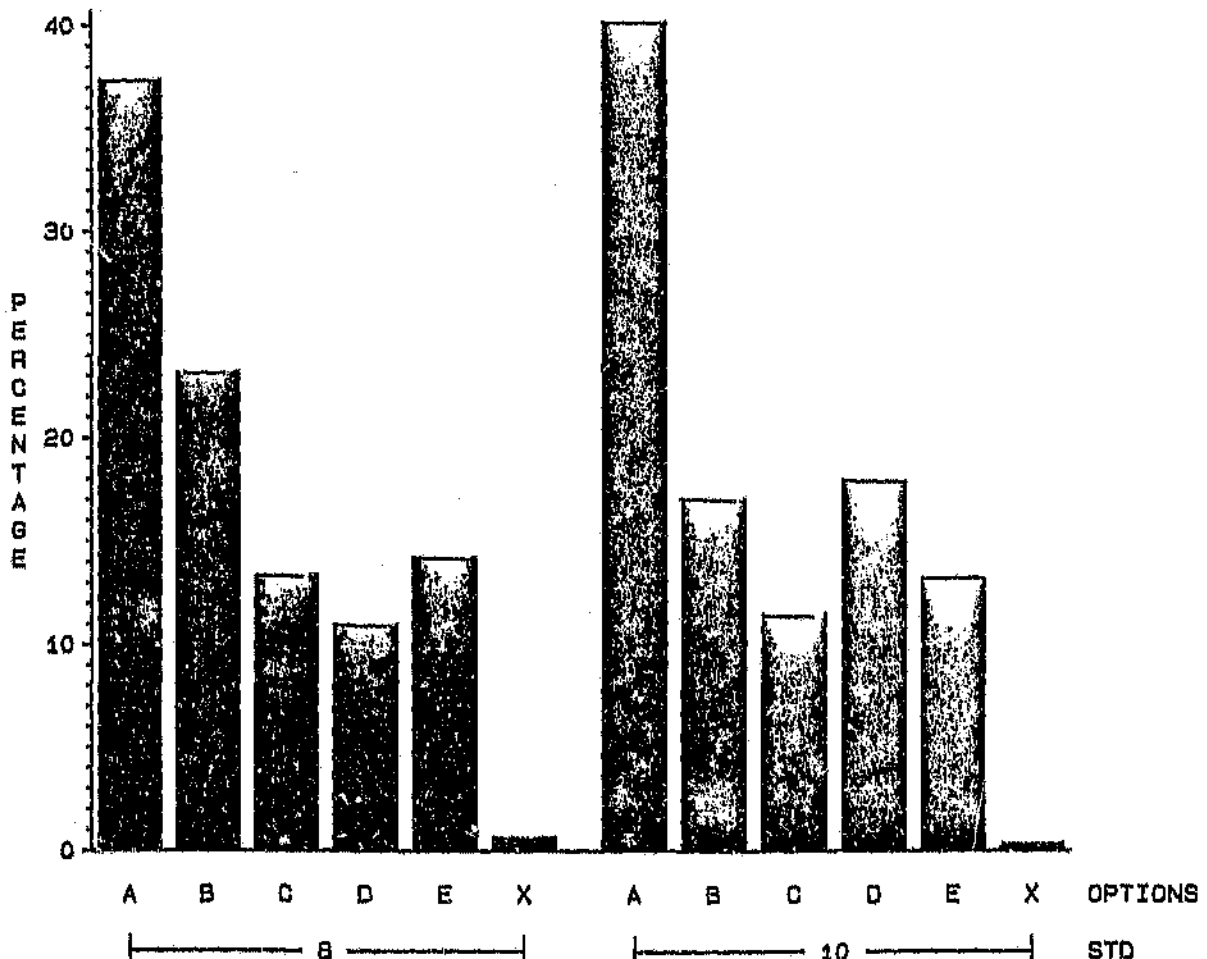
STD 8 QUESTIONNAIRE

QUESTION 5
CORRECT ANSWER IS E



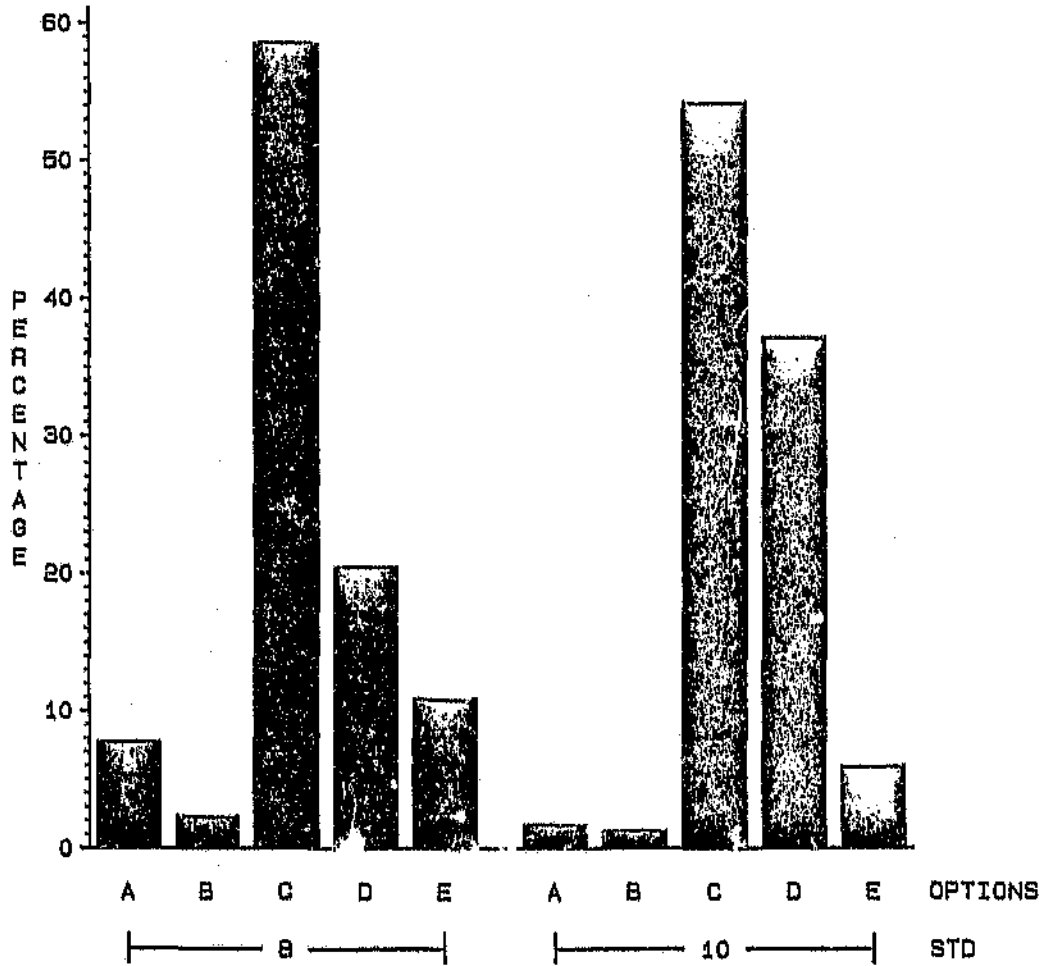
STD 8 QUESTIONNAIRE

QUESTION 4
CORRECT ANSWER IS A



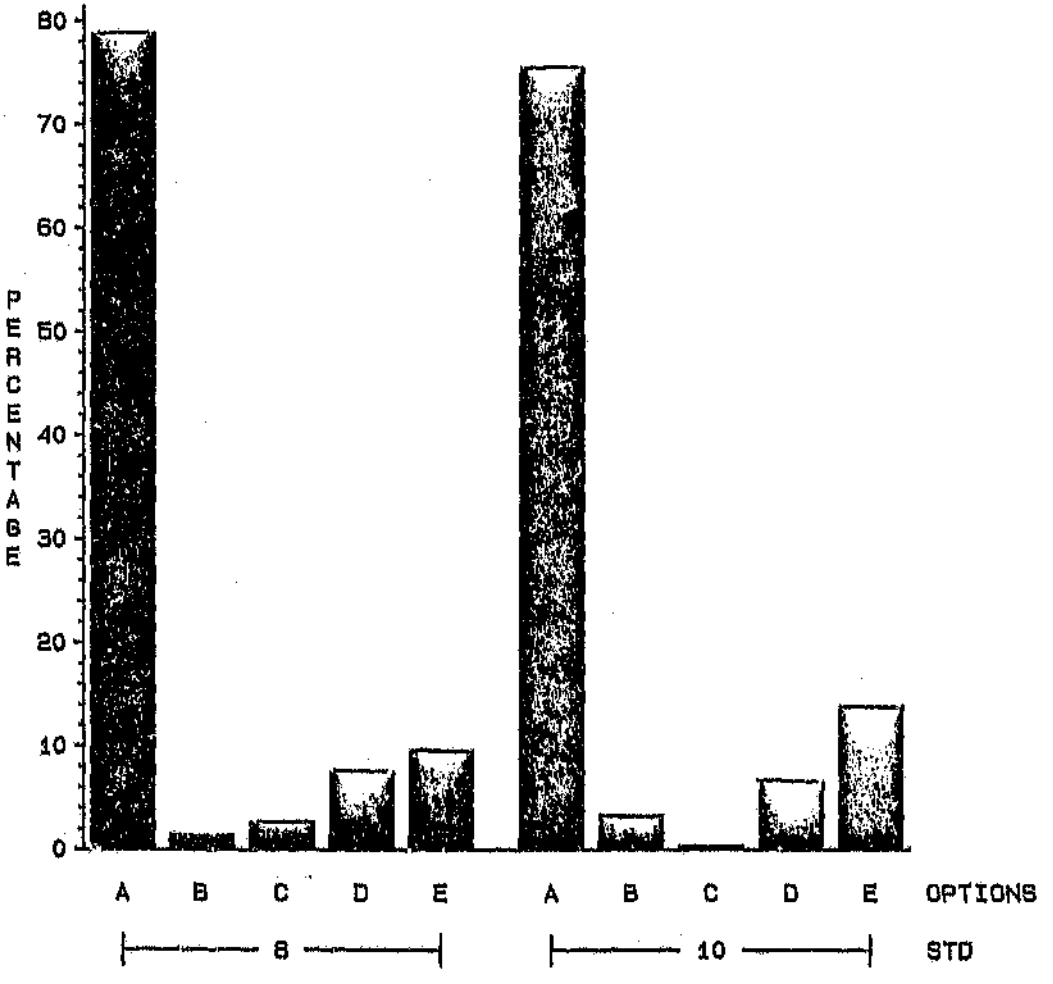
STD 8 QUESTIONNAIRE

QUESTION 3
CORRECT ANSWER IS E



STD 8 QUESTIONNAIRE

QUESTION 1
CORRECT ANSWER IS D



APPENDIX J1

OBS	TEN1	TEN2	TEN3	TEN4	TEN5	TEN6	TEN7	MCQ101	MCQ102	MCQ103	MCQ104	MCQ105	MCQ106	MCQ107	TOTTEN	SCHOOL	STD
602	B	A	D	E	A	A	B	0	0	1	1	0	0	0	2	School no.1	10
603	B	B	B	A	A	A	B	0	0	0	0	0	0	0	0	School no.1	10
604	A	B	D	A	B	A	C	0	0	1	0	0	0	1	2	School no.1	10
605	B	D	B	A	D	C	D	1	0	0	0	0	0	0	1	School no.1	10
606	B	E	B	E	A	X	B	0	0	0	1	0	0	0	1	School no.1	10
607	E	A	B	A	D	A	E	1	0	0	0	0	0	0	1	School no.1	10
608	E	A	B	A	D	A	E	1	0	0	0	0	0	0	1	School no.1	10
609	[illegible]	A	B	A	D	A	E	1	0	0	0	[illegible]	0	0	1	School no.1	10
610	E	C	D	[illegible]	E	A	B	1	1	1	0	[illegible]	0	0	3	School no.1	10
611	D	D	E	E	D	C	B	0	0	0	1	0	0	0	1	School no.1	10
612	B	B	E	E	E	C	B	0	0	0	1	0	0	0	1	School no.1	10
613	D	D	B	E	D	C	B	0	0	0	1	0	0	0	1	School no.1	10
614	B	E	E	A	D	B	C	0	0	0	0	0	0	1	1	School no.1	10
615	E	A	D	E	E	E	B	1	0	1	1	0	1	0	4	School no.1	10
616	E	A	C	E	E	E	C	1	0	0	1	0	1	1	4	School no.1	10
617	E	A	C	E	E	E	C	1	0	0	1	0	1	1	4	School no.1	10
618	E	A	C	E	E	E	C	1	0	0	1	0	1	1	4	School no.1	10
619	D	E	B	C	D	A	C	0	0	0	0	0	0	1	1	School no.1	10
620	D	B	D	C	A	E	B	0	0	1	0	0	1	0	2	School no.1	10
621	D	B	D	C	E	A	A	0	0	1	0	0	0	0	1	School no.1	10
622	D	E	D	A	D	B	C	0	0	1	0	0	0	1	2	School no.6	10
623	B	C	C	A	B	E	C	0	1	0	0	0	1	1	3	School no.6	10
624	D	D	D	E	D	D	D	0	0	1	1	0	0	0	2	School no.6	10
625	A	D	D	E	A	D	D	0	0	1	1	0	0	0	2	School no.6	10
626	D	D	B	E	D	D	D	0	0	0	1	0	0	0	1	School no.6	10
627	A	B	E	C	D	B	A	0	0	0	0	0	0	0	0	School no.6	10
628	A	B	A	E	A	A	A	0	0	0	1	0	0	0	1	School no.6	10
629	C	D	D	C	A	B	E	0	0	1	0	0	0	0	1	School no.6	10
630	A	D	C	D	E	D	D	0	0	0	0	0	0	0	0	School no.6	10
631	E	D	B	C	A	D	E	1	0	0	0	0	0	0	1	School no.6	10
632	C	C	B	E	A	A	B	0	1	0	1	0	0	0	2	School no.6	10
633	A	X	C	C	A	C	A	0	0	0	0	0	0	0	0	School no.6	10
634	A	A	E	E	D	C	E	0	0	0	1	0	0	0	1	School no.6	10
635	B	D	D	C	E	A	E	0	0	1	0	0	0	0	1	School no.6	10
636	E	B	B	E	A	D	C	1	0	0	1	0	0	1	3	School no.6	10
637	C	D	C	E	E	E	A	0	0	0	1	0	1	0	2	School no.6	10
638	A	D	A	C	E	D	C	0	0	0	0	0	0	1	1	School no.6	10
639	D	C	E	E	D	B	C	0	1	0	1	0	0	1	3	School no.6	10
640	E	C	B	C	A	D	E	1	1	0	0	0	0	0	2	School no.6	10
641	E	B	B	B	A	A	B	1	0	0	0	0	0	0	1	School no.6	10
642	D	B	A	C	A	B	C	0	0	0	0	0	0	1	1	School no.6	10
643	E	C	D	E	A	E	C	1	1	1	1	0	1	1	6	School no.6	10
644	B	C	B	D	D	E	C	0	1	0	0	0	1	1	3	School no.6	10
645	E	D	D	C	D	E	B	1	0	1	0	0	1	0	3	School no.6	10
646	A	B	D	A	A	D	C	0	0	1	0	0	0	1	2	School no.6	10

OBS	TEN1	TEN2	TEN3	TEN4	TEN5	TEN6	TEN7	MCQ101	MCQ102	MCQ103	MCQ104	MCQ105	MCQ106	MCQ107	TOTTEN	SCHOOL	STD
554	D	C	B	E	D	B	A	0	1	0	1	0	0	0	2	School no.3	10
555	C	C	B	D	E	D	A	0	1	0	0	0	0	0	1	School no.3	10
556	C	B	B	A	D	A	B	0	0	0	0	0	0	0	0	School no.3	10
557	D	D	E	E	E	E	A	0	0	0	1	0	1	0	2	School no.3	10
558	D	A	C	A	A	B	C	0	0	0	0	0	0	1	1	School no.3	10
559	A	C	D	A	D	C	C	0	1	1	0	0	0	1	3	School no.3	10
560	C	B	D	B	B	C	C	0	0	1	0	0	0	1	2	School no.3	10
561	E	A	E	A	D	E	B	1	0	0	0	0	1	0	2	School no.3	10
562	C	D	A	A	D	E	A	0	0	0	0	0	1	0	1	School no.3	10
563	A	B	A	B	B	C	A	0	0	0	0	0	0	0	0	School no.3	10
564	D	B	B	E	A	D	A	0	0	0	1	0	0	0	1	School no.3	10
565	B	D	B	E	A	E	C	0	0	0	1	0	1	1	3	School no.3	10
566	A	D	D	E	B	C	A	0	0	1	1	0	0	0	2	School no.3	10
567	A	B	D	D	B	A	A	0	0	1	0	0	0	0	1	School no.3	10
568	A	C	D	D	B	A	A	0	1	1	0	0	0	0	2	School no.3	10
569	A	D	D	E	B	A	C	0	0	1	1	0	0	1	3	School no.3	10
570	A	C	E	D	D	A	B	0	1	0	0	0	0	0	1	School no.3	10
571	A	C	E	C	D	D	B	0	1	0	0	0	0	0	1	School no.3	10
572	A	C	E	D	D	B	C	0	1	0	0	0	0	1	2	School no.3	10
573	A	C	E	D	D	A	B	0	1	0	0	0	0	0	1	School no.3	10
574	A	B	E	A	E	A	A	0	0	0	0	0	0	0	0	School no.3	10
575	A	D	D	A	D	C	C	0	0	1	0	0	0	1	2	School no.3	10
576	C	C	D	B	A	D	D	0	1	1	0	0	0	0	2	School no.3	10
577	D	E	E	A	A	D	C	0	0	0	0	0	0	1	1	School no.3	10
578	B	A	E	A	A	B	E	0	0	0	0	0	0	0	0	School no.3	10
579	A	B	C	B	E	E	A	0	0	0	0	0	1	0	1	School no.3	10
580	A	B	D	B	C	E	B	0	0	1	0	1	1	0	3	School no.3	10
581	A	B	D	E	E	D	B	0	0	1	1	0	0	0	2	School no.3	10
582	B	C	D	E	E	D	B	0	1	1	1	0	0	0	3	School no.3	10
583	B	B	B	A	A	A	D	0	0	0	0	0	0	0	0	School no.1	10
584	B	D	B	A	A	C	D	0	0	0	0	0	0	0	0	School no.1	10
585	A	E	B	E	A	X	B	0	0	0	1	0	0	0	1	School no.1	10
586	E	E	B	E	A	A	B	1	0	0	0	0	0	0	2	School no.1	10
587	B	A	D	E	A	A	B	0	0	1	1	0	0	0	2	School no.1	10
588	B	B	B	E	A	C	B	0	0	0	1	0	0	0	1	School no.1	10
589	B	A	D	C	A	A	B	0	0	1	0	0	0	0	1	School no.1	10
590	A	E	D	E	A	C	B	0	0	1	1	0	0	0	2	School no.1	10
591	E	A	D	B	E	E	C	1	0	1	0	0	1	1	4	School no.1	10
592	E	A	D	E	E	E	B	1	0	1	1	0	1	0	4	School no.1	10
593	A	B	A	A	C	D	A	0	0	0	0	1	0	0	1	School no.1	10
594	E	E	B	C	A	X	B	1	0	0	0	0	0	0	1	School no.1	10
595	E	A	D	E	E	E	B	1	0	1	1	0	1	0	4	School no.1	10
596	B	B	E	E	E	C	B	0	0	0	1	0	0	0	1	School no.1	10
597	E	A	D	E	E	E	B	1	0	1	1	0	1	0	4	School no.1	10
598	E	A	C	E	E	E	C	1	0	0	1	0	1	1	4	School no.1	10
599	E	E	B	E	A	D	B	1	0	0	1	0	0	0	2	School no.1	10
600	B	B	B	E	A	C	B	0	0	0	1	0	0	0	1	School no.1	10
601	B	D	B	E	A	C	D	0	0	0	1	0	0	0	1	School no.1	10

OBS	TEN1	TEN2	TEN3	TEN4	TEN5	TEN6	TEN7	MCQ101	MCQ102	MCQ103	MCQ104	MCQ105	MCQ106	MCQ107	TOTTEN	SCHOOL	STD
503	B	D	B	B	E	B	C	0	0	0	0	0	0	1	1	School no.2	10
504	D	B	B	C	E	B	D	0	0	0	0	0	0	0	0	School no.2	10
505	A	A	B	A	D	D	C	0	0	0	0	0	0	1	1	School no.2	10
506	D	D	A	E	E	D	B	0	0	0	1	0	0	0	1	School no.2	10
507	E	D	A	E	C	D	B	1	0	0	1	1	0	0	3	School no.2	10
508	A	C	B	A	D	A	C	0	1	0	0	0	0	1	2	School no.2	10
509	A	C	B	B	D	A	C	0	1	0	0	0	0	1	2	School no.2	10
510	C	B	B	C	D	B	A	0	0	0	0	0	0	0	0	School no.2	10
511	C	B	B	A	A	A	C	0	0	0	0	0	0	1	1	School no.2	10
512	C	B	E	C	D	B	C	0	0	0	0	0	0	1	1	School no.2	10
513	C	B	B	C	B	D	D	0	0	0	0	0	0	0	0	School no.2	10
514	A	B	B	B	B	A	C	0	0	0	0	0	0	1	1	School no.2	10
515	A	B	C	B	B	D	C	0	0	0	0	0	0	1	1	School no.2	10
516	D	B	C	C	E	A	C	0	0	0	0	0	0	1	1	School no.2	10
517	A	D	A	C	E	B	D	0	0	0	0	0	0	0	0	School no.2	10
518	E	D	C	B	C	D	A	1	0	0	0	1	0	0	2	School no.2	10
519	A	B	B	B	B	D	C	0	0	0	0	0	0	1	1	School no.2	10
520	D	A	D	A	B	E	C	0	0	1	0	0	1	1	3	School no.2	10
521	D	A	D	A	B	E	C	0	0	1	0	0	1	1	3	School no.2	10
522	D	A	C	A	D	E	C	0	0	0	0	0	1	1	2	School no.2	10
523	E	C	C	E	A	A	D	1	1	0	1	0	0	0	3	School no.2	10
524	E	B	C	E	A	A	D	1	0	0	1	0	0	0	2	School no.2	10
525	E	C	E	A	A	A	D	1	1	0	0	0	0	0	2	School no.2	10
526	E	B	C	E	D	D	C	1	0	0	1	0	0	1	3	School no.2	10
527	E	B	C	B	D	D	C	1	0	0	0	0	0	1	2	School no.2	10
528	A	A	B	B	D	B	A	0	0	0	0	0	0	0	0	School no.2	10
529	A	C	A	E	A	D	C	0	1	0	1	0	0	1	3	School no.2	10
530	A	B	B	B	B	D	A	0	0	0	0	0	0	0	0	School no.2	10
531	A	B	D	A	D	D	B	0	0	1	0	0	0	0	1	School no.2	10
532	D	B	B	E	D	D	A	0	0	0	1	0	0	0	1	School no.2	10
533	E	B	D	A	D	D	B	1	0	1	0	0	0	0	2	School no.2	10
534	D	D	B	E	D	B	E	0	0	0	1	0	0	0	1	School no.2	10
535	D	B	D	B	C	E	B	0	0	1	0	1	1	0	3	School no.2	10
536	A	E	C	C	D	C	E	0	0	0	0	0	0	0	0	School no.2	10
537	D	B	D	E	D	A	B	0	0	1	1	0	0	0	2	School no.2	10
538	A	A	C	E	D	A	C	0	0	0	1	0	0	1	2	School no.2	10
539	D	B	B	E	D	C	A	0	0	0	1	0	0	0	1	School no.2	10
540	A	C	D	D	A	D	B	0	1	1	0	0	0	0	2	School no.2	10
541	B	C	C	A	A	D	C	0	1	0	0	0	0	1	2	School no.2	10
542	A	D	D	A	E	D	C	0	0	1	0	0	0	1	2	School no.2	10
543	C	B	D	E	A	C	E	0	0	1	1	0	0	0	2	School no.2	10
544	B	C	C	A	C	D	A	0	1	0	0	1	0	0	2	School no.2	10
545	A	B	E	B	D	A	B	0	0	0	0	0	0	0	0	School no.2	10
546	E	C	D	E	B	E	A	1	1	1	1	0	1	0	5	School no.2	10
547	A	D	D	C	E	E	C	0	0	1	0	0	1	1	3	School no.2	10
548	A	D	D	A	E	E	C	0	0	1	0	0	1	1	3	School no.2	10
549	A	B	A	A	E	D	C	0	0	0	0	0	0	1	1	School no.2	10
550	A	D	D	A	A	D	B	0	0	1	0	0	0	1	1	School no.2	10
551	E	B	D	E	B	B	C	1	0	1	1	0	0	1	4	School no.3	10
552	A	C	E	A	D	C	B	0	1	0	0	0	0	0	1	School no.3	10
553	B	B	B	D	C	B	A	0	0	0	0	1	0	0	1	School no.3	10

OBS	TEN1	TEN2	TEN3	TEN4	TEN5	TEN6	TEN7	MCQ101	MCQ102	MCQ103	MCQ104	MCQ105	MCQ106	MCQ107	TOTTEN	SCHOOL	STD
457	A	B	E	A	E	A	B	0	0	0	0	0	0	0	0	School no.4	10
458	E	B	B	C	E	C	A	1	0	0	0	0	0	0	1	School no.4	10
459	E	D	D	C	D	E	B	1	0	1	0	0	1	0	3	School no.4	10
460	A	B	E	A	A	D	B	0	0	0	0	0	0	0	0	School no.4	10
461	C	D	C	C	A	D	C	0	0	0	0	0	0	1	1	School no.4	10
462	A	E	E	C	D	A	D	0	0	0	0	0	0	0	0	School no.4	10
463	A	E	B	A	A	D	D	0	0	0	0	0	0	0	0	School no.4	10
464	B	C	B	E	D	E	B	0	1	0	1	0	1	0	3	School no.4	10
465	E	B	B	A	A	E	E	1	0	0	0	0	1	0	2	School no.4	10
466	C	C	D	X	A	B	B	0	1	1	0	0	0	0	2	School no.4	10
467	A	D	E	C	E	D	B	0	0	0	0	0	0	0	0	School no.4	10
468	A	C	D	E	D	E	D	0	1	1	1	0	1	0	4	School no.4	10
469	A	B	D	C	A	A	A	0	0	1	0	0	0	0	1	School no.4	10
470	A	C	D	C	E	B	E	0	1	1	0	0	0	0	2	School no.4	10
471	A	C	E	A	A	C	A	0	1	0	0	0	0	0	1	School no.4	10
472	D	B	B	E	D	E	E	0	0	0	1	0	1	0	2	School no.4	10
473	B	E	B	A	A	A	C	0	0	0	0	0	0	1	1	School no.4	10
474	D	E	A	B	A	B	B	0	0	0	0	0	0	0	0	School no.4	10
475	E	C	B	E	C	D	C	1	1	0	1	1	0	1	5	School no.4	10
476	C	D	B	A	A	A	B	0	0	0	0	0	0	0	0	School no.4	10
477	B	C	A	A	C	E	B	0	1	0	0	1	1	0	3	School no.4	10
478	E	B	B	C	B	E	C	1	0	0	0	0	1	1	3	School no.4	10
479	B	C	D	B	B	C	C	0	1	1	0	0	0	1	3	School no.4	10
480	A	C	E	A	D	A	C	0	1	0	0	0	0	1	2	School no.4	10
481	A	C	E	D	B	E	B	0	1	0	0	0	1	0	2	School no.4	10
482	A	C	E	A	A	E	B	0	1	0	0	0	1	0	2	School no.4	10
483	E	D	C	E	A	D	C	1	0	0	1	0	0	1	3	School no.4	10
484	A	D	C	A	A	D	B	0	0	0	0	0	0	0	0	School no.4	10
485	D	D	C	E	A	A	A	0	0	0	1	0	0	0	1	School no.4	10
486	D	C	D	B	A	C	A	0	1	1	0	0	0	0	2	School no.4	10
487	E	B	D	E	D	A	B	1	0	1	1	0	0	0	3	School no.4	10
488	E	B	B	B	B	D	B	1	0	0	0	0	0	0	1	School no.4	10
489	B	A	D	E	A	D	B	0	0	1	1	0	0	0	2	School no.4	10
490	A	B	D	E	D	D	A	0	0	1	1	0	0	0	2	School no.4	10
491	E	B	C	A	E	D	A	1	0	0	0	0	0	0	1	School no.4	10
492	E	D	D	E	A	D	B	1	0	1	1	0	0	0	3	School no.4	10
493	A	B	B	E	A	A	D	0	0	0	1	0	0	0	1	School no.4	10
494	E	C	B	A	D	D	B	1	1	0	0	0	0	0	2	School no.4	10
495	C	B	B	C	A	A	B	0	0	0	0	0	0	0	0	School no.4	10
496	E	D	D	E	D	D	C	1	0	1	1	0	0	1	4	School no.4	10
497	E	D	D	E	A	D	B	1	0	1	1	0	0	0	3	School no.4	10
498	A	B	D	C	D	X	B	0	0	1	0	0	0	0	1	School no.4	10
499	D	D	B	A	D	E	B	0	0	0	0	0	1	0	1	School no.2	10
500	A	C	B	A	D	A	C	0	1	0	0	0	0	1	2	School no.2	10
501	A	B	B	C	D	A	B	0	0	0	0	0	0	0	0	School no.2	10
502	A	B	X	C	D	E	A	0	0	0	0	0	1	0	1	School no.2	10

PHASE 2: FREQUENCY TABLES FOR ALL SCHOOLS EXCEPT SCHOOL NO.1, SCHOOL NO.5 AND SCHOOL NO.6.

Chi-Square test

TABLE OF PHASE BY Q2

PHASE Q2

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	141	270	411
	18.36	35.16	53.52
	34.31	65.69	
	51.46	54.66	
2	133	224	357
	17.32	29.17	46.48
	37.25	62.29	
	48.54	45.34	
Total	274	494	768
	35.68	64.32	100.00

STATISTICS FOR TABLE OF PHASE BY Q2

Statistic	DF	Value	Prob
Chi-Square	1	0.724	0.395
Likelihood Ratio Chi-Square	1	0.723	0.395
Continuity Adj. Chi-Square	1	0.601	0.438
Mantel-Haenszel Chi-Square	1	0.723	0.395
Fisher's Exact Test (Left)			0.219
(Right)			0.823
(2-Tail)			0.407
Phi Coefficient		-0.031	
Contingency Coefficient		0.031	
Cramer's V		-0.031	

Sample Size = 768

PHASE 2: FREQUENCY TABLES FOR ALL SCHOOLS EXCEPT SCHOOL NO.1, SCHOOL NO.5 AND SCHOOL NO.6.

(Phase I, (N=411) with teaching delayed phase 2, (N=357))

Chi-Square test

TABLE OF PHASE BY Q1

PHASE Q1

Frequency Percent Row Pct Col Pct	0	1	Total
1	380	31	411
	49.48	4.04	53.52
	92.46	7.54	
	53.75	50.82	
2	327	30	357
	42.58	3.91	46.48
	91.24	8.76	
	49.67	53.73	
Total	707	61	768
	92.06	7.94	100.00

STATISTICS FOR TABLE OF PHASE BY Q1

Statistic	DF	Value	Prob
Chi-Square	1	0.194	0.660
Likelihood Ratio Chi-Square	1	0.193	0.660
Continuity Adj. Chi-Square	1	0.094	0.759
Mantel-Haenszel Chi-Square	1	0.193	0.660
Fisher's Exact Test (Left)			0.717
(Right)			0.379
(2-Tail)			0.690
Phi Coefficient		0.016	
Contingency Coefficient		0.016	
Cramer's V		0.016	

Sample Size = 768

APPENDIX A2

COMPARISON OF STANDARD 8'S RESULTS FOR PHASE 1 & 2 ON THE STANDARD 8 REACTIVITY QUESTIONNAIRE

[Phase 1, (N=411) with teaching delayed phase 2, (N=357)]

Students t-test

TTEST PROCEDURE

Variable: TOTAL

PHASE	N	Mean	Std Dev	Std Error
1	411	1.91240876	1.22060233	0.06020787
2	357	2.32773109	1.30325377	0.06897550

Variances	T	DF	Prob>|T|
Unequal	-4.5362	734.0	0.0001
Equal	-4.5572	766.0	0.0000

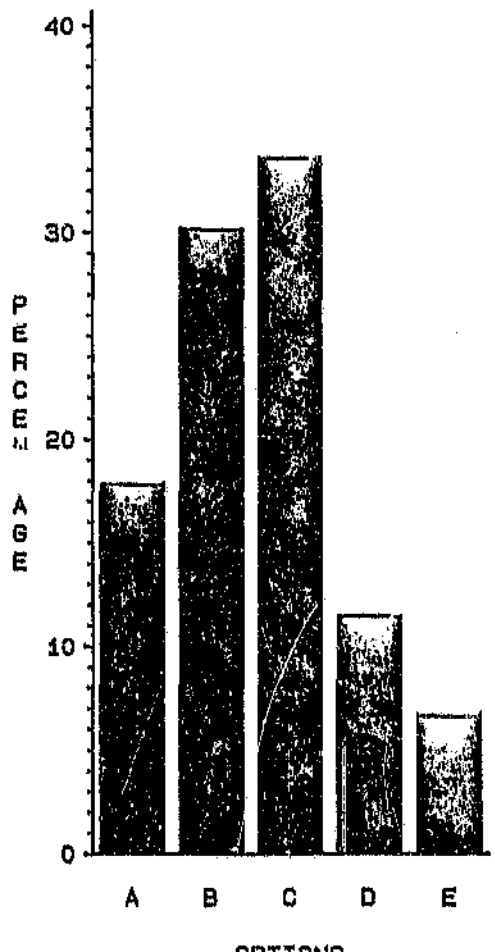
For HO: Variances are equal, F' = 1.14 DF = (356,410) Prob>F' = 0.1998

APPENDIX A2

PHASE 2

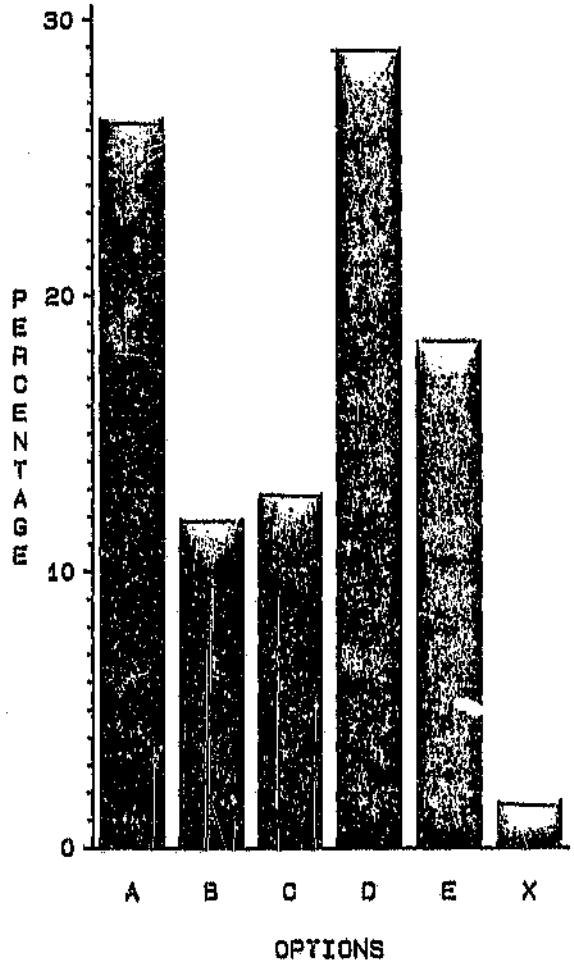
STD 10 QUESTIONNAIRE

QUESTION 7
CORRECT ANSWER IS C



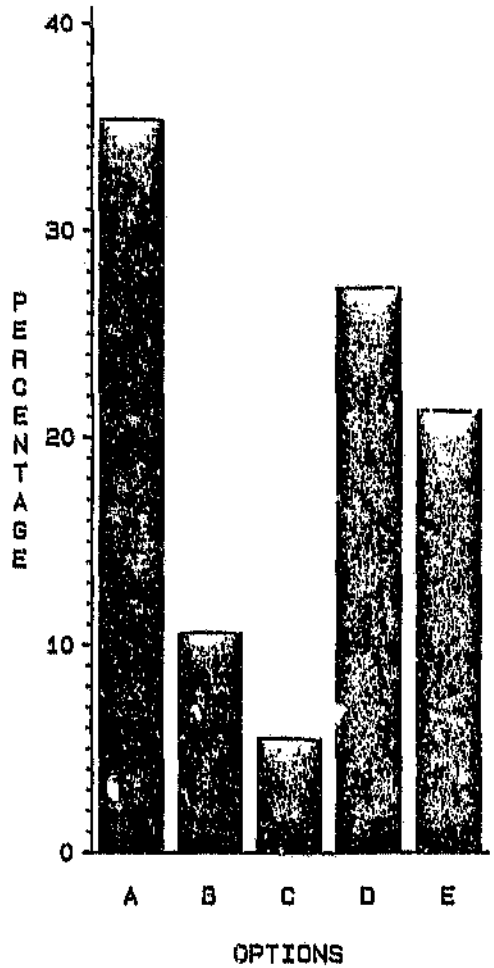
STD 10 QUESTIONNAIRE

QUESTION 6
CORRECT ANSWER IS E



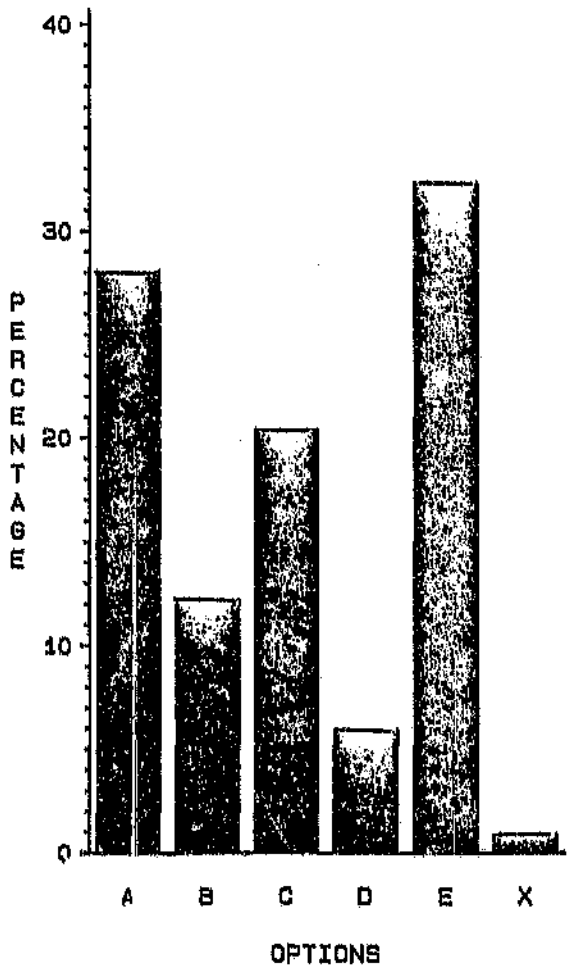
STD 10 QUESTIONNAIRE

QUESTION 5
CORRECT ANSWER IS C



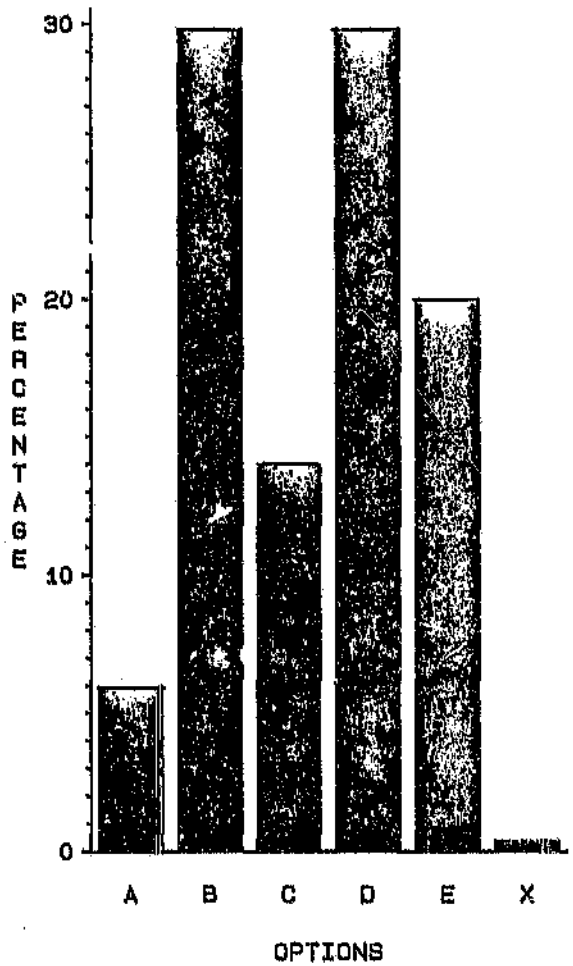
STD 10 QUESTIONNAIRE

QUESTION 4
CORRECT ANSWER IS E



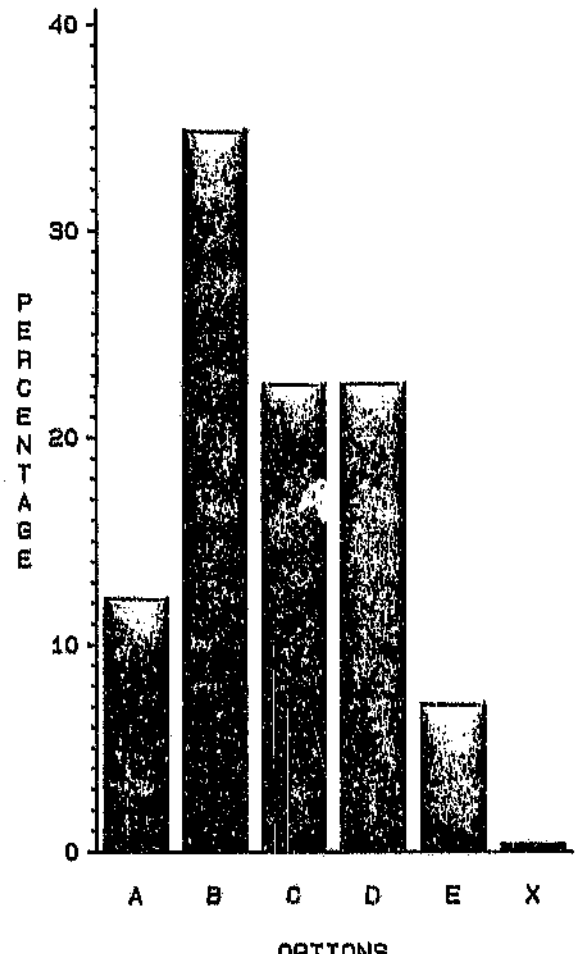
STD 10 QUESTIONNAIRE

QUESTION 3
CORRECT ANSWER IS D



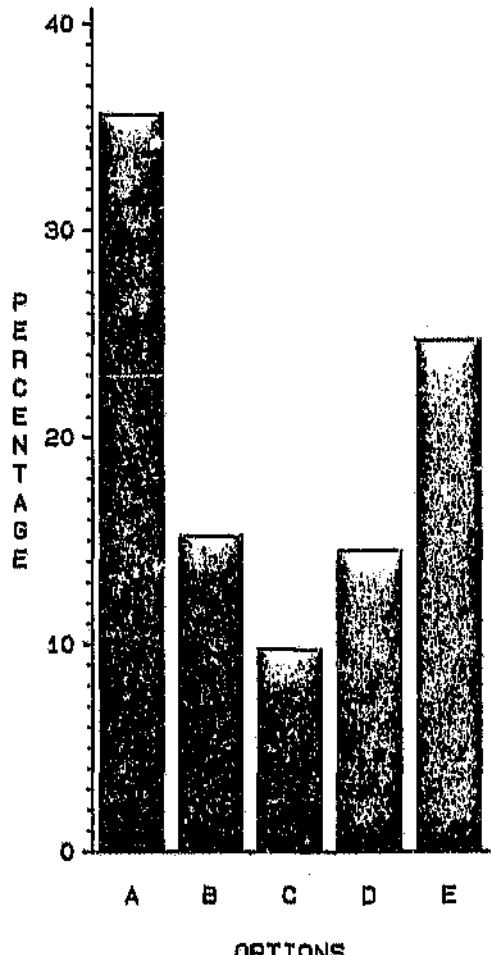
STD 10 QUESTIONNAIRE

QUESTION 2
CORRECT ANSWER IS C



STD 10 QUESTIONNAIRE

QUESTION 1
CORRECT ANSWER IS E



Chi-Square test

PHASE Q4

Frequency Percent Row Pct Col Pct	0	1	Total
1	258	153	411
	46.99	27.87	74.86
	62.77	37.23	
	75.44	73.91	
2	84	54	138
	15.30	9.84	25.14
	60.87	39.13	
	24.56	26.09	
Total	342	207	549
	62.30	37.70	100.00

STATISTICS FOR TABLE OF PHASE BY Q4

Statistic	DF	Value	Prob
Chi-Square	1	0.159	0.690
Likelihood Ratio Chi-Square	1	0.159	0.690
Continuity Adj. Chi-Square	1	0.089	0.766
Mantel-Haenszel Chi-Square	1	0.159	0.690
Fisher's Exact Test (Left)			0.693
(Right)			0.382
(2-Tail)			0.686
Phi Coefficient		0.017	
Contingency Coefficient		0.017	
Cramer's V		0.017	

Effective Sample Size = 549

Chi-Square test

PHASE Q3

Frequency Percent Row Pct Col Pct	0	1	Total
1	366	45	411
	66.67	8.20	74.86
	89.05	10.95	
	74.09	81.82	
2	128	10	138
	23.32	1.82	25.14
	92.75	7.25	
	25.91	18.18	
Total	494	55	549
	89.98	10.02	100.00

STATISTICS FOR TABLE OF PHASE BY Q3

Statistic	DF	Value	Prob
Chi-Square	1	1.571	0.210
Likelihood Ratio Chi-Square	1	1.673	0.196
Continuity Adj. Chi-Square	1	1.187	0.276
Mantel-Haenszel Chi-Square	1	1.568	0.210
Fisher's Exact Test (Left)			0.137
(Right)			0.926
(2-Tail)			0.253
Phi Coefficient		-0.053	
Contingency Coefficient		0.053	
Cramer's V		-0.053	

Effective Sample Size = 549

Chi-Square test

PHASE Q2

Frequency Percent Row Pct Col Pct	0	1	Total
1	141 25.68 34.31 75.00	270 49.18 65.69 74.79	411 74.86
2	47 8.56 34.06 25.00	91 16.58 65.94 25.21	138 25.14
Total	188 34.24	361 65.76	549 100.00

STATISTICS FOR TABLE OF PHASE BY Q2

Statistic	DF	Value	Prob
Chi-Square	1	0.003	0.958
Likelihood Ratio Chi-Square	1	0.003	0.958
Continuity Adj. Chi-Square	1	0.000	1.000
Mantel-Haenszel Chi-Square	1	0.003	0.958
Fisher's Exact Test (Left)			0.560
(Right)			0.522
(2-Tail)			1.000
Phi Coefficient		0.002	
Contingency Coefficient		0.002	
Cramer's V		0.002	

Effective Sample Size = 549

Chi-Square test

TABLE OF PHASE BY Q1

PHASE Q1

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	380	31	411
	69.22	5.65	74.86
	92.46	7.54	
	74.80	75.61	
2	128	10	138
	23.32	1.82	25.14
	92.75	7.25	
	25.20	24.39	
Total	508	41	549
	92.53	7.47	100.00

STATISTICS FOR TABLE OF PHASE BY Q1

Statistic	DF	Value	Prob
Chi-Square	1	0.013	0.909
Likelihood Ratio Chi-Square	1	0.013	0.909
Continuity Adj. Chi-Square	1	0.000	1.000
Mantel-Haenszel Chi-Square	1	0.013	0.909
Fisher's Exact Test (Left)			0.539
(Right)			0.609
(2-Tail)			1.000
Phi Coefficient		-0.005	
Contingency Coefficient		0.005	
Cramer's V		-0.005	

Effective Sample Size = 549

APPENDIX B2

COMPARISON OF STANDARD 8'S RESULTS FOR PHASE 1 & 2 ON THE STANDARD 8 REACTIVITY QUESTIONNAIRE

(Phase 1, (N=411) with teaching undelayed phase 2, (N=138))

Students t-test

TTEST PROCEDURE

Variable: TOTAL

PHASE	N	Mean	Std Dev	Std Error
1	411	1.91240876	1.22060233	0.06020787
2	138	2.00724638	1.16202929	0.09891850

Variances	T	DF	Prob>|T|
Unequal	-0.8190	246.0	0.4136
Equal	-0.7992	247.0	0.4245

For H0: Variances are equal, F' = 1.10 DF = (410,137) Prob>F' = 0.4997

APPENDIX B2

PHASE 2: FREQUENCY TABLES FOR ALL SCHOOLS EXCEPT SCHOOL NO.1, SCHOOL NO.5 AND SCHOOL NO.6.

Chi-Square test

TABLE OF PHASE BY Q8

PHASE Q8

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	341	70	471
	44.40	9.11	53.52
	82.97	17.03	
	53.70	52.63	
2	294	63	357
	38.28	8.20	46.48
	82.35	17.65	
	46.30	47.37	
Total	635	133	768
	82.68	17.32	100.00

STATISTICS FOR TABLE OF PHASE BY Q8

Statistic	DF	Value	Prob
Chi-Square	1	0.051	0.822
Likelihood Ratio Chi-Square	1	0.051	0.822
Continuity Adj. Chi-Square	1	0.017	0.897
Mantel-Haenszel Chi-Square	1	0.050	0.822
Fisher's Exact Test (Left)			0.626
(Right)			0.448
(2-Tail)			0.849
Phi Coefficient		0.008	
Contingency Coefficient		0.008	
Cramer's V		0.008	

Sample Size = 768

PHASE 2: FREQUENCY TABLES FOR ALL SCHOOLS EXCEPT SCHOOL NO.1, SCHOOL NO.5 AND SCHOOL NO.6.

Chi-Square test

TABLE OF PHASE BY Q7

PHASE Q7

Frequency Percent Row Pct Col Pct	0	1	Total
1	327	84	411
	42.58	10.94	53.52
	79.56	20.44	
	53.17	54.90	
2	288	69	357
	37.50	8.98	46.48
	80.67	19.33	
	46.83	45.10	
Total	615	153	768
	80.08	19.92	100.00

STATISTICS FOR TABLE OF PHASE BY Q7

Statistic	DF	Value	Prob
Chi-Square	1	0.148	0.701
Likelihood Ratio Chi-Square	1	0.148	0.701
Continuity Adj. Chi-Square	1	0.086	0.769
Mantel-Haenszel Chi-Square	1	0.147	0.701
Fisher's Exact Test (Left)			0.385
(Right)			0.682
(2-Tail)			0.710
Phi Coefficient		-0.014	
Contingency Coefficient		0.014	
Cramer's V		-0.014	

Sample Size = 768

PHASE 2: FREQUENCY TABLES FOR ALL SCHOOLS EXCEPT SCHOOL NO.1, SCHOOL NO.5 AND SCHOOL NO.6.

Chi-Square test

TABLE OF PHASE BY Q6

PHASE Q6

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	316	95	411
	41.15	12.37	53.52
	76.89	23.11	
	49.45	73.64	
2	323	34	357
	42.06	4.43	46.48
	90.48	9.52	
	50.55	26.36	
Total	639	129	768
	83.20	16.80	100.00

STATISTICS FOR TABLE OF PHASE BY Q6

Statistic	DF	Value	Prob
Chi-Square	1	25.250	0.000
Likelihood Ratio Chi-Square	1	26.306	0.000
Continuity Adj. Chi-Square	1	24.287	0.000
Mantel-Haenszel Chi-Square	1	25.217	0.000
Fisher's Exact Test (Left)			2.55E-07
(Right)			1.000
(2-Tail)			3.80E-07
Phi Coefficient		-0.181	
Contingency Coefficient		0.178	
Cramer's V		-0.181	

Sample Size = 768

PHASE 2: FREQUENCY TABLES FOR ALL SCHOOLS EXCEPT SCHOOL NO.1, SCHOOL NO.5 AND SCHOOL NO.6.

Chi-Square test

TABLE OF PHASE BY Q5

PHASE Q5

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	373	38	411
	48.57	4.95	53.52
	90.75	9.25	
	60.26	25.50	
2	246	111	357
	32.03	14.45	46.48
	68.91	31.09	
	39.74	74.50	
Total	619	149	768
	80.60	19.40	100.00

STATISTICS FOR TABLE OF PHASE BY Q5

Statistic	DF	Value	Prob
Chi-Square	1	58.313	0.000
Likelihood Ratio Chi-Square	1	59.797	0.000
Continuity Adj. Chi-Square	1	56.924	0.000
Mantel-Haenszel Chi-Square	1	58.237	0.000
Fisher's Exact Test (Left)			1.000
(Right)			1.13E-14
(2-Tail)			1.72E-14
Phi Coefficient		0.276	
Contingency Coefficient		0.266	
Cramer's V		0.276	

Sample Size = 768

PHASE 2: FREQUENCY TABLES FOR ALL SCHOOLS EXCEPT SCHOOL NO.1, SCHOOL NO.5 AND SCHOOL NO.6.

Chi-Square test

TABLE OF PHASE BY Q4

PHASE Q4

Frequency Percent Row Pct Col Pct	0	1	Total
1	258 33.59 62.77 62.47	153 19.92 37.23 43.10	411 53.52
2	155 20.18 43.42 37.53	202 26.30 55.58 56.90	357 46.48
Total	413 53.78	355 45.22	768 100.00

STATISTICS FOR TABLE OF PHASE BY Q4

Statistic	DF	Value	Prob
Chi-Square	1	28.797	0.000
Likelihood Ratio Chi-Square	1	28.946	0.000
Continuity Adj. Chi-Square	1	28.023	0.000
Mantel-Haenszel Chi-Square	1	28.759	0.000
Fisher's Exact Test (Left)			1.000
(Right)			5.59E-08
(2-Tail)			1.08E-07
Phi Coefficient		0.194	
Contingency Coefficient		0.190	
Cramer's V		0.194	

Sample Size = 768

PHASE 2: FREQUENCY TABLES FOR ALL SCHOOLS EXCEPT SCHOOL NO.1, SCHOOL NO.5 AND SCHOOL NO.6.

Chi-Square test

TABLE OF PHASE BY Q3

PHASE Q3

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	366	45	411
	47.66	5.86	53.52
	89.05	10.95	
	58.56	31.47	
2	259	98	357
	33.72	12.76	46.48
	72.55	27.45	
	41.44	68.53	
Total	625	143	768
	81.38	18.62	100.00

STATISTICS FOR TABLE OF PHASE BY Q3

Statistic	DF	Value	Prob
Chi-Square	1	34.335	0.000
Likelihood Ratio Chi-Square	1	34.729	0.000
Continuity Adj. Chi-Square	1	33.254	0.000
Mantel-Haenszel Chi-Square	1	34.290	0.000
Fisher's Exact Test (Left)			1.000
(Right)			3.38E-09
(2-Tail)			1.37E-09
Phi Coefficient		0.211	
Contingency Coefficient		0.207	
Cramer's V		0.211	

Sample Size = 768

Chi-Square test

MCQ26 GROUP

Frequency Percent Row Pct Col Pct	DELAYED	NOT DEL	Total
0	323	119	442
	65.25	24.04	89.29
	73.08	26.92	
	90.48	86.23	
1	34	19	53
	6.87	3.84	10.71
	64.15	35.85	
	9.52	13.77	
Total	357	138	495
	72.12	27.88	100.00

STATISTICS FOR TABLE OF MCQ26 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	1.875	0.171
Likelihood Ratio Chi-Square	1	1.794	0.180
Continuity Adj. Chi-Square	1	1.458	0.227
Mantel-Haenszel Chi-Square	1	1.871	0.171
Fisher's Exact Test (Left)			0.935
(Right)			0.115
(2-Tail)			0.195
Phi Coefficient		0.062	
Contingency Coefficient		0.061	
Cramer's V		0.062	

Sample Size = 495

Chi-Square test

MCQ25 GROUP

Frequency Percent Row Pct Col Pct	DELAYED	NOT DEL	Total
0	246	87	333
	49.70	17.58	67.27
	73.87	26.13	
	68.91	63.04	
1	111	51	162
	22.42	10.30	32.73
	68.52	31.48	
	31.09	36.96	
Total	357	138	495
	72.12	27.88	100.00

STATISTICS FOR TABLE OF MCQ25 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	1.555	0.212
Likelihood Ratio Chi-Square	1	1.536	0.215
Continuity Adj. Chi-Square	1	1.300	0.254
Mantel-Haenszel Chi-Square	1	1.551	0.213
Fisher's Exact Test (Left)			0.911
(Right)			0.127
(2-Tail)			0.240
Phi Coefficient		0.056	
Contingency Coefficient		0.056	
Cramer's V		0.056	

Sample Size = 495

Chi-Square test

MCQ24 GROUP

Frequency / Percent / Row Pct / Col Pct	DELAYED	NOT DEL	Total
0	155	84	239
	31.31	16.97	48.28
	64.85	35.15	
	43.42	60.87	
1	202	54	256
	40.81	10.91	51.72
	78.91	21.09	
	56.58	39.13	
Total	357	138	495
	72.12	27.88	100.00

STATISTICS FOR TABLE OF MCQ24 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	12.140	0.000
Likelihood Ratio Chi-Square	1	12.196	0.000
Continuity Adj. Chi-Square	1	11.451	0.001
Mantel-Haenszel Chi-Square	1	12.115	0.001
Fisher's Exact Test (Left)			3.49E-04
(Right)			1.000
(2-Tail)			6.24E-04
Phi Coefficient		-0.157	
Contingency Coefficient		0.155	
Cramer's V		-0.157	

Sample Size = 495

Chi-Square test

MCQ23 GROUP

Frequency / Percent / Row Pct / Col Pct	DELAYED	NOT DEL	Total
0	259	128	387
	52.32	25.86	78.18
	66.93	33.07	
	72.55	92.75	
1	98	10	108
	19.80	2.02	21.82
	90.74	9.26	
	27.45	7.25	
Total	357	138	495
	72.12	27.88	100.00

STATISTICS FOR TABLE OF MCQ23 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	23.819	0.000
Likelihood Ratio Chi-Square	1	27.988	0.000
Continuity Adj. Chi-Square	1	22.649	0.000
Mantel-Haenszel Chi-Square	1	23.771	0.000
Fisher's Exact Test (Left)			1.47E-07
(Right)			1.000
(2-Tail)			2.23E-07
Phi Coefficient		-0.219	
Contingency Coefficient		0.214	
Cramer's V		-0.219	

Sample Size = 495

Chi-Square test

MCQ22 GROUP

Frequency / Percent / Row Pct / Col Pct	DELAYED	NOT DEL	Total
0	133	47	180
	26.87	9.49	36.36
	73.89	26.11	
	37.25	34.06	
1	224	91	315
	45.25	18.38	63.64
	71.11	28.89	
	62.75	65.94	
Total	357	138	495
	72.12	27.88	100.00

STATISTICS FOR TABLE OF MCQ22 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	0.440	0.507
Likelihood Ratio Chi-Square	1	0.442	0.506
Continuity Adj. Chi-Square	1	0.312	0.576
Mantel-Haenszel Chi-Square	1	0.439	0.508
Fisher's Exact Test (Left)			0.778
(Right)			0.289
(2-Tail)			0.533
Phi Coefficient		0.030	
Contingency Coefficient		0.030	
Cramer's V		0.030	

Sample Size = 495

Chi-Square test

MCQ21 GROUP

Frequency Percent Row Pct Col Pct	DELAYED	NOT DEL	Total
0	327	128	455
	66.06	25.86	91.92
	71.87	28.13	
	91.60	92.75	
1	30	10	40
	6.06	2.02	8.08
	75.00	25.00	
	8.40	7.25	
Total	357	138	495
	72.12	27.88	100.00

STATISTICS FOR TABLE OF MCQ21 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	0.179	0.672
Likelihood Ratio Chi-Square	1	0.183	0.669
Continuity Adj. Chi-Square	1	0.057	0.811
Mantel-Haenszel Chi-Square	1	0.179	0.672
Fisher's Exact Test (Left)			0.414
(Right)			0.723
(2-Tail)			0.854
Phi Coefficient		-0.019	
Contingency Coefficient		0.019	
Cramer's V		-0.019	

Sample Size = 495

APPENDIX C2

COMPARISON OF STANDARD 8'S RESULTS FOR PHASE 2 ON THE STANDARD 8 REACTIVITY QUESTIONNAIRE

(Teaching delayed (old & new; N=357) with teaching delayed, (old & new; N=138))

Students t-test

TTEST PROCEDURE

Variable: TOTAL

PHASE	N	Mean	Std Dev	Std Error
DEL	357	2.32773109	1.30325377	0.06897550
NOT DEL	138	2.00724638	1.16202929	0.09891850

Variances	T	DF	Prob>|T|
Unequal	-2.6576	277.4	0.0083
Equal	-2.5263	493.0	0.0118

For H0: Variances are equal, F' = 1.26 DF = (356,137) Prob>F' = 0.1182

APPENDIX C2

Chi-Square test

problem option d is not the correct response.

PHASE Q8

Frequency / Percent / Row Pct / Col Pct	0	1	Total	
1	230	181	411	
	41.89	32.97	74.86	
	55.96	44.04		
	70.55	81.17		
2	96	42	138	correct option is not D check
	17.49	7.65	25.14	
	69.57	30.43		
	29.45	18.83		
Total	326	223	549	
	59.38	40.62	100.00	

STATISTICS FOR TABLE OF PHASE BY Q8

Statistic	DF	Value	Prob
Chi-Square	1	7.927	0.005
Likelihood Ratio Chi-Square	1	8.122	0.004
Continuity Adj. Chi-Square	1	7.373	0.007
Mantel-Haenszel Chi-Square	1	7.913	0.005
Fisher's Exact Test (Left)			3.05E-03
(Right)			0.998
(2-Tail)			5.04E-03
Phi Coefficient		-0.120	
Contingency Coefficient		0.119	
Cramer's V		-0.120	

Effective Sample Size = 549

Chi-Square test

PHASE Q7

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	327	84	411
	59.56	15.30	74.86
	79.56	20.44	
	74.49	76.36	
2	112	26	138
	20.40	4.74	25.14
	81.16	18.84	
	25.51	23.64	
Total	439	110	549
	79.96	20.04	100.00

STATISTICS FOR TABLE OF PHASE BY Q7

Statistic	DF	Value	Prob
Chi-Square	1	0.165	0.685
Likelihood Ratio Chi-Square	1	0.166	0.683
Continuity Adj. Chi-Square	1	0.080	0.777
Mantel-Haenszel Chi-Square	1	0.164	0.685
Fisher's Exact Test (Left)			0.393
(Right)			0.698
(2-Tail)			0.714
Phi Coefficient		-0.017	
Contingency Coefficient		0.017	
Cramer's V		-0.017	

Effective Sample Size = 549

Chi-Square test

PHASE Q6

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	316	95	411
	57.56	17.30	74.86
	76.89	23.11	
	72.64	83.33	
2	119	19	138
	21.68	3.46	25.14
	86.23	13.77	
	27.36	16.67	
Total	435	114	549
	79.23	20.77	100.00

STATISTICS FOR TABLE OF PHASE BY Q6

Statistic	DF	Value	Prob
Chi-Square	1	5.485	0.019
Likelihood Ratio Chi-Square	1	5.868	0.015
Continuity Adj. Chi-Square	1	4.932	0.026
Mantel-Haenszel Chi-Square	1	5.475	0.019
Fisher's Exact Test (Left)			0.011
(Right)			0.994
(2-Tail)			0.021
Phi Coefficient		-0.100	
Contingency Coefficient		0.099	
Cramer's V		-0.100	

Effective Sample Size = 549

Chi-Square test

PHASE Q5

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	373	38	411
	67.94	6.92	74.86
	90.75	9.25	
	81.09	42.70	
2	87	51	138
	15.85	9.29	25.14
	63.04	36.96	
	18.91	57.30	
Total	460	89	549
	83.79	16.21	100.00

STATISTICS FOR TABLE OF PHASE BY Q5

Statistic	DF	Value	Prob
Chi-Square	1	58.404	0.000
Likelihood Ratio Chi-Square	1	51.449	0.000
Continuity Adj. Chi-Square	1	56.382	0.000
Mantel-Haenszel Chi-Square	1	58.298	0.000
Fisher's Exact Test (Left)			1.000
(Right)			8.34E-13
(2-Tail)			1.25E-12
Phi Coefficient		0.326	
Contingency Coefficient		0.310	
Cramer's V		0.326	

Effective Sample Size = 549

Chi-Square test

MCQ24 GROUP

Frequency Percent Row Pct Col Pct	DELAYED	NOT DEL	Total
0	85 29.62 70.83 36.48	35 12.20 29.17 64.81	120 41.81
1	148 51.57 88.62 63.52	19 6.62 11.38 35.19	167 58.19
Total	233 81.18	54 18.82	287 100.00

STATISTICS FOR TABLE OF MCQ24 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	14.466	0.000
Likelihood Ratio Chi-Square	1	14.329	0.000
Continuity Adj. Chi-Square	1	13.325	0.000
Mantel-Haenszel Chi-Square	1	14.416	0.000
Fisher's Exact Test (Left)			1.40E-04
(Right)			1.000
(2-Tail)			2.03E-04
Phi Coefficient		-0.225	
Contingency Coefficient		0.219	
Cramer's V		-0.225	

Sample Size = 287

Chi-Square test

MCQ23 GROUP

Frequency Percent Row Pct Col Pct	DELAYED	NOT DEL	Total
0	158	48	206
	55.05	16.72	71.78
	76.70	23.30	
	67.81	88.89	
1	75	6	81
	26.13	2.09	28.22
	92.59	7.41	
	32.19	11.11	
Total	233	54	287
	81.18	18.82	100.00

STATISTICS FOR TABLE OF MCQ23 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	9.615	0.002
Likelihood Ratio Chi-Square	1	11.103	0.001
Continuity Adj. Chi-Square	1	8.602	0.003
Mantel-Haenszel Chi-Square	1	9.581	0.002
Fisher's Exact Test (Left)			9.30E-04
(Right)			1.000
(2-Tail)			1.36E-03
Phi Coefficient		-0.183	
Contingency Coefficient		0.180	
Cramer's V		-0.183	

Sample Size = 287

Chi-Square test

MCQ22 GROUP

Frequency Percent Row Pct Col Pct	DELAYED	NOT DEL	Total
0	71	22	93
	24.74	7.67	32.40
	76.34	23.66	
	30.47	40.74	
1	162	32	194
	56.45	11.15	67.60
	83.51	16.49	
	69.53	59.26	
Total	233	54	287
	81.18	18.82	100.00

STATISTICS FOR TABLE OF MCQ22 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	2.110	0.146
Likelihood Ratio Chi-Square	1	2.051	0.152
Continuity Adj. Chi-Square	1	1.668	0.197
Mantel-Haenszel Chi-Square	1	2.103	0.147
Fisher's Exact Test (Left)			0.099
(Right)			0.945
(2-Tail)			0.150
Phi Coefficient		-0.086	
Contingency Coefficient		0.085	
Cramer's V		-0.086	

Sample Size = 287

1233 - SCHOOL NO.2 & SCHOOL NO.4 (DEL) V 54 SCHOOL NO.5 (NOT DEL)

Chi-Square test

MCQ21 GROUP

Frequency / Percent / Row Pct / Col Pct	DELAYED	NOT DEL	Total
0	207	48	255
	72.13	16.72	88.85
	81.18	18.82	
	88.84	88.89	
1	26	6	32
	9.06	2.09	11.15
	81.25	18.75	
	11.16	11.11	
Total	233	54	287
	81.18	18.82	100.00

STATISTICS FOR TABLE OF MCQ21 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	0.000	0.992
Likelihood Ratio Chi-Square	1	0.000	0.992
Continuity Adj. Chi-Square	1	0.000	1.000
Mantel-Haenszel Chi-Square	1	0.000	0.992
Fisher's Exact Test (Left)			0.605
(Right)			0.584
(2-Tail)			1.000
Phi Coefficient		-0.001	
Contingency Coefficient		0.001	
Cramer's V		-0.001	

Sample Size = 287

APPENDIX D2

COMPARISON OF STANDARD 8'S RESULTS FOR PHASE 2 ON THE STANDARD 8 REACTIVITY QUESTIONNAIRE

(Teaching delayed (old; N=233) with teaching undelayed, (old; N=54))

PHASE 2: - SCHOOL NO.2 & SCHOOL NO.4 (DEL) V 54 SCHOOL NO.5 (NOT DEL)

Student's t-test

TTEST PROCEDURE

Variable: TOTTWO

GROUP	N	Mean	Std Dev	Std Error
DELAYED	233	2.62231760	1.28446277	0.08414795
NOT DEL	54	2.01851852	1.10727851	0.15068152

Variances	T	DF	Prob>|T|
Unequal	3.4985	89.2	0.0007
Equal	3.1896	285.0	0.0016

For HO: Variances are equal, F' = 1.35 DF = (232,53) Prob>F' = 0.1978

APPENDIX D2

1138 - NOT DELAYED

TWO5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	47	34.1	47	34.1
B	8	5.8	55	39.9
C	7	5.1	62	44.9
D	24	17.4	86	62.3
#E	51	37.0	137	99.3
X	1	0.7	138	100.0

TWO6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	11	8.0	11	8.0
B	33	23.9	44	31.9
C	54	39.1	98	71.0
#D	19	13.8	117	84.8
E	20	14.5	137	99.3
X	1	0.7	138	100.0

TWO7	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	21	15.2	21	15.2
B	48	34.8	69	50.0
#C	26	18.8	95	68.8
D	22	15.9	117	84.8
E	21	15.2	138	100.0

TWO8	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	38	27.5	38	27.5
B	32	23.2	70	50.7
C	9	6.5	79	57.2
D	42	30.4	121	87.7
#E	16	11.6	137	99.3
X	1	0.7	138	100.0

PHASE -2 UNDELAYED: -SCHOOL NO.6, SCHOOL NO.5, SCHOOL NO.1 NOT DELAYED

TWO1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	111	80.4	111	80.4
B	1	0.7	112	81.2
C	2	1.4	114	82.6
#D	10	7.2	124	89.9
E	14	10.1	138	100.0

TWO2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	18	13.0	18	13.0
#B	91	65.9	109	79.0
C	6	4.3	115	83.3
D	8	5.8	123	89.1
E	11	8.0	134	97.1
X	4	2.9	138	100.0

TWO3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	4	2.9	4	2.9
B	6	4.3	10	7.2
C	92	66.7	102	73.9
D	26	18.8	128	92.8
#E	10	7.2	138	100.0

TWO4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
#A	54	39.1	54	39.1
B	18	13.0	72	52.2
C	38	27.5	110	79.7
D	16	11.6	126	91.3
E	10	7.2	136	98.6
X	2	1.4	138	100.0

PHASE 2 -DELAYED

TWO5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	106	29.7	106	29.7
B	18	5.0	124	34.7
C	38	10.6	162	45.4
D	72	20.2	234	65.5
#E	111	31.1	345	96.6
X	12	3.4	357	100.0

TWO6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	23	6.4	23	6.4
B	118	33.1	141	39.5
C	120	33.6	261	73.1
#D	34	9.5	295	82.6
E	62	17.4	357	100.0

TWO7	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	50	14.0	50	14.0
B	114	31.9	164	45.9
#C	69	19.3	233	65.3
D	34	9.5	267	74.8
E	77	21.6	344	96.4
X	13	3.6	357	100.0

TWO8	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	51	14.3	51	14.3
B	134	37.5	185	51.8
C	20	5.6	205	57.4
D	85	23.8	290	81.2
#E	63	17.6	353	98.9
X	4	1.1	357	100.0

PHASE 2: FREQUENCY TABLES FOR PHASE 2, N=357 (DELAYED) and N=138 (UNDELAYED)

PHASE 2-DELAYED : School no.

TWO1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	300	84.0	300	84.0
C	2	0.6	302	84.6
#D	30	8.4	332	93.0
E	25	7.0	357	100.0

TWO2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	57	15.0	57	16.0
#B	224	62.7	281	78.7
C	10	2.8	391	81.5
D	32	9.0	323	90.5
E	32	9.0	355	99.4
X	2	0.6	357	100.0

TWO3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	25	7.0	25	7.0
B	15	4.2	40	11.2
C	130	36.4	170	47.6
D	89	24.9	259	72.5
#E	98	27.5	357	100.0

TWO4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
#A	202	56.6	202	56.6
B	41	11.5	243	68.1
C	54	15.1	297	83.2
D	32	9.0	329	92.2
E	25	7.0	354	99.2
X	5	0.8	357	100.0

Chi-Square test

MCQ28 GROUP

Frequency / Percent / Row Pct / Col Pct	DELAYED	NOT DEL	Total
0	294	122	416
	59.39	24.65	84.04
	70.67	29.33	
	82.35	88.41	
1	63	16	79
	12.73	3.23	15.96
	79.75	20.25	
	17.65	11.59	
Total	357	138	495
	72.12	27.88	100.00

STATISTICS FOR TABLE OF MCQ28 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	2.719	0.099
Likelihood Ratio Chi-Square	1	2.868	0.090
Continuity Adj. Chi-Square	1	2.286	0.131
Mantel-Haenszel Chi-Square	1	2.713	0.100
Fisher's Exact Test (Left)			0.063
(Right)			0.966
(2-Tail)			0.103
Phi Coefficient		-0.074	
Contingency Coefficient		0.07	
Cramer's V		-0.074	

Sample Size = 495

Chi-Square test

MCQ27 GROUP

Frequency Percent Row Pct Col Pct	DELAYED	NOT DEL	Total
0	286	112	400
	58.18	22.63	80.81
	72.00	28.00	
	80.67	81.16	
1	69	26	95
	13.94	5.25	19.19
	72.63	27.37	
	19.33	18.84	
Total	357	138	495
	72.12	27.88	100.00

STATISTICS FOR TABLE OF MCQ27 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	0.015	0.902
Likelihood Ratio Chi-Square	1	0.015	0.902
Continuity Adj. Chi-Square	1	0.000	1.000
Mantel-Haenszel Chi-Square	1	0.015	0.902
Fisher's Exact Test (Left)			0.506
(Right)			0.595
(2-Tail)			1.000
Phi Coefficient		-0.006	
Contingency Coefficient		0.006	
Cramer's V		-0.006	

Sample Size = 495

APPENDIX F2

184 - SCHOOL NO.1 & SCHOOL NO.6 (NOT DEL)

TWO6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	7	8.3	7	8.3
B	23	27.4	30	35.7
C	29	34.5	59	70.2
#D	14	16.7	73	86.9
E	10	11.9	83	98.8
X	1	1.2	84	100.0

TWO7	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	15	17.9	15	17.9
B	27	32.1	42	50.0
#C	17	20.2	59	70.2
D	14	16.7	73	86.9
E	11	13.1	84	100.0

TWO8	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	17	20.2	17	20.2
B	25	29.8	42	50.0
C	6	7.1	48	57.1
D	32	38.1	80	95.2
#E	3	3.6	83	98.8
X	1	1.2	84	100.0

184 - SCHOOL NO.1 & SCHOOL NO.6 (NOT DEL)

TWO1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	71	84.5	71	84.5
B	1	1.2	72	85.7
C	1	1.2	73	86.9
#D	4	4.8	77	91.7
E	7	8.3	84	100.0

TWO2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	11	13.1	11	13.1
#B	59	70.2	70	83.3
C	3	3.6	73	86.9
D	4	4.8	77	91.7
E	3	3.6	80	95.2
X	4	4.8	84	100.0

TWO3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	2	2.4	2	2.4
B	2	2.4	4	4.8
C	59	70.2	63	75.0
D	17	20.2	80	95.2
#E	4	4.8	84	100.0

TWO4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
#A	35	41.7	35	41.7
B	10	11.9	45	53.6
C	21	25.0	66	78.6
D	9	10.7	75	89.3
E	9	10.7	84	100.0

TWO5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	29	34.5	29	34.5
B	4	4.8	33	39.3
C	4	4.8	37	44.0
D	14	16.7	51	60.7
#E	32	38.1	83	98.8
X	1	1.2	84	100.0

APPENDIX E2

COMPARISON OF STANDARD 8'S RESULTS FOR PHASE 2 ON THE STANDARD 8 REACTIVITY QUESTIONNAIRE

[Teaching undelayed(old; N=54) with teaching undelayed, (new; N=84)]

Student's t-test

Variable: TOTTWO

TYPE	N	Mean	Std Dev	Std Error
NEW	84	2.00000000	1.20240727	0.13119338
OLD	54	2.01851852	1.10727851	0.15068152

Variances	T	DF	Prob>|T|
Unequal	-0.0927	119.8	0.9263
Equal	-0.0910	136.0	0.9276

For H0: Variances are equal, F' = 1.18 DF = (83,53) Prob>F' = 0.5236

APPENDIX E2

154 SCHOOL NO.5 (NOT DEL)

TWO4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
#A	19	35.2	19	35.2
B	8	14.8	27	50.0
C	17	31.5	44	81.5
D	7	13.0	51	94.4
E	1	1.9	52	96.3
X	2	3.7	54	100.0

TWO5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	18	33.3	18	33.3
B	4	7.4	22	40.7
C	3	5.6	25	46.3
D	10	18.5	35	64.8
#E	19	35.2	54	100.0

TWO6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	4	7.4	4	7.4
B	10	18.5	14	25.9
C	25	46.3	39	72.2
#D	5	9.3	44	81.5
E	10	18.5	54	100.0

TWO7	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	6	11.1	6	11.1
B	21	38.9	27	50.0
#C	9	16.7	36	66.7
D	8	14.8	44	81.5
E	10	18.5	54	100.0

TWO8	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	21	38.9	21	38.9
B	7	13.0	28	51.9
C	3	5.6	31	57.4
D	10	18.5	41	75.9
#E	13	24.1	54	100.0

1233 - SCHOOL NO.2 & SCHOOL NO.4 (DEL)

TWO7	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	44	18.9	44	18.9
B	75	32.2	119	51.1
#C	57	24.5	176	75.5
D	21	9.0	197	84.5
E	36	15.5	233	100.0

TWO8	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	40	17.2	40	17.2
B	77	33.0	117	50.2
C	13	5.6	130	55.8
D	51	21.9	181	77.7
#E	49	21.0	230	98.7
X	3	1.3	233	100.0

154 SCHOOL NO.5 (NOT DEL)

TWO1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	40	74.1	40	74.1
C	1	1.9	41	75.9
#D	6	11.1	47	87.0
E	7	13.0	54	100.0

TWO2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	7	13.0	7	13.0
#B	32	59.3	39	72.2
C	3	5.6	42	77.8
D	4	7.4	46	85.2
E	8	14.8	54	100.0

TWO3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	2	3.7	2	3.7
B	4	7.4	6	11.1
C	33	61.1	39	72.2
D	9	16.7	48	88.9
#E	6	11.1	54	100.0

1233 - SCHOOL NO.2 & SCHOOL NO.4 (DEL)

TWO1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	186	79.8	186	79.8
C	1	0.4	187	80.3
#D	26	11.2	213	91.4
E	20	8.6	233	100.0

TWO2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	34	14.6	34	14.6
#B	162	69.5	196	84.1
C	6	2.6	202	86.7
D	14	6.0	216	92.7
E	17	7.3	233	100.0

TWO3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	10	4.3	10	4.3
B	10	4.3	20	8.6
C	83	35.6	103	44.2
D	55	23.6	158	67.8
#E	75	32.2	233	100.0

TWO4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
#A	148	63.5	148	63.5
B	16	6.9	164	70.4
C	38	16.3	202	86.7
D	21	9.0	223	95.7
E	8	3.4	231	99.1
X	2	0.9	233	100.0

TWO5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	80	34.3	80	34.3
B	17	7.3	97	41.6
C	19	8.2	116	49.8
D	48	20.6	164	70.4
#E	69	29.6	233	100.0

TWO6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	15	6.4	15	6.4
B	88	37.8	103	44.2
C	61	26.2	164	70.4
#D	25	10.7	189	81.1
E	44	18.9	233	100.0

Chi-Square test

MCQ28 GROUP

Frequency / Percent / Row Pct / Col Pct	DELAYED	NOT DEL	Total
0	184	41	225
	64.11	14.29	78.40
	81.78	18.22	
	78.97	75.93	
1	49	13	62
	17.07	4.53	21.60
	79.03	20.97	
	21.03	24.07	
Total	233	54	287
	81.18	18.82	100.00

STATISTICS FOR TABLE OF MCQ28 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	0.240	0.624
Likelihood Ratio Chi-Square	1	0.235	0.628
Continuity Adj. Chi-Square	1	0.094	0.759
Mantel-Haenszel Chi-Square	1	0.239	0.625
Fisher's Exact Test (Left)			0.753
(Right)			0.372
(2-Tail)			0.714
Phi Coefficient		0.029	
Contingency Coefficient		0.029	
Cramer's V		0.029	

Sample Size = 287

Chi-Square test

MCQ27 GROUP

Frequency / Percent / Row Pct / Col Pct	DELAYED	NOT DEL	Total
0	176	45	221
	61.32	15.68	77.00
	79.64	20.36	
	75.54	83.33	
1	57	9	66
	19.86	3.14	23.00
	86.36	13.64	
	24.46	16.67	
Total	233	54	287
	81.18	18.82	100.00

STATISTICS FOR TABLE OF MCQ27 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	1.505	0.220
Likelihood Ratio Chi-Square	1	1.594	0.207
Continuity Adj. Chi-Square	1	1.097	0.295
Mantel-Haenszel Chi-Square	1	1.500	0.221
Fisher's Exact Test (Left)			0.147
(Right)			0.924
(2-Tail)			0.282
Phi Coefficient		-0.072	
Contingency Coefficient		0.072	
Cramer's V		-0.072	

Sample Size = 287

Chi-Square test

MCQ26 GROUP

Frequency Percent Row Pct Col Pct	DELAYED	NOT DEL	Total
0	208	49	257
	72.47	17.07	89.55
	80.93	19.07	
	89.27	90.74	
1	25	5	30
	8.71	1.74	10.45
	83.33	16.67	
	10.73	9.26	
Total	233	54	287
	81.18	18.82	100.00

STATISTICS FOR TABLE OF MCQ26 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	0.101	0.750
Likelihood Ratio Chi-Square	1	0.104	0.747
Continuity Adj. Chi-Square	1	0.005	0.943
Mantel-Haenszel Chi-Square	1	0.101	0.751
Fisher's Exact Test (Left)			0.488
(Right)			0.704
(2-Tail)			1.000
Phi Coefficient		-0.019	
Contingency Coefficient		0.019	
Cramer's V		-0.019	

Sample Size = 287

Chi-Square test

MCQ25 GROUP

Frequency / Percent / Row Pct / Col Pct	DELAYED	NOT DEL	Total
0	164	35	199
	57.14	12.20	69.34
	82.41	17.59	
	70.39	64.81	
1	69	19	88
	24.04	6.62	30.66
	78.41	21.59	
	29.61	35.19	
Total	233	54	287
	81.18	18.82	100.00

STATISTICS FOR TABLE OF MCQ25 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	0.640	0.424
Likelihood Ratio Chi-Square	1	0.628	0.428
Continuity Adj. Chi-Square	1	0.405	0.525
Mantel-Haenszel Chi-Square	1	0.638	0.424
Fisher's Exact Test (Left)			0.833
(Right)			0.260
(2-Tail)			0.418
Phi Coefficient		0.047	
Contingency Coefficient		0.047	
Cramer's V		0.047	

Sample Size = 287

SCHOOL=School no.5

Variable: TOTAL

PHASE	N	Mean	Std Dev	Std Error
1	74	2.77027027	1.21121808	0.14080124
2	54	2.01851852	1.10727851	0.15068152

Variances	T	DF	Prob>|T|
Unequal	3.6452	119.7	0.0004
Equal	3.5942	126.0	0.0005

For H0: Variances are equal, F' = 1.20 , DF = (73,53) Prob>F' = 0.4946

APPENDIX I2

COMPARISON OF SCHOOLS RESULTS THAT TOOK PART IN PHASE 1 & 2 ON THE STANDARD 8 REACTIVITY QUESTIONNAIRE

Student's t-test

SCHOOL=School no.2

Variable: TOTAL

PHASE	N	Mean	Std Dev	Std Error
1	115	1.80869565	1.18392487	0.11040156
2	67	2.80597015	1.39521700	0.17045289

Variances	T	DF	Prob>|T|
Unequal	-4.9107	120.7	0.0001
Equal	-5.1275	180.0	0.0000

For HO: Variances are equal, F' = 1.39 DF = (66,114) Prob>F' = 0.1247

SCHOOL=School no.4

Variable: TOTAL

PHASE	N	Mean	Std Dev	Std Error
1	48	1.52083333	0.98908045	0.14276147
2	166	2.54819277	1.23368546	0.09575023

Variances	T	DF	Prob>|T|
Unequal	-5.9766	93.4	0.0001
Equal	-5.2956	212.0	0.0000

For HO: Variances are equal, F' = 1.56 DF = (165,47) Prob>F' = 0.0780

APPENDIX I2

SCHOOL Comparison	Lower Confidence Limit	Difference Between Means	Upper Confidence Limit	
SCHOOL NO.3 - SCHOOL NO.2	-1.3968	-1.0230	-0.6491	***
SCHOOL NO.3 - SCHOOL NO.4	-1.0630	-0.7652	-0.4674	***
SCHOOL NO.3 - SCHOOL NO.1	-0.8614	-0.4170	0.0275	
SCHOOL NO.3 - SCHOOL NO.5	-0.6359	-0.2355	0.1649	
SCHOOL NO.3 - SCHOOL NO.6	-0.4647	-0.0352	0.3944	
SCHOOL NO.3 - SCHOOL NO.7	-0.5498	0.0608	0.6714	
SCHOOL NO.7 - SCHOOL NO.2	-1.7196	-1.0837	-0.4479	***
SCHOOL NO.7 - SCHOOL NO.4	-1.4203	-0.8260	-0.2316	***
SCHOOL NO.7 - SCHOOL NO.1	-1.1576	-0.4778	0.2020	
SCHOOL NO.7 - SCHOOL NO.5	-0.9482	-0.2963	0.3556	
SCHOOL NO.7 - SCHOOL NO.6	-0.7661	-0.0960	0.5742	
SCHOOL NO.7 - SCHOOL NO.3	-0.6714	-0.0608	0.5498	

General Linear Models Procedure

T tests (LSD) for variable: TOTTWO

NOTE: This test controls the type I comparisonwise error rate not the experimentwise error rate.

Alpha= 0.05 Confidence= 0.95 df= 486 MSE= 1.485942
Critical Value of T= 1.96484

Comparisons significant at the 0.05 level are indicated by '***'.

SCHOOL Comparison	Lower Confidence Limit	Difference Between Means	Upper Confidence Limit	
SCHOOL NO.2 - SCHOOL NO.4	-0.0889	0.2578	0.6044	
SCHOOL NO.2 - SCHOOL NO.1	0.1274	0.6060	1.0845	***
SCHOOL NO.2 - SCHOOL NO.5	0.3494	0.7875	1.2255	***
SCHOOL NO.2 - SCHOOL NO.6	0.5230	0.9878	1.4525	***
SCHOOL NO.2 - SCHOOL NO.3	0.6491	1.0230	1.3968	***
SCHOOL NO.2 - SCHOOL NO.7	0.4479	1.0837	1.7196	***
SCHOOL NO.4 - SCHOOL NO.2	-0.6044	-0.2578	0.0889	
SCHOOL NO.4 - SCHOOL NO.1	-0.0737	0.3482	0.7701	
SCHOOL NO.4 - SCHOOL NO.5	0.1545	0.5297	0.9049	***
SCHOOL NO.4 - SCHOOL NO.6	0.3239	0.7300	1.1361	***
SCHOOL NO.4 - SCHOOL NO.3	0.4674	0.7652	1.0630	***
SCHOOL NO.4 - SCHOOL NO.7	0.2316	0.8260	1.4203	***
SCHOOL NO.1 - SCHOOL NO.2	-1.0845	-0.6060	-0.1274	***
SCHOOL NO.1 - SCHOOL NO.4	-0.7701	-0.3482	0.0737	
SCHOOL NO.1 - SCHOOL NO.5	-0.3182	0.1815	0.6811	
SCHOOL NO.1 - SCHOOL NO.6	-0.1414	0.3818	0.9051	
SCHOOL NO.1 - SCHOOL NO.3	-0.0275	0.4170	0.8614	
SCHOOL NO.1 - SCHOOL NO.7	-0.2020	0.4778	1.1576	
SCHOOL NO.5 - SCHOOL NO.2	-1.2255	-0.7875	-0.3494	***
SCHOOL NO.5 - SCHOOL NO.4	-0.9049	-0.5297	-0.1545	***
SCHOOL NO.5 - SCHOOL NO.1	-0.6811	-0.1815	0.3182	
SCHOOL NO.5 - SCHOOL NO.6	-0.2861	0.2003	0.6868	
SCHOOL NO.5 - SCHOOL NO.3	-0.1649	0.2355	0.6359	
SCHOOL NO.5 - SCHOOL NO.7	-0.3556	0.2963	0.9482	
SCHOOL NO.6 - SCHOOL NO.2	-1.4525	-0.9878	-0.5230	***
SCHOOL NO.6 - SCHOOL NO.4	-1.1361	-0.7300	-0.3239	***
SCHOOL NO.6 - SCHOOL NO.1	-0.9051	-0.3818	0.1414	
SCHOOL NO.6 - SCHOOL NO.5	-0.6868	-0.2003	0.2861	
SCHOOL NO.6 - SCHOOL NO.3	-0.3944	0.0352	0.4647	
SCHOOL NO.6 - SCHOOL NO.7	-0.5742	0.0960	0.7661	

PHASE 2: COMPARISON OF DIFFERENT SCHOOLS RESULTS FOR STANDARD 8 REACTIVITY QUESTIONNAIRE (TEACHING DELAYED AND UNDELAYED)

General Linear Models Procedure
Class Level Information

Class	Levels	Values
SCHOOL	7	SCHOOL NO.5 SCHOOL NO.3 SCHOOL NO.7 SCHOOL NO.4 SCHOOL NO.2 SCHOOL NO.1 SCHOOL NO.6

Number of observations in data set = 495

1 General Linear Models Procedure

Dependent Variable: TOTTWO

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	74.7311562	12.4551927	8.38	0.0001
Error	488	725.1395509	1.4859417		
Corrected Total	494	799.8707071			

R-Square	C.V.	Root MSE	TOTTWO Mean
0.093429	54.45859	1.21899	2.23838

Source	DF	Type I SS	Mean Square	F Value	Pr > F
SCHOOL	6	74.7311562	12.4551927	8.38	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SCHOOL	6	74.7311562	12.4551927	8.38	0.0001

General Linear Models Procedure

T tests (LSD) for variable: TOTTWO

NOTE: This test controls the type I comparisonwise error rate not the experimentwise error rate.

Alpha= 0.05 Confidence= 0.95 df= 353 MSE= 1.538946
Critical Value of T= 1.96671

Comparisons significant at the 0.05 level are indicated by '***'.

SCHOOL Comparison	Lower Confidence Limit	Difference Between Means	Upper Confidence Limit	
SCHOOL NO.2 - SCHOOL NO.4	-0.0953	0.2578	0.6109	
SCHOOL NO.2 - SCHOOL NO.3	0.6422	1.0230	1.4037	***
SCHOOL NO.2 - SCHOOL NO.7	0.4360	1.0837	1.7314	***
SCHOOL NO.4 - SCHOOL NO.2	-0.6109	-0.2578	0.0953	
SCHOOL NO.4 - SCHOOL NO.3	0.4618	0.7652	1.0685	***
SCHOOL NO.4 - SCHOOL NO.7	0.2206	0.8260	1.4314	***
SCHOOL NO.3 - SCHOOL NO.2	-1.4037	-1.0230	-0.6422	***
SCHOOL NO.3 - SCHOOL NO.4	-1.0685	-0.7652	-0.4618	***
SCHOOL NO.3 - SCHOOL NO.7	-0.5612	0.0608	0.6828	
SCHOOL NO.7 - SCHOOL NO.2	-1.7314	-1.0837	-0.4360	***
SCHOOL NO.7 - SCHOOL NO.4	-1.4314	-0.8260	-0.2206	***
SCHOOL NO.7 - SCHOOL NO.3	-0.6828	-0.0608	0.5612	

PHASE 2: COMPARISON OF ALL SCHOOLS RESULTS THAT DELAYED TEACHING ON THE STANDARD 8 REACTIVITY QUESTIONNAIRE

General Linear Models Procedure
Class Level Information

Class	Levels	Values
SCHOOL	4	SCHOOL NO.3 SCHOOL NO.7 SCHOOL NO.4 SCHOOL NO.2

Number of observations in data set = 357

General Linear Models Procedure

Dependent Variable: TOTTWO

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	61.4428473	20.4809491	13.31	0.0001
Error	353	543.2126148	1.5388459		
Corrected Total	356	604.6554622			

R-Square	C.V.	Root MSE	TOTTWO Mean
0.101616	53.29234	1.24050	2.32773

Source	DF	Type I SS	Mean Square	F Value	Pr > F
SCHOOL	3	61.4428473	20.4809491	13.31	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SCHOOL	3	61.4428473	20.4809491	13.31	0.0001

APPENDIX H2

APPENDIX G2

COMPARISON OF STANDARD 8'S RESULTS FOR PHASE 2 ON THE STANDARD 8 REACTIVITY QUESTIONNAIRE

[Teaching undelayed (new; N=84) with teaching delayed, (new; N=124))

Student's t-test

TTEST PROCEDURE

Variable: TOTTWO

GROUP	N	Mean	Std Dev	Std Error
DELAYED	124	1.77419355	1.15356436	0.10359314
NOT DEL	84	2.00000000	1.20240722	0.13119338

Variances	T	DF	Prob>|T|
Unequal	-1.3508	173.3	0.1785
Equal	-1.3617	206.0	0.1748

For H0: Variances are equal, F' = 1.09 DF = (83,123) Prob>F' = 0.6702

APPENDIX G2

APPENDIX F2

COMPARISON OF STANDARD 8'S RESULTS FOR PHASE 2 ON THE STANDARD 8 REACTIVITY QUESTIONNAIRE

[Teaching delayed (old; N=233) with teaching delayed, (new; N=124)]

Student's t-test

TTEST PROCEDURE

Variable: TOTTWC

TYPE	N	Mean	Std Dev	Std Error
NEW	124	1.77419355	1.15356436	0.10359314
OLD	233	2.62231760	1.28446277	0.08414795

Variances	T	DF	Prob>|T|
Unequal	-6.3547	275.3	0.0001
Equal	-6.1497	355.0	0.0000

For H0: Variances are equal, F' = 1.24 DF = (232,123) Prob>F' = 0.1839

Chi-Square test

SCHOOL=School no.4

TABLE OF PHASE BY Q4

PHASE Q4

Frequency Percent Row Pct Col Pct	0	1	Total
1	30 14.02 62.50 28.30	18 8.41 37.50 16.67	48 22.43
2	76 35.51 45.78 71.70	90 42.06 54.22 83.33	166 77.57
Total	106 49.53	108 50.47	214 100.00

STATISTICS FOR TABLE OF PHASE BY Q4

Statistic	DF	Value	Prob
Chi-Square	1	4.162	0.041
Likelihood Ratio Chi-Square	1	4.195	0.041
Continuity Adj. Chi-Square	1	3.521	0.061
Mantel-Haenszel Chi-Square	1	4.143	0.042
Fisher's Exact Test (Left)			0.987
(Right)			0.030
(2-Tail)			0.049
Phi Coefficient		0.139	
Contingency Coefficient		0.136	
Cramer's V		0.139	

Effective Sample Size = 214

Chi-Square test

SCHOOL=School no.4

TABLE OF PHASE BY Q3

PHASE	Q3		
Frequency Percent Row Pct Col Pct	0	1	Total
1	45 21.03 93.75 28.66	3 1.40 6.25 5.26	48 22.43
2	112 52.34 67.47 71.34	54 25.23 32.53 94.74	166 77.57
Total	157 73.36	57 26.64	214 100.00

STATISTICS FOR TABLE OF PHASE BY Q3

Statistic	DF	Value	Prob
Chi-Square	1	13.160	0.000
Likelihood Ratio Chi-Square	1	16.199	0.000
Continuity Adj. Chi-Square	1	11.849	0.001
Mantel-Haenszel Chi-Square	1	13.098	0.000
Fisher's Exact Test (Left)			1.000
(Right)			8.61E-05
(2-Tail)			1.50E-04
Phi Coefficient		0.248	
Contingency Coefficient		0.241	
Cramer's V		0.248	

Effective Sample Size = 214

Chi-Square test

SCHOOL=School no.4

TABLE OF PHASE BY Q2

PHASE	Q2		
Frequency Percent Row Pct Col Pct	0	1	Total
1	22 10.28 45.83 28.21	26 12.15 54.17 19.12	48 22.43
2	56 26.17 33.73 71.79	110 51.40 66.27 80.88	166 77.57
Total	78 36.45	136 63.55	214 100.00

STATISTICS FOR TABLE OF PHASE BY Q2

Statistic	DF	Value	Prob
Chi-Square	1	2.353	0.125
Likelihood Ratio Chi-Square	1	2.306	0.129
Continuity Adj. Chi-Square	1	1.859	0.173
Mantel-Haenszel Chi-Square	1	2.342	0.126
Fisher's Exact Test (Left)			0.955
(Right)			0.087
(2-Tail)			0.130
Phi Coefficient		0.105	
Contingency Coefficient		0.104	
Cramer's V		0.105	

Effective Sample Size = 214

Chi-Square test

SCHOOL=School no.4

TABLE OF PHASE BY Q1

PHASE Q1

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	44	4	48
	20.56	1.87	22.43
	91.67	8.33	
	23.04	17.39	
2	147	19	166
	68.69	8.88	77.57
	88.55	11.45	
	76.96	82.61	
Total	191	23	214
	89.25	10.75	100.00

STATISTICS FOR TABLE OF PHASE BY Q1

Statistic	DF	Value	Prob
Chi-Square	1	0.376	0.540
Likelihood Ratio Chi-Square	1	0.396	0.529
Continuity Adj. Chi-Square	1	0.122	0.727
Mantel-Haenszel Chi-Square	1	0.374	0.541
Fisher's Exact Test (Left)			0.807
(Right)			0.377
(2-Tail)			0.791
Phi Coefficient		0.042	
Contingency Coefficient		0.042	
Cramer's V		0.042	

Effective Sample Size = 214

Chi-Square test

SCHOOL=School no.2

TABLE OF PHASE BY Q8

PHASE Q8

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	105	10	115
	57.69	5.49	63.19
	91.30	8.70	
	65.63	45.45	
2	55	12	67
	30.22	6.59	36.81
	82.09	17.91	
	34.38	54.55	
Total	160	22	182
	87.91	12.09	100.00

STATISTICS FOR TABLE OF PHASE BY Q8

Statistic	DF	Value	Prob
Chi-Square	1	3.383	0.066
Likelihood Ratio Chi-Square	1	3.262	0.071
Continuity Adj. Chi-Square	1	2.571	0.109
Mantel-Haenszel Chi-Square	1	3.364	0.067
Fisher's Exact Test (Left)			0.980
(Right)			0.056
(2-Tail)			0.097
Phi Coefficient		0.136	
Contingency Coefficient		0.135	
Cramer's V		0.136	

Effective Sample Size = 182

Chi-Square test

SCHOOL=School no.2

TABLE OF PHASE BY Q7

PHASE Q7

Frequency Percent Row Pct Col Pct	0	1	Total
1	94 51.65 81.74 63.51	21 11.54 18.26 61.76	115 63.19
2	54 29.67 80.60 36.49	13 7.14 19.40 38.24	67 36.81
Total	148 81.32	34 18.68	182 100.00

STATISTICS FOR TABLE OF PHASE BY Q7

Statistic	DF	Value	Prob
Chi-Square	1	0.036	0.849
Likelihood Ratio Chi-Square	1	0.036	0.849
Continuity Adj. Chi-Square	1	0.000	1.000
Mantel-Haenszel Chi-Square	1	0.036	0.849
Fisher's Exact Test (Left)			0.654
(Right)			0.498
(2-Tail)			0.846
Phi Coefficient		0.014	
Contingency Coefficient		0.014	
Cramer's V		0.014	

Effective Sample Size = 182

Chi-Square test

SCHOOL=School no.2

TABLE OF PHASE BY Q6

PHASE Q6

Frequency Percent Row Pct Col Pct	0	1	Total
1	92 50.55 80.00 60.93	23 12.64 20.00 74.19	115 63.19
2	59 32.42 88.06 39.07	8 4.40 11.94 25.81	67 36.81
Total	151 82.97	31 17.03	182 100.00

STATISTICS FOR TABLE OF PHASE BY Q6

Statistic	DF	Value	Prob
Chi-Square	1	1.946	0.163
Likelihood Ratio Chi-Square	1	2.032	0.154
Continuity Adj. Chi-Square	1	1.417	0.234
Mantel-Haenszel Chi-Square	1	1.935	0.164
Fisher's Exact Test (Left)			0.116
(Right)			0.948
(2-Tail)			0.220
Phi Coefficient		-0.103	
Contingency Coefficient		0.103	
Cramer's V		-0.103	

Effective Sample Size = 182

Chi-Square test

SCHOOL=School no.2

TABLE OF PHASE BY Q5

PHASE	Q5		
Frequency Percent Row Pct Col Pct	0	1	Total
1	107 58.79 93.04 68.15	8 4.40 6.96 32.00	115 63.19
2	50 27.47 74.63 31.85	17 9.34 25.37 68.00	67 36.81
Total	157 86.26	25 13.74	182 100.00

STATISTICS FOR TABLE OF PHASE BY Q5

Statistic	DF	Value	Prob
Chi-Square	1	12.118	0.000
Likelihood Ratio Chi-Square	1	11.678	0.001
Continuity Adj. Chi-Square	1	10.613	0.001
Mantel-Haenszel Chi-Square	1	12.051	0.001
Fisher's Exact Test (Left)			1.000
(Right)			6.82E-04
(2-Tail)			7.50E-04
Phi Coefficient		0.258	
Contingency Coefficient		0.250	
Cramer's V		0.258	

Effective Sample Size = 182

Chi-Square test

SCHOOL=School no.2

TABLE OF PHASE BY Q4

PHASE Q4

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	68	47	115
	37.36	25.82	63.19
	59.13	40.87	
	88.31	44.76	
2	9	58	67
	4.95	31.87	36.81
	13.43	86.57	
	11.69	55.24	
Total	77	105	182
	42.31	57.69	100.00

STATISTICS FOR TABLE OF PHASE BY Q4

Statistic	DF	Value	Prob
Chi-Square	1	36.220	0.000
Likelihood Ratio Chi-Square	1	39.546	0.000
Continuity Adj. Chi-Square	1	34.372	0.000
Mantel-Haenszel Chi-Square	1	36.021	0.000
Fisher's Exact Test (Left)			1.000
(Right)			5.15E-10
(2-Tail)			6.29E-10
Phi Coefficient		0.446	
Contingency Coefficient		0.407	
Cramer's V		0.446	

Effective Sample Size = 182

Chi-Square test

SCHOOL=School no.2

TABLE OF PHASE BY Q3

PHASE Q3

Frequency Percent Row Pct Col Pct	0	1	Total
1	97 53.30 84.35 67.83	18 9.89 15.65 46.15	115 63.19
2	46 25.27 68.66 32.17	21 11.54 31.34 53.85	67 36.81
Total	143 78.57	39 21.43	182 100.00

STATISTICS FOR TABLE OF PHASE BY Q3

Statistic	DF	Value	Prob
Chi-Square	1	6.191	0.013
Likelihood Ratio Chi-Square	1	6.016	0.014
Continuity Adj. Chi-Square	1	5.294	0.021
Mantel-Haenszel Chi-Square	1	6.157	0.013
Fisher's Exact Test (Left)			0.996
(Right)			0.011
(2-Tail)			0.016
Phi Coefficient		0.184	
Contingency Coefficient		0.181	
Cramer's V		0.184	

Effective Sample Size = 182

Chi-Square test

SCHOOL=School no.2

TABLE OF PHASE BY Q2

PHASE Q2

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	48	67	115
	26.37	36.81	63.19
	41.74	58.26	
	76.19	56.30	
2	15	52	67
	8.24	28.57	36.81
	22.39	77.61	
	23.81	43.70	
Total	63	119	182
	34.62	65.38	100.00

STATISTICS FOR TABLE OF PHASE BY Q2

Statistic	DF	Value	Prob
Chi-Square	1	7.004	0.008
Likelihood Ratio Chi-Square	1	7.264	0.007
Continuity Adj. Chi-Square	1	6.175	0.013
Mantel-Haenszel Chi-Square	1	6.966	0.008
Fisher's Exact Test (Left)			0.998
(Right)			5.87E-03
(2-Tail)			9.67E-03
Phi Coefficient		0.196	
Contingency Coefficient		0.193	
Cramer's V		0.196	

Effective Sample Size = 182

FREQUENCY TABLES FOR SCHOOLS OF PHASE 1 & 2 OF THE ON THE STD. 8 REACTIVITY QUESTIONNAIRE.

Chi-Square test

SCHOOL=School no.2

TABLE OF PHASE BY Q1

PHASE Q1

Frequency Percent Row Pct Col Pct	0	1	Total
1	101	14	115
	55.49	7.69	63.19
	87.83	12.17	
	62.73	66.67	
2	60	7	67
	32.97	3.85	36.81
	89.55	10.45	
	37.27	33.33	
Total	161	21	182
	88.46	11.54	100.00

STATISTICS FOR TABLE OF PHASE BY Q1

Statistic	DF	Value	Prob
Chi-Square	1	0.124	0.725
Likelihood Ratio Chi-Square	1	0.125	0.724
Continuity Adj. Chi-Square	1	0.012	0.912
Mantel-Haenszel Chi-Square	1	0.123	0.726
Fisher's Exact Test (Left)			0.463
(Right)			0.719
(2-Tail)			0.813
Phi Coefficient		-0.026	
Contingency Coefficient		0.026	
Cramer's V		-0.026	

Effective Sample Size = 182

Chi-Square test

SCHOOL=School no.5

TABLE OF PHASE BY Q8

PHASE Q8

Frequency Percent Row Pct Col Pct	0	1	Total
1	39	35	74
	30.47	27.34	57.81
	52.70	47.30	
	48.75	72.92	
2	41	13	54
	32.03	10.16	42.19
	75.93	24.07	
	51.25	27.08	
Total	80	48	128
	62.50	37.50	100.00

STATISTICS FOR TABLE OF PHASE BY Q8

Statistic	DF	Value	Prob
Chi-Square	1	7.184	0.007
Likelihood Ratio Chi-Square	1	7.382	0.007
Continuity Adj. Chi-Square	1	6.227	0.013
Mantel-Haenszel Chi-Square	1	7.128	0.008
Fisher's Exact Test (Left)			5.85E-03
(Right)			0.998
(2-Tail)			9.54E-03
Phi Coefficient		-0.237	
Contingency Coefficient		0.231	
Cramer's V		-0.237	

Effective Sample Size = 128

Chi-Square test

SCHOOL=School no.5

TABLE OF PHASE BY Q7

PHASE Q7

Frequency Percent Row Pct Col Pct	0	1	Total
1	51 39.84 68.92 53.13	23 17.97 31.08 71.88	74 57.81
2	45 35.16 83.33 46.88	9 7.03 16.67 28.13	54 42.19
Total	96 75.00	32 25.00	128 100.00

STATISTICS FOR TABLE OF PHASE BY Q7

Statistic	DF	Value	Prob
Chi-Square	1	3.459	0.063
Likelihood Ratio Chi-Square	1	3.575	0.059
Continuity Adj. Chi-Square	1	2.733	0.098
Mantel-Haenszel Chi-Square	1	3.432	0.064
Fisher's Exact Test (Left)			0.048
(Right)			0.982
(2-Tail)			0.067
Phi Coefficient		-0.164	
Contingency Coefficient		0.162	
Cramer's V		-0.164	

Effective Sample Size = 128

Chi-Square test

SCHOOL=School no.5

TABLE OF PHASE BY Q6

PHASE Q6

Frequency Percent Row Pct Col Pct	0	1	Total
1	49 38.28 66.22 50.00	25 19.53 33.78 83.33	74 57.81
2	49 38.28 90.74 50.00	5 3.91 9.26 16.67	54 42.19
Total	98 76.56	30 23.44	128 100.00

STATISTICS FOR TABLE OF PHASE BY Q6

Statistic	DF	Value	Prob
Chi-Square	1	10.464	0.001
Likelihood Ratio Chi-Square	1	11.417	0.001
Continuity Adj. Chi-Square	1	9.142	0.002
Mantel-Haenszel Chi-Square	1	10.382	0.001
Fisher's Exact Test (Left)			8.75E-04
(Right)			1.000
(2-Tail)			1.34E-03
Phi Coefficient		-0.286	
Contingency Coefficient		0.275	
Cramer's V		-0.286	

Effective Sample Size = 128

Chi-Square test

SCHOOL=School no.5

TABLE OF PHASE BY Q5

PHASE Q5

Frequency Percent Row Pct Col Pct	0	1	Total
1	63	11	74
	49.22	8.59	57.81
	85.14	14.86	
	64.29	36.67	
2	35	19	54
	27.34	14.84	42.19
	64.81	35.19	
	35.71	63.33	
Total	98	30	128
	76.56	23.44	100.00

STATISTICS FOR TABLE OF PHASE BY Q5

Statistic	DF	Value	Prob
Chi-Square	1	7.184	0.007
Likelihood Ratio Chi-Square	1	7.134	0.008
Continuity Adj. Chi-Square	1	6.096	0.014
Mantel-Haenszel Chi-Square	1	7.128	0.008
Fisher's Exact Test (Left)			0.998
(Right)			6.94E-03
(2-Tail)			0.011
Phi Coefficient		0.237	
Contingency Coefficient		0.231	
Cramer's V		0.237	

Effective Sample Size = 128

Chi-Square test

SCHOOL=School no.5

TABLE OF PHASE BY Q4

PHASE Q4

Frequency Percent Row Pct Col Pct	0	1	Total
1	28 21.88 37.84 44.44	46 35.94 62.16 70.77	74 57.81
2	35 27.34 64.81 55.56	19 14.84 35.19 29.23	54 42.19
Total	63 49.22	65 50.78	128 100.00

STATISTICS FOR TABLE OF PHASE BY Q4

Statistic	DF	Value	Prob
Chi-Square	1	9.090	0.003
Likelihood Ratio Chi-Square	1	9.204	0.002
Continuity Adj. Chi-Square	1	8.043	0.005
Mantel-Haenszel Chi-Square	1	9.019	0.003
Fisher's Exact Test (Left)			2.19E-03
(Right)			0.999
(2-Tail)			4.00E-03
Phi Coefficient		-0.266	
Contingency Coefficient		0.258	
Cramer's V		-0.266	

Effective Sample Size = 128

Chi-Square test

SCHOOL=School no.5

TABLE OF PHASE BY Q3

PHASE Q3

Frequency Percent Row Pct Col Pct	0	1	Total
1	68 53.13 91.89 58.62	6 4.69 8.11 50.00	74 57.81
2	48 37.50 88.89 41.38	6 4.69 11.11 50.00	54 42.19
Total	116 90.63	12 9.38	128 100.00

STATISTICS FOR TABLE OF PHASE BY Q3

Statistic	DF	Value	Prob
Chi-Square	1	0.331	0.565
Likelihood Ratio Chi-Square	1	0.328	0.567
Continuity Adj. Chi-Square	1	0.072	0.788
Mantel-Haenszel Chi-Square	1	0.329	0.566
Fisher's Exact Test (Left)			0.812
(Right)			0.390
(2-Tail)			0.760
Phi Coefficient		0.051	
Contingency Coefficient		0.051	
Cramer's V		0.051	

Effective Sample Size = 128

Chi-Square test

SCHOOL=School no.5

TABLE OF PHASE BY Q2

PHASE Q2

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	18	56	74
	14.06	43.75	57.81
	24.32	75.68	
	45.00	63.64	
2	22	32	54
	17.19	25.00	42.19
	40.74	59.26	
	55.00	36.36	
Total	40	88	128
	31.25	68.75	100.00

STATISTICS FOR TABLE OF PHASE BY Q2

Statistic	DF	Value	Prob
Chi-Square	1	3.916	0.048
Likelihood Ratio Chi-Square	1	3.892	0.049
Continuity Adj. Chi-Square	1	3.189	0.074
Mantel-Haenszel Chi-Square	1	3.885	0.049
Fisher's Exact Test (Left)			0.037
(Right)			0.985
(2-Tail)			0.055
Phi Coefficient		-0.175	
Contingency Coefficient		0.172	
Cramer's V		-0.175	

Effective Sample Size = 128

Chi-Square test

SCHOOL=School no.5

TABLE OF PHASE BY Q1

PHASE Q1

Frequency Percent Row Pct Col Pct	0	1	Total
1	71 55.47 95.95 59.66	3 2.34 4.05 33.33	74 57.81
2	48 37.50 88.89 40.34	6 4.69 11.11 66.67	54 42.19
Total	119 92.97	9 7.03	128 100.00

STATISTICS FOR TABLE OF PHASE BY Q1

Statistic	DF	Value	Prob
Chi-Square	1	2.378	0.123
Likelihood Ratio Chi-Square	1	2.355	0.125
Continuity Adj. Chi-Square	1	1.421	0.233
Mantel-Haenszel Chi-Square	1	2.360	0.124
Fisher's Exact Test (Left)			0.971
(Right)			0.117
(2-Tail)			0.166
Phi Coefficient		0.136	
Contingency Coefficient		0.135	
Cramer's V		0.136	

Effective Sample Size = 128
Frequency Missing = 20

Chi-Square test

SCHOOL=School no.4

TABLE OF PHASE BY Q8

PHASE Q8

Frequency Percent Row Pct Col Pct	0	1	Total
1	43	5	48
	20.09	2.34	22.43
	89.58	10.42	
	25.00	11.90	
2	129	37	166
	60.28	17.29	77.57
	77.71	22.29	
	75.00	88.10	
Total	172	42	214
	80.37	19.63	100.00

STATISTICS FOR TABLE OF PHASE BY Q8

Statistic	DF	Value	Prob
Chi-Square	1	3.327	0.068
Likelihood Ratio Chi-Square	1	3.717	0.054
Continuity Adj. Chi-Square	1	2.617	0.106
Mantel-Haenszel Chi-Square	1	3.312	0.069
Fisher's Exact Test (Left)			0.984
(Right)			0.048
(2-Tail)			0.097
Phi Coefficient		0.125	
Contingency Coefficient		0.124	
Cramer's V		0.125	

Effective Sample Size = 214

Chi-Square test

SCHOOL=School no.4

TABLE OF PHASE BY Q7

PHASE Q7

Frequency Percent Row Pct Col Pct	0	1	Total
1	39 18.22 81.25 24.22	9 4.21 18.75 16.98	48 22.43
2	122 57.01 73.49 75.78	44 20.56 26.51 83.02	166 77.57
Total	161 75.23	53 24.77	214 100.00

STATISTICS FOR TABLE OF PHASE BY Q7

Statistic	DF	Value	Prob
Chi-Square	1	1.202	0.273
Likelihood Ratio Chi-Square	1	1.257	0.262
Continuity Adj. Chi-Square	1	0.822	0.365
Mantel-Haenszel Chi-Square	1	1.196	0.274
Fisher's Exact Test (Left)			0.903
(Right)			0.183
(2-Tail)			0.344
Phi Coefficient		0.075	
Contingency Coefficient		0.075	
Cramer's V		0.075	

Effective Sample Size = 214

Chi-Square test

SCHOOL=School no.4

TABLE OF PHASE BY Q6

PHASE Q6

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	46	2	48
	21.50	0.93	22.43
	95.83	4.17	
	23.59	10.53	
2	149	17	166
	69.63	7.94	77.57
	89.76	10.24	
	76.41	89.47	
Total	195	19	214
	91.12	8.88	100.00

STATISTICS FOR TABLE OF PHASE BY Q6

Statistic	DF	Value	Prob
Chi-Square	1	1.698	0.193
Likelihood Ratio Chi-Square	1	1.977	0.160
Continuity Adj. Chi-Square	1	1.030	0.310
Mantel-Haenszel Chi-Square	1	1.690	0.194
Fisher's Exact Test (Left)			0.955
(Right)			0.154
(2-Tail)			0.256
Phi Coefficient		0.089	
Contingency Coefficient		0.089	
Cramer's V		0.089	

Effective Sample Size = 214
Frequency Missing = 118

Chi-Square test

SCHOOL=School no.4

TABLE OF PHASE BY Q5

PHASE Q5

Frequency Percent Row Pct Col Pct	0	1	Total
1	42 19.63 87.50 26.92	6 2.80 12.50 10.34	48 22.43
2	114 53.27 68.67 73.08	52 24.30 31.33 89.66	166 77.57
Total	156 72.90	58 27.10	214 100.00

STATISTICS FOR TABLE OF PHASE BY Q5

Statistic	DF	Value	Prob
Chi-Square	1	6.679	0.010
Likelihood Ratio Chi-Square	1	7.504	0.006
Continuity Adj. Chi-Square	1	5.760	0.016
Mantel-Haenszel Chi-Square	1	6.648	0.010
Fisher's Exact Test (Left)			0.998
(Right)			6.08E-03
(2-Tail)			9.65E-03
Phi Coefficient		0.177	
Contingency Coefficient		0.174	
Cramer's V		0.177	

Effective Sample Size = 214

PHASE 2: FREQUENCY TABLES BY SCHOOL

TWO5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	18	45.0	18	45.0
B	1	2.5	19	47.5
C	2	5.0	21	52.5
D	7	17.5	28	70.0
#E	12	30.0	40	100.0

TWO6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
B	10	25.0	10	25.0
C	19	47.5	29	72.5
#D	9	22.5	38	95.0
E	1	2.5	39	97.5
X	1	2.5	40	100.0

TWO7	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	9	22.5	9	22.5
B	10	25.0	19	47.5
#C	10	25.0	29	72.5
D	6	15.0	35	87.5
E	5	12.5	40	100.0

TWO8	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	8	20.0	8	20.0
B	13	32.5	21	52.5
C	3	7.5	24	60.0
D	14	35.0	38	95.0
#E	1	2.5	39	97.5
X	1	2.5	40	100.0

PHASE 2: FREQUENCY TABLES BY SCHOOL

SCHOOL=School no.6

TWO1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	39	88.6	39	88.6
B	1	2.3	40	90.9
C	1	2.3	41	93.2
#D	2	4.5	43	97.7
E	1	2.3	44	100.0

PHASE 2: FREQUENCY TABLES BY SCHOOL

TWO7	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	19	28.4	19	28.4
B	22	32.8	41	61.2
#C	13	19.4	54	80.6
D	6	9.0	60	89.6
E	7	10.4	67	100.0

TWO8	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	5	7.5	5	7.5
B	31	46.3	36	53.7
C	1	1.5	37	55.2
D	16	23.9	53	79.1
#E	12	17.9	65	97.0
X	2	3.0	67	100.0

PHASE 2: FREQUENCY TABLES BY SCHOOL

SCHOOL=School no.1

TWO1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	32	80.0	32	80.0
#D	2	5.0	34	85.0
E	6	15.0	40	100.0

TWO2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	1	2.5	1	2.5
#B	36	90.0	37	92.5
D	2	5.0	39	97.5
E	1	2.5	40	100.0

TWO3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
B	1	2.5	1	2.5
C	22	55.0	23	57.5
D	14	35.0	37	92.5
#E	3	7.5	40	100.0

TWO4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
#A	15	37.5	15	37.5
B	7	17.5	22	55.0
C	10	25.0	32	80.0
D	1	2.5	33	82.5
E	7	17.5	40	100.0

PHASE 2: FREQUENCY TABLES BY SCHOOL

SCHOOL=School no.2

TWO1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	55	82.1	55	82.1
#D	7	10.4	62	92.5
E	5	7.5	67	100.0

TWO2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	9	13.4	9	13.4
#B	52	77.6	61	91.0
C	1	1.5	62	92.5
D	3	4.5	65	97.0
E	2	3.0	67	100.0

TWO3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	3	4.5	3	4.5
B	3	4.5	6	9.0
C	26	38.8	32	47.8
D	14	20.9	46	68.7
#E	21	31.3	67	100.0

TWO4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
#A	58	86.6	58	86.6
B	3	4.5	61	91.0
C	3	4.5	64	95.5
E	3	4.5	67	100.0

TWO5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	27	40.3	27	40.3
B	5	7.5	32	47.8
C	4	6.0	36	53.7
D	14	20.9	50	74.6
#E	17	25.4	67	100.0

TWO6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	3	4.5	3	4.5
B	38	56.7	41	61.2
C	13	19.4	54	80.6
#D	8	11.9	62	92.5
E	5	7.5	67	100.0

PHASE 2: FREQUENCY TABLES BY SCHOOL

TWO4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
#A	90	54.2	90	54.2
B	13	7.8	103	62.0
C	35	21.1	138	83.1
D	21	12.7	159	95.8
E	5	3.0	164	98.8
X	2	1.2	166	100.0

TWO5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	53	31.9	53	31.9
B	12	7.2	65	39.2
C	15	9.0	80	48.2
D	34	20.5	114	68.7
#E	52	31.3	166	100.0

TWO6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	12	7.2	12	7.2
B	50	30.1	62	37.3
C	48	28.9	110	66.3
#D	17	10.2	127	76.5
E	39	23.5	166	100.0

TWO7	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	25	15.1	25	15.1
B	53	31.9	78	47.0
#C	44	26.5	122	73.5
D	15	9.0	137	82.5
E	29	17.5	166	100.0

TWO8	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	35	21.1	35	21.1
B	46	27.7	81	48.8
C	12	7.2	93	56.0
D	35	21.1	128	77.1
#E	37	22.3	165	99.4
X	1	0.6	166	100.0

PHASE 2: FREQUENCY TABLES BY SCHOOL

TWO6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	4	22.2	4	22.2
B	7	38.9	11	61.1
C	1	5.6	12	66.7
#D	2	11.1	14	77.8
E	4	22.2	18	100.0

TWO7	Frequency	Percent	Cumulative Frequency	Cumulative Percent
E	7	38.9	7	38.9
X	11	61.1	18	100.0

TWO8	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	4	22.2	4	22.2
B	1	5.6	5	27.8
D	13	72.2	18	100.0

PHASE 2: FREQUENCY TABLES BY SCHOOL

SCHOOL=School no.4

TWO1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	131	78.9	131	78.9
C	1	0.6	132	79.5
#D	19	11.4	151	91.0
E	15	9.0	166	100.0

TWO2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	25	15.1	25	15.1
#B	110	66.3	135	81.3
C	5	3.0	140	84.3
D	11	6.6	151	91.0
E	15	9.0	166	100.0

TWO3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	7	4.2	7	4.2
B	7	4.2	14	8.4
C	57	34.3	71	42.8
D	41	24.7	112	67.5
#E	54	32.5	166	100.0

PHASE 2: FREQUENCY TABLES BY SCHOOL

TWO8	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	7	6.6	7	6.6
B	56	52.8	63	59.4
C	7	6.6	70	66.0
D	21	19.8	91	85.8
#E	14	13.2	105	99.1
X	1	0.9	106	100.0

PHASE 2: FREQUENCY TABLES BY SCHOOL

SCHOOL=School no.7

TWO1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	17	94.4	17	94.4
#D	1	5.6	18	100.0

TWO2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	2	11.1	2	11.1
#B	12	66.7	14	77.8
E	4	22.2	18	100.0

TWO3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
B	1	5.6	1	5.6
C	4	22.2	5	27.8
D	8	44.4	13	72.2
#E	5	27.8	18	100.0

TWO4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
#A	4	22.2	4	22.2
B	7	38.9	11	61.1
D	4	22.2	15	83.3
E	3	16.7	18	100.0

TWO5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
#E	7	38.9	7	38.9
X	11	61.1	18	100.0

PHASE 2: FREQUENCY TABLES BY SCHOOL

TWO3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	15	14.2	15	14.2
B	4	3.8	19	17.9
C	43	40.6	62	58.5
D	26	24.5	88	83.0
#E	18	17.0	106	100.0

TWO4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
#A	50	47.2	50	47.2
B	18	17.0	68	64.2
C	16	15.1	84	79.2
D	7	6.6	91	85.8
E	14	13.2	105	99.1
X	1	0.9	106	100.0

TWO5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	26	24.5	26	24.5
B	1	0.9	27	25.5
C	19	17.9	46	43.4
D	24	22.6	70	66.0
#E	35	33.0	105	99.1
X	1	0.9	106	100.0

TWO6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	4	3.8	4	3.8
B	23	21.7	27	25.5
C	58	54.7	85	80.2
#D	7	6.6	92	86.8
E	14	13.2	106	100.0

TWO7	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	6	5.7	6	5.7
B	39	36.8	45	42.5
#C	12	11.3	57	53.8
D	13	12.3	70	66.0
E	34	32.1	104	98.1
X	2	1.9	106	100.0

PHASE 2: FREQUENCY TABLES BY SCHOOL

TWO6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	4	7.4	4	7.4
B	10	18.5	14	25.9
C	25	46.3	39	72.2
#D	5	9.3	44	81.5
E	10	18.5	54	100.0

TWO7	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	6	11.1	6	11.1
B	21	38.9	27	50.0
#C	9	16.7	36	66.7
D	8	14.8	44	81.5
E	10	18.5	54	100.0

TWO8	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	21	38.9	21	38.9
B	7	13.0	28	51.9
C	3	5.6	31	57.4
D	10	18.5	41	75.9
#E	13	24.1	54	100.0

PHASE 2: FREQUENCY TABLES BY SCHOOL

SCHOOL=School no.3

TWO1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	97	91.5	97	91.5
C	1	0.9	98	92.5
#D	3	2.8	101	95.3
E	5	4.7	106	100.0

TWO2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	21	19.8	21	19.8
#B	50	47.2	71	67.0
C	4	3.8	75	70.8
D	18	17.0	93	87.7
E	11	10.4	104	98.1
X	2	1.9	106	100.0

PHASE 2: FREQUENCY TABLES BY SCHOOL ON THE STD. 8
REACTIVITY QUESTIONNAIRE

PHASE 2

SCHOOL=School no.5

TWO1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	40	74.1	40	74.1
C	1	1.9	41	75.9
#D	6	11.1	47	87.0
E	7	13.0	54	100.0

TWO2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	7	13.0	7	13.0
#B	32	59.3	39	72.2
C	3	5.6	42	77.8
D	4	7.4	46	85.2
E	8	14.8	54	100.0

TWO3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	2	3.7	2	3.7
B	4	7.4	6	11.1
C	33	61.1	39	72.2
D	9	16.7	48	88.9
#E	6	11.1	54	100.0

TWO4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
#A	19	35.2	19	35.2
B	8	14.8	27	50.0
C	17	31.5	44	81.5
D	7	13.0	51	94.4
E	1	1.9	52	96.3
X	2	3.7	54	100.0

SCHOOL=School no.5

TWO5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	18	33.3	18	33.3
B	4	7.4	22	40.7
C	3	5.6	25	46.3
D	10	18.5	35	64.8
#E	19	35.2	54	100.0

PHASE 2

SCHOOL=School no.6

Variable	N	Mean	Std Dev	Minimum	Maximum
MCQ21	44	0.0454545	0.2107071	0	1.0000000
MCQ22	44	0.5227273	0.5052578	0	1.0000000
MCQ23	44	0.0227273	0.1507557	0	1.0000000
MCQ24	44	0.4545455	0.5036862	0	1.0000000
MCQ25	44	0.4545455	0.5036862	0	1.0000000
MCQ26	44	0.1136364	0.3210382	0	1.0000000
MCQ27	44	0.1590909	0.3699894	0	1.0000000
MCQ28	44	0.0454545	0.2107071	0	1.0000000
TOTTWO	44	1.8181818	1.1668413	0	4.0000000

PHASE 2

SCHOOL=School no.4

Variable	N	Mean	Std Dev	Minimum	Maximum
MCQ21	166	0.1144578	0.3193298	0	1.0000000
MCQ22	166	0.6626506	0.4742358	0	1.0000000
MCQ23	166	0.3253012	0.4699048	0	1.0000000
MCQ24	166	0.5421687	0.4997261	0	1.0000000
MCQ25	166	0.3132530	0.4652197	0	1.0000000
MCQ26	166	0.1024096	0.3041036	0	1.0000000
MCQ27	166	0.2650602	0.4427007	0	1.0000000
MCQ28	166	0.2228916	0.4174454	0	1.0000000
TOTTWO	166	2.5481928	1.2336555	0	7.0000000

SCHOOL=School no.2

Variable	N	Mean	Std Dev	Minimum	Maximum
MCQ21	67	0.1044776	0.3081877	0	1.0000000
MCQ22	67	0.7761194	0.4199890	0	1.0000000
MCQ23	67	0.3134328	0.4673898	0	1.0000000
MCQ24	67	0.8656716	0.3435784	0	1.0000000
MCQ25	67	0.2537313	0.4384298	0	1.0000000
MCQ26	67	0.1194030	0.3267094	0	1.0000000
MCQ27	67	0.1940299	0.3984366	0	1.0000000
MCQ28	67	0.1791045	0.3863337	0	1.0000000
TOTTWO	67	2.8059701	1.3952170	0	7.0000000

SCHOOL=School no.1

Variable	N	Mean	Std Dev	Minimum	Maximum
MCQ21	40	0.0500000	0.2207214	0	1.0000000
MCQ22	40	0.9000000	0.3038218	0	1.0000000
MCQ23	40	0.0750000	0.2667468	0	1.0000000
MCQ24	40	0.3750000	0.4902903	0	1.0000000
MCQ25	40	0.3000000	0.4640955	0	1.0000000
MCQ26	40	0.2250000	0.4229021	0	1.0000000
MCQ27	40	0.2500000	0.4385290	0	1.0000000
MCQ28	40	0.0250000	0.1581139	0	1.0000000
TOTTWO	40	2.2000000	1.2236976	0	5.0000000

PHASE 2: OVERALL RESULTS FOR ALL SCHOOLS ON THE STD. 8 REACTIVITY QUESTIONNAIRE

PHASE 2

SCHOOL=School no.5

Variable	N	Mean	Std Dev	Minimum	Maximum
MCQ21	54	0.1111111	0.3172206		1.0000000
MCQ22	54	0.5925926	0.4959656		1.0000000
MCQ23	54	0.1111111	0.3172206		.0000000
MCQ24	54	0.3518519	0.4820322	0	1.0000000
MCQ25	54	0.3518519	0.4820322	0	1.0000000
MCQ26	54	0.0925926	0.2925824	0	1.0000000
MCQ27	54	0.1666667	0.3761774	0	1.0000000
MCQ28	54	0.2407407	0.4315477	0	1.0000000
TOTTWO	54	2.0185185	1.1072785	0	5.0000000

SCHOOL=School no.3

Variable	N	Mean	Std Dev	Minimum	Maximum
MCQ21	106	0.0283019	0.1666217	0	1.0000000
MCQ22	106	0.4716981	0.5015699	0	1.0000000
MCQ23	106	0.1698113	0.3772507	0	1.0000000
MCQ24	106	0.4716981	0.5015699	0	1.0000000
MCQ25	106	0.3301887	0.4725150	0	1.0000000
MCQ26	106	0.0660377	0.2495279	0	1.0000000
MCQ27	106	0.1132075	0.3183515	0	1.0000000
MCQ28	106	0.1320755	0.3401812	0	1.0000000
TOTTWO	106	1.7830189	1.1127377	0	5.0000000

SCHOOL=School no.7

Variable	N	Mean	Std Dev	Minimum	Maximum
MCQ21	18	0.0555556	0.2357023	0	1.0000000
MCQ22	18	0.6666667	0.4850713	0	1.0000000
MCQ23	18	0.2777778	0.4608886	0	1.0000000
MCQ24	18	0.2222222	0.4277926	0	1.0000000
MCQ25	18	0.3888889	0.5016313	0	1.0000000
MCQ26	18	0.1111111	0.3233808	0	1.0000000
MCQ27	18	0	0	0	0
MCQ28	18	0	0	0	0
TOTTWO	18	1.7222222	1.4061025	0	4.0000000

OBS	TWO1	TWO2	TWO3	TWO4	TWO5	TWO6	TWO7	TWO8	MCQ21	MCQ22	MCQ23	MCQ24	MCQ25	MCQ26	MCQ27	MCQ28	TOTWO	SCHOOL	
485	A	B	C	A	E	B	B	A	0	1	0	1	1	0	0	0	3	School	no.6
486	A	B	C	A	E	B	B	D	0	1	0	1	1	0	0	0	3	School	no.6
487	A	X	C	A	D	C	E	B	0	0	0	1	0	0	0	0	1	School	no.6
488	A	X	C	A	B	E	D	B	0	0	0	1	0	0	0	0	1	School	no.6
489	A	C	C	A	C	D	B	D	0	0	0	1	0	1	0	0	2	School	no.6
490	C	C	A	B	E	A	B	D	0	0	0	0	1	0	0	0	1	School	no.6
491	A	C	C	A	C	C	B	D	0	0	0	1	0	0	0	0	1	School	no.6
492	A	B	C	A	E	A	E	B	0	1	0	1	1	0	0	0	3	School	no.6
493	A	A	C	A	D	E	B	C	0	0	0	1	0	0	0	0	1	School	no.6
494	D	A	C	C	E	B	C	B	1	0	0	0	1	0	1	0	3	School	no.6

OBS	TWO1	TWO2	TWO3	TWO4	TWO5	TWO6	TWO7	TWO8	MCQ21	MCQ22	MCQ23	MCQ24	MCQ25	MCQ26	MCQ27	MCQ28	TOTWO	SCHOOL	
438	A	B	C	C	A	C	A	B	0	1	0	0	0	0	0	0	1	School	no.1
439	A	B	C	C	A	C	B	B	0	1	0	0	0	0	0	0	1	School	no.1
440	A	B	C	B	E	B	A	B	0	1	0	0	1	0	0	0	2	School	no.1
441	D	E	E	A	A	B	B	A	1	0	1	1	0	0	0	0	3	School	no.1
442	E	B	C	A	B	C	E	B	0	1	0	1	0	0	0	0	2	School	no.1
443	A	B	E	A	E	B	E	D	0	1	1	1	1	0	0	0	4	School	no.1
444	A	B	C	B	E	E	C	A	0	1	0	0	1	0	1	0	3	School	no.1
445	A	B	C	C	A	C	A	D	0	1	0	0	0	0	0	0	1	School	no.1
446	A	B	C	A	D	C	A	D	0	1	0	1	0	0	0	0	2	School	no.1
447	D	B	D	E	A	B	B	X	1	1	0	0	0	0	0	0	2	School	no.1
448	A	A	D	B	D	B	E	B	0	0	0	0	0	0	0	0	0	School	no.1
449	A	B	C	C	E	C	A	B	0	1	0	0	1	0	0	0	2	School	no.1
450	A	B	C	C	A	C	E	A	0	1	0	0	0	0	0	0	1	School	no.1
451	A	B	E	A	D	C	A	C	0	1	1	1	0	0	0	0	3	School	no.1
452	A	B	C	D	B	C	A	A	0	1	0	0	0	0	0	0	1	School	no.6
453	A	D	C	A	E	C	E	B	0	0	0	1	1	0	0	0	2	School	no.6
454	A	B	C	B	A	D	C	E	0	1	0	0	0	1	1	1	4	School	no.6
455	A	A	D	C	A	E	D	B	0	0	0	0	0	0	0	0	0	School	no.6
456	A	B	C	D	B	D	D	D	0	1	0	0	0	1	0	0	2	School	no.6
457	E	B	C	B	A	D	E	B	0	1	0	0	0	1	0	0	2	School	no.6
458	A	B	C	A	E	B	D	A	0	1	0	1	1	0	0	0	3	School	no.6
459	A	B	D	A	A	C	E	E	0	1	0	1	0	0	0	1	3	School	no.6
460	A	B	C	C	D	B	B	D	0	1	0	0	0	0	0	0	1	School	no.6
461	A	B	C	C	A	B	B	D	0	1	0	0	0	0	0	0	1	School	no.6
462	A	B	C	C	E	B	B	D	0	1	0	0	1	0	0	0	2	School	no.6
463	A	B	C	C	E	E	B	A	0	1	0	0	1	0	0	0	2	School	no.6
464	A	A	C	C	A	C	C	D	0	0	0	0	0	0	1	0	1	School	no.6
465	A	D	C	C	E	E	A	A	0	0	0	0	1	0	0	0	1	School	no.6
466	A	B	C	D	A	B	A	D	0	1	0	0	0	0	0	0	1	School	no.6
467	B	A	B	A	A	E	A	C	0	0	0	1	0	0	0	0	1	School	no.6
468	A	E	C	E	E	C	B	B	0	0	0	0	1	0	0	0	1	School	no.6
469	A	B	C	A	E	E	D	C	0	1	0	1	1	0	0	0	3	School	no.6
470	A	B	A	D	D	E	B	A	0	1	0	0	0	0	0	0	1	School	no.6
471	A	B	C	D	E	E	B	A	0	1	0	0	1	0	0	0	2	School	no.6
472	A	B	C	D	D	C	A	D	0	1	0	0	0	0	0	0	1	School	no.6
473	A	A	C	A	E	C	C	D	0	0	0	1	1	0	1	0	3	School	no.6
474	A	B	C	A	A	A	C	A	0	1	0	1	0	0	1	0	3	School	no.6
475	A	B	C	C	E	D	C	D	0	1	0	0	1	1	1	0	4	School	no.6
476	A	X	C	C	X	A	B	D	0	0	0	0	0	0	0	0	0	School	no.6
477	A	A	C	A	A	C	D	B	0	0	0	1	0	0	0	0	1	School	no.6
478	A	A	C	A	E	A	D	B	0	0	0	1	1	0	0	0	2	School	no.6
479	A	A	C	E	D	B	B	D	0	0	0	0	0	0	0	0	0	School	no.6
480	A	B	C	A	E	B	A	D	0	1	0	1	1	0	0	0	3	School	no.6
481	A	X	C	D	A	B	E	A	0	0	0	0	0	0	0	0	0	School	no.6
482	A	B	E	A	E	B	B	D	0	1	1	1	1	0	0	0	4	School	no.6
483	A	E	D	D	D	A	D	B	0	0	0	0	0	0	0	0	0	School	no.6
484	A	B	C	A	E	B	B	D	0	1	0	1	1	0	0	0	3	School	no.6

OBS	TWO1	TWO2	TWO3	TWO4	TWO5	TWO6	TWO7	TWO8	MCQ21	MCQ22	MCQ23	MCQ24	MCQ25	MCQ26	MCQ27	MCQ28	TOTWO	SCHOL	
390	E	B	E	A	C	D	B	B	0	1	1	1	0	1	0	0	4	School	no.2
391	A	B	E	A	A	C	D	D	0	1	1	1	0	0	0	0	3	School	no.2
392	A	D	C	A	A	C	B	D	0	0	0	1	0	0	0	0	1	School	no.2
393	E	B	C	A	B	B	A	D	0	1	0	1	0	0	0	0	2	School	no.2
394	E	B	C	A	B	C	B	B	0	1	0	1	0	0	0	0	2	School	no.2
395	E	B	C	A	E	B	B	E	0	1	0	1	1	0	0	1	4	School	no.2
396	A	B	E	A	D	B	A	B	0	1	1	1	0	0	0	0	3	School	no.2
397	A	B	E	A	D	B	A	B	0	1	1	1	0	0	0	0	3	School	no.2
398	A	B	E	A	E	C	D	B	0	1	1	1	1	0	0	0	4	School	no.2
399	A	B	C	A	C	B	A	D	0	1	0	1	0	0	0	0	2	School	no.2
400	A	B	C	A	E	B	A	E	0	1	0	1	1	0	0	1	4	School	no.2
401	A	B	C	A	E	B	A	E	0	1	0	1	1	0	0	1	4	School	no.2
402	D	B	D	A	A	C	B	B	1	1	0	1	0	0	0	0	3	School	no.2
403	D	B	D	A	A	C	B	B	1	1	0	1	0	0	0	0	3	School	no.2
404	D	B	D	A	A	E	B	B	1	1	0	1	0	0	0	0	3	School	no.2
405	A	B	D	A	A	E	B	B	0	1	0	1	0	0	0	0	2	School	no.2
406	A	B	E	A	E	B	A	E	0	1	1	1	1	0	0	1	5	School	no.2
407	A	B	E	A	E	B	A	B	0	1	1	1	1	0	0	0	4	School	no.2
408	A	B	E	A	E	B	A	E	0	1	1	1	1	0	0	1	5	School	no.2
409	A	B	E	A	D	E	A	X	0	1	1	1	0	0	0	0	3	School	no.2
410	A	B	E	A	D	B	A	B	0	1	1	1	0	0	0	0	3	School	no.2
411	A	B	E	A	A	C	D	D	0	1	1	1	0	0	0	0	3	School	no.2
412	A	B	D	B	A	D	B	A	0	1	0	0	0	1	0	0	2	School	no.1
413	A	B	D	C	A	D	D	E	0	1	0	0	0	1	0	1	3	School	no.1
414	A	B	D	B	C	D	C	D	0	1	0	0	0	1	1	0	3	School	no.1
415	A	B	D	B	A	D	C	D	0	1	0	0	0	1	1	0	3	School	no.1
416	A	B	D	A	A	D	C	D	0	1	0	1	0	1	1	0	4	School	no.1
417	A	B	D	B	A	C	B	D	0	1	0	0	0	0	0	0	1	School	no.1
418	A	B	D	D	A	C	B	C	0	1	0	0	0	0	0	0	1	School	no.1
419	A	B	C	A	D	B	C	B	0	1	0	1	0	0	1	0	3	School	no.1
420	A	B	D	A	E	D	C	D	0	1	0	1	1	1	1	0	5	School	no.1
421	A	B	D	C	A	D	B	A	0	1	0	0	0	1	0	0	2	School	no.1
422	A	B	C	A	E	X	C	D	0	1	0	1	1	0	1	0	4	School	no.1
423	A	B	D	E	A	D	C	A	0	1	0	0	0	1	1	0	3	School	no.1
424	E	B	C	C	E	B	D	B	0	1	0	0	1	0	0	0	2	School	no.1
425	E	B	C	A	E	C	D	B	0	1	0	1	1	0	0	0	3	School	no.1
426	A	B	D	A	E	D	C	D	0	1	0	1	1	1	1	0	5	School	no.1
427	A	B	C	A	D	B	C	B	0	1	0	1	0	0	1	0	3	School	no.1
428	A	B	C	E	D	B	B	C	0	1	0	0	0	0	0	0	1	School	no.1
429	A	B	C	E	D	C	E	A	0	1	0	0	0	0	0	0	1	School	no.1
430	A	B	B	E	C	C	E	D	0	1	0	0	0	0	0	0	1	School	no.1
431	E	B	C	A	A	C	D	D	0	1	0	1	0	0	0	0	2	School	no.1
432	E	B	C	A	A	C	D	D	0	1	0	1	0	0	0	0	2	School	no.1
433	E	B	C	A	E	C	D	B	0	1	0	1	1	0	0	0	3	School	no.1
434	A	B	C	C	A	C	A	A	0	1	0	0	0	0	0	0	1	School	no.1
435	A	D	C	E	A	C	A	B	0	0	0	0	0	0	0	0	0	School	no.1
436	A	D	C	E	E	C	A	B	0	0	0	0	1	0	0	0	1	School	no.1
437	A	B	D	C	E	B	B	D	0	1	0	0	1	0	0	0	?	School	no.1

OBS	TWO1	TWO2	TWO3	TWO4	TWO5	TWO6	TWO7	TWO8	MCQ21	MCQ22	MCQ23	MCQ24	MCQ25	MCQ26	MCQ27	MCQ28	TOTWO	SCHOOL
292	E	E	B	A	A	B	B	D	0	0	0	1	0	0	0	0	1	School no.4
293	D	B	D	A	A	A	B	B	1	1	0	1	0	0	0	0	3	School no.4
294	A	A	E	A	A	B	C	B	0	0	1	1	0	0	1	0	3	School no.4
295	A	A	D	A	A	B	C	B	0	0	0	1	0	0	1	0	2	School no.4
296	A	B	D	A	A	B	B	A	0	1	0	1	0	0	0	0	2	School no.4
297	A	B	D	A	A	B	A	A	0	1	0	1	0	0	0	0	2	School no.4
298	A	E	E	C	C	B	D	A	0	0	1	0	0	0	0	0	1	School no.4
299	A	A	C	A	E	C	E	B	0	0	0	1	1	0	0	0	2	School no.4
300	A	B	C	C	C	D	E	B	0	1	0	0	0	1	0	0	2	School no.4
301	A	B	A	A	A	C	B	B	0	1	0	1	0	0	0	0	2	School no.4
302	E	B	E	A	C	D	B	B	0	1	1	1	0	1	0	0	4	School no.4
303	A	B	E	A	A	C	D	D	0	1	1	1	0	0	0	0	3	School no.4
304	A	D	C	A	A	C	B	D	0	0	0	1	0	0	0	0	1	School no.4
305	E	B	C	A	B	B	A	D	0	1	0	1	0	0	0	0	2	School no.4
306	E	B	E	A	B	C	B	B	0	1	1	1	0	0	0	0	3	School no.4
307	E	B	C	A	E	B	E	A	0	1	0	1	1	0	0	0	3	School no.4
308	A	B	E	A	D	B	A	B	0	1	1	1	0	0	0	0	3	School no.4
309	A	B	E	A	D	B	A	B	0	1	1	1	0	0	0	0	3	School no.4
310	A	B	E	A	E	C	D	B	0	1	1	1	1	0	0	0	4	School no.4
311	A	B	C	A	C	B	A	D	0	1	0	1	0	0	0	0	2	School no.4
312	A	B	C	A	C	B	A	A	0	1	0	1	0	0	0	0	2	School no.4
313	A	B	E	A	E	B	E	D	0	1	1	1	1	0	0	0	4	School no.4
314	D	B	D	A	A	C	B	B	1	1	0	1	0	0	0	0	3	School no.4
315	D	B	D	A	A	C	B	B	1	1	0	1	0	0	0	0	3	School no.4
316	D	B	D	A	A	E	B	B	1	1	0	1	0	0	0	0	3	School no.4
317	A	B	D	A	E	E	B	A	0	1	0	1	1	0	0	0	3	School no.4
318	A	B	E	A	D	B	A	B	0	1	1	1	0	0	0	0	3	School no.4
319	A	B	E	A	D	B	A	B	0	1	1	1	0	0	0	0	3	School no.4
320	A	B	E	A	D	B	A	B	0	1	1	1	0	0	0	0	3	School no.4
321	A	B	E	A	D	B	A	A	0	1	1	1	0	0	0	0	3	School no.4
322	A	B	E	A	D	B	A	A	0	1	1	1	0	0	0	0	3	School no.4
323	A	B	E	A	E	C	C	E	0	1	1	1	1	0	1	1	6	School no.4
324	D	E	C	D	D	E	C	D	1	0	0	0	0	0	1	0	2	School no.4
325	A	B	E	B	A	B	C	A	0	1	1	0	0	0	1	0	3	School no.4
326	D	D	B	B	D	D	C	A	1	0	0	0	0	1	1	0	3	School no.4
327	A	E	C	A	E	C	C	E	0	0	0	1	1	0	1	1	4	School no.4
328	A	E	C	C	D	C	B	E	0	0	0	0	0	0	0	1	1	School no.4
329	A	B	E	C	C	C	B	E	0	1	1	0	0	0	0	1	3	School no.4
330	D	A	C	C	A	C	E	A	1	0	0	0	0	0	0	0	1	School no.4
331	A	B	E	E	D	E	B	B	0	1	1	0	0	0	0	0	2	School no.4
332	A	B	A	A	E	C	D	C	0	1	0	1	1	0	0	0	3	School no.4
333	A	B	E	C	C	A	D	D	0	1	1	0	0	0	0	0	2	School no.4
334	A	B	B	D	E	A	E	D	0	1	0	0	1	0	0	0	2	School no.4
335	A	E	A	C	E	C	D	E	0	0	0	0	1	0	0	1	2	School no.4
336	A	E	D	D	D	D	C	D	0	0	0	0	0	1	1	0	2	School no.4
337	A	B	E	D	E	A	E	X	0	1	1	0	1	0	0	0	3	School no.4
338	A	A	D	A	C	B	C	D	0	0	0	1	0	0	1	0	2	School no.4
339	A	A	C	A	E	C	B	D	0	0	0	1	1	0	0	0	2	School no.4

OBS	TWO1	TWO2	TWO3	TWO4	TWO5	TWO6	TWO7	TWO8	MCQ21	MCQ22	MCQ23	MCQ24	MCQ25	MCQ26	MCQ27	MCQ28	TOTWO	SCHOOL
242	A	A	D	D	C	C	B	B	0	0	0	0	0	0	0	0	0	School no.4
243	A	B	D	C	E	E	C	E	0	1	0	0	1	0	1	1	4	School no.4
244	A	B	D	A	A	E	E	C	0	1	0	1	0	0	0	0	2	School no.4
245	A	B	D	D	B	E	C	C	0	1	0	0	0	0	1	0	2	School no.4
246	A	D	D	C	D	C	B	B	0	0	0	0	0	0	0	0	0	School no.4
247	A	B	E	C	A	E	B	D	0	1	1	0	0	0	0	0	2	School no.4
248	A	B	D	A	E	E	E	C	0	1	0	1	1	0	0	0	3	School no.4
249	A	B	D	C	B	E	B	D	0	1	0	0	0	0	0	0	1	School no.4
250	A	B	D	D	E	E	C	B	0	1	0	0	1	0	1	0	3	School no.4
251	A	B	D	A	E	E	B	D	0	1	0	1	1	0	0	0	3	School no.4
252	A	B	E	D	E	E	E	E	0	1	1	0	1	0	0	1	4	School no.4
253	A	B	D	D	E	E	B	E	0	1	0	0	1	0	0	1	3	School no.4
254	A	C	A	D	E	C	B	E	0	0	0	0	1	0	0	1	2	School no.4
255	A	B	D	D	E	E	B	E	0	1	0	0	1	0	0	1	3	School no.4
256	A	B	D	A	E	E	E	E	0	1	0	1	1	0	0	1	4	School no.4
257	A	B	B	A	B	B	C	D	0	1	0	1	0	0	1	0	3	School no.4
258	A	B	C	C	A	B	E	E	0	1	0	0	0	0	0	1	2	School no.4
259	A	B	E	A	D	B	C	B	0	1	1	1	0	0	1	0	4	School no.4
260	A	B	C	A	D	C	C	E	0	1	0	1	0	0	1	1	4	School no.4
261	A	B	C	A	E	B	E	D	0	1	0	1	1	0	0	0	3	School no.4
262	A	B	E	A	D	B	C	D	0	1	1	1	0	0	1	0	4	School no.4
263	A	B	C	A	D	B	C	D	0	1	0	1	0	0	1	0	3	School no.4
264	A	B	E	A	A	B	A	E	0	1	1	1	0	0	0	1	4	School no.4
265	A	B	E	A	A	E	B	E	0	1	1	1	0	0	0	0	3	School no.4
266	D	B	E	A	E	B	C	E	1	1	1	1	1	0	1	1	7	School no.4
267	A	B	C	A	D	B	A	B	0	1	0	1	0	0	0	0	2	School no.4
268	A	B	D	A	A	E	B	B	0	1	0	1	0	0	0	0	2	School no.4
269	A	A	A	E	A	D	B	E	0	0	0	0	0	1	0	1	2	School no.4
270	A	B	E	A	D	B	A	B	0	1	1	1	0	0	0	0	3	School no.4
271	A	B	D	B	D	B	B	A	0	1	0	0	0	0	0	0	1	School no.4
272	A	B	C	A	D	B	C	B	0	1	0	1	0	0	1	0	3	School no.4
273	A	B	C	E	B	B	A	E	0	1	0	0	0	0	0	1	2	School no.4
274	A	A	E	A	E	C	C	E	0	0	1	1	1	0	1	1	5	School no.4
275	A	B	E	A	A	D	A	B	0	1	1	1	0	1	0	0	4	School no.4
276	A	A	C	A	B	B	A	B	0	0	0	1	0	0	0	0	1	School no.4
277	A	B	C	A	E	D	E	E	0	1	0	1	1	1	0	1	5	School no.4
278	A	B	E	A	A	C	A	B	0	1	1	1	0	0	0	0	3	School no.4
279	A	B	C	A	E	D	C	E	0	1	0	1	1	1	1	1	6	School no.4
280	A	C	C	A	E	D	E	E	0	0	0	1	1	1	0	1	4	School no.4
281	D	B	D	A	A	A	C	A	1	1	0	1	0	0	1	0	4	School no.4
282	A	B	E	A	D	B	A	B	0	1	1	1	0	0	0	0	3	School no.4
283	A	A	C	B	E	B	B	E	0	0	0	0	1	0	0	1	2	School no.4
284	A	B	E	A	A	D	B	B	0	1	1	1	0	1	0	0	4	School no.4
285	D	A	C	A	A	B	D	B	1	0	0	1	0	0	0	0	2	School no.4
286	A	B	E	A	A	B	B	A	0	1	1	1	0	0	0	0	3	School no.4
287	A	B	C	E	A	C	B	C	0	1	0	0	0	0	0	0	1	School no.4
288	A	A	C	B	E	E	B	B	0	0	0	0	1	0	0	0	1	School no.4
289	A	B	D	A	E	B	E	B	0	1	0	1	1	0	0	0	3	School no.4
290	A	D	E	A	A	B	C	B	0	0	1	1	0	0	1	0	3	School no.4
291	A	D	C	A	A	A	D	A	0	0	0	1	0	0	0	0	1	School no.4

OBS	TWO1	TWO2	TWO3	TWO4	TWO5	TWO6	TWO7	TWO8	MCQ21	MCQ22	MCQ23	MCQ24	MCQ25	MCQ26	MCQ27	MCQ28	TOTWO	SCHOOL
193	A	A	E	A	D	B	B	A	0	0	1	1	0	0	0	0	2	School no.4
194	A	B	C	C	E	C	E	B	0	1	0	0	1	0	0	0	2	School no.4
195	A	B	C	D	A	D	E	D	0	1	0	0	0	1	0	0	2	School no.4
196	E	B	E	B	E	B	C	E	0	1	1	0	1	0	1	1	5	School no.4
197	E	B	C	C	D	C	A	C	0	1	0	0	0	0	0	0	1	School no.4
198	A	B	C	C	A	C	B	B	0	1	0	0	0	0	0	0	1	School no.4
199	D	B	C	A	A	C	E	A	1	1	0	1	0	0	0	0	3	School no.4
200	A	D	C	A	E	B	E	A	0	0	0	1	1	0	0	0	2	School no.4
201	E	B	E	C	D	E	C	B	0	1	1	0	0	0	1	0	3	School no.4
202	E	A	C	B	A	B	B	D	0	0	0	0	0	0	0	0	0	School no.4
203	A	B	E	X	E	C	E	A	0	1	1	0	1	0	0	0	3	School no.4
204	A	B	D	A	A	C	B	A	0	1	0	1	0	0	0	0	2	School no.4
205	A	B	C	A	D	C	D	A	0	1	0	1	0	0	0	0	2	School no.4
206	A	B	C	C	D	C	B	A	0	1	0	0	0	0	0	0	1	School no.4
207	A	B	E	B	E	C	E	E	0	1	1	0	1	0	0	1	4	School no.4
208	A	B	C	C	E	C	C	D	0	1	0	0	1	0	1	0	3	School no.4
209	A	B	C	B	A	C	D	D	0	1	0	0	0	0	0	0	1	School no.4
210	A	C	D	A	E	E	E	B	0	0	0	1	1	0	0	0	2	School no.4
211	D	B	E	A	A	D	C	A	1	1	1	1	0	1	1	0	6	School no.4
212	A	B	E	D	E	B	C	E	0	1	1	0	1	0	1	1	5	School no.4
213	D	C	D	A	B	E	B	D	1	0	0	1	0	0	0	0	2	School no.4
214	A	B	B	A	C	A	D	C	0	1	0	1	0	0	0	0	2	School no.4
215	A	E	E	A	B	E	B	C	0	0	1	1	0	0	0	0	2	School no.4
216	A	B	C	A	A	B	B	A	0	1	0	1	0	0	0	0	2	School no.4
217	D	E	C	D	E	E	E	A	1	0	0	0	1	0	0	0	2	School no.4
218	A	B	C	B	A	B	C	B	0	1	0	0	0	0	1	0	2	School no.4
219	D	D	E	B	D	D	C	A	1	0	1	0	0	1	1	0	4	School no.4
220	A	E	C	A	A	C	E	B	0	0	0	1	0	0	0	0	1	School no.4
221	A	E	C	C	E	C	E	E	0	0	0	0	1	0	0	1	2	School no.4
222	A	B	C	C	E	C	C	E	0	1	0	0	1	0	1	1	4	School no.4
223	D	A	C	C	A	C	E	A	1	0	0	0	0	0	0	0	1	School no.4
224	A	B	E	E	D	E	B	E	0	1	1	0	0	0	0	1	3	School no.4
225	A	B	A	A	B	C	D	C	0	1	0	1	0	0	0	0	2	School no.4
226	A	B	C	C	C	A	D	D	0	1	0	0	0	0	0	0	1	School no.4
227	A	B	B	D	E	A	C	E	0	1	0	0	1	0	1	1	4	School no.4
228	A	E	A	C	C	C	D	E	0	0	0	0	0	0	0	1	1	School no.4
229	A	E	E	D	D	D	C	D	0	0	0	1	0	0	1	1	3	School no.4
230	A	B	B	D	E	A	C	E	0	1	0	0	1	0	1	1	4	School no.4
231	A	C	D	A	C	B	C	D	0	0	0	1	0	0	1	0	2	School no.4
232	A	A	C	A	E	C	C	E	0	0	0	1	1	0	1	1	4	School no.4
233	D	E	C	C	A	E	B	D	1	1	0	0	0	0	0	0	2	School no.4
234	E	D	C	A	A	E	B	A	0	0	0	1	0	0	0	0	1	School no.4
235	A	B	E	C	D	A	C	C	0	1	1	0	0	0	1	0	3	School no.4
236	A	B	D	D	C	D	A	D	0	1	0	0	0	1	0	0	2	School no.4
237	A	A	D	A	A	E	B	D	0	0	0	1	0	0	0	0	1	School no.4
238	D	B	D	C	E	F	C	D	1	1	0	0	1	0	1	0	4	School no.4
239	E	A	C	C	B	E	B	E	0	0	0	0	0	0	0	1	1	School no.4
240	A	A	E	A	A	E	B	A	0	0	1	1	0	0	0	0	2	School no.4
241	A	A	D	D	A	E	B	E	0	0	0	0	0	0	0	1	1	School no.4

OBS	TWO1	TWO2	TWO3	TWO4	TWO5	TWO6	TWO7	TWO8	MCQ21	MCQ22	MCQ23	MCQ24	MCQ25	MCQ26	MCQ27	MCQ28	TOTTWO	SCHOOL
143	A	B	C	A	A	B	B	B	0	1	0	1	0	0	0	0	2	School no.3
144	A	B	E	B	C	C	B	B	0	1	1	0	0	0	0	0	2	School no.3
145	A	B	C	C	C	E	B	B	0	1	0	0	0	0	0	0	1	School no.3
146	A	E	D	C	E	C	E	E	0	0	0	0	1	0	0	1	2	School no.3
147	A	D	C	B	E	A	E	X	0	0	0	0	1	0	0	0	1	School no.3
148	A	A	A	B	C	D	B	B	0	0	0	0	0	1	0	0	1	School no.3
149	A	A	A	B	C	D	D	B	0	0	0	0	0	1	0	0	1	School no.3
150	A	A	D	C	D	B	D	B	0	0	0	0	0	0	0	0	0	School no.3
151	A	C	B	A	C	D	E	B	0	0	0	1	0	1	0	0	2	School no.3
152	A	B	A	C	E	C	E	E	0	1	0	0	1	0	0	1	3	School no.3
153	A	D	C	A	A	C	D	B	0	0	0	1	0	0	0	0	1	School no.3
154	A	D	E	C	E	E	E	E	0	0	1	0	1	0	0	1	3	School no.3
155	E	B	C	D	B	C	B	B	0	1	0	0	0	0	0	0	1	School no.3
156	A	D	A	B	D	E	D	C	0	0	0	0	0	0	0	0	0	School no.3
157	A	E	C	E	C	B	E	A	0	0	0	0	0	0	0	0	0	School no.3
158	A	B	C	A	D	B	A	B	0	1	0	1	0	0	0	0	2	School no.3
159	A	D	B	C		C	D	B	0	0	0	0	0	0	0	0	0	School no.3
160	E	D	D	E		C	E	B	0	0	0	0	1	0	0	0	1	School no.3
161	A	B	D	D	E	A	E	D	0	1	0	0	1	0	0	0	2	School no.7
162	A	B	B	B	X	A	X	D	0	1	0	0	0	0	0	0	1	School no.7
163	A	E	D	B	X	A	X	D	0	0	0	0	0	0	0	0	0	School no.7
164	A	E	D	B	X	B	X	D	0	0	0	0	0	0	0	0	0	School no.7
165	A	B	E	E	X	B	X	D	0	1	1	0	0	0	0	0	2	School no.7
166	A	B	E	D	E	E	E	D	0	1	1	0	1	0	0	0	3	School no.7
167	A	B	E	D	E	E	E	D	0	1	1	0	1	0	0	0	3	School no.7
168	A	B	E	D	X	E	X	D	0	1	1	0	0	0	0	0	2	School no.7
169	D	B	C	A	E	B	E	B	1	1	0	1	1	0	0	0	4	School no.7
170	A	B	C	E	X	B	X	D	0	1	0	0	0	0	0	0	1	School no.7
171	A	B	D	A	X	E	X	A	0	1	0	1	0	0	0	0	2	School no.7
172	A	B	D	A	E	D	E	D	0	1	0	1	1	1	0	0	4	School no.7
173	A	E	D	B	X	B	X	D	0	0	0	0	0	0	0	0	0	School no.7
174	A	B	C	E	X	C	X	A	0	1	0	0	0	0	0	0	1	School no.7
175	A	A	D	B	E	B	E	A	0	0	0	0	1	0	0	0	1	School no.7
176	A	B	E	A	X	D	X	A	0	1	1	1	0	1	0	0	4	School no.7
177	A	E	D	B	X	B	X	D	0	0	0	0	0	0	0	0	0	School no.7
178	A	A	C	B	E	A	E	D	0	0	0	0	1	0	0	0	1	School no.7
179	E	B	E	C	B	C	A	C	0	1	1	0	0	0	0	0	2	School no.4
180	A	C	C	X	E	E	C	E	0	0	0	0	1	0	1	1	3	School no.4
181	A	B	E	A	A	C	E	A	0	1	1	1	0	0	0	0	3	School no.4
182	E	B	D	A	A	C	B	A	0	1	0	1	0	0	0	0	2	School no.4
183	A	D	D	A	D	E	D	D	0	0	0	1	0	0	0	0	1	School no.4
184	C	B	C	C	E	E	C	E	0	1	0	0	1	0	1	1	4	School no.4
185	A	B	D	D	A	E	B	A	0	1	0	0	0	0	0	0	1	School no.4
186	A	E	C	C	A	C	A	B	0	0	0	0	0	0	0	0	0	School no.4
187	A	E	E	C	E	C	C	E	0	0	1	0	1	0	1	1	4	School no.4
188	E	A	C	B	E	C	C	B	0	0	0	0	1	0	1	0	2	School no.4
189	A	D	E	A	E	D	E	A	0	0	1	1	1	1	0	0	4	School no.4
190	A	B	C	C	A	B	A	B	0	1	0	0	0	0	0	0	1	School no.4
191	A	A	E	C	E	B	C	B	0	0	1	0	1	0	1	0	3	School no.4
192	A	B	C	B	D	C	B	A	0	1	0	0	0	0	0	0	1	School no.4

OBS	TWO1	TWO2	TWO3	TWO4	TWO5	TWO6	TWO7	TWO8	MCQ21	MCQ22	MCQ23	MCQ24	MCQ25	MCQ26	MCQ27	MCQ28	TOTWO	SCHOOL
93	A	A	D	E	A	D	E	B	0	0	0	0	0	1	0	0	1	School no.3
94	A	B	C	A	A	C	B	D	0	1	0	1	0	0	0	0	2	School no.3
95	A	B	C	A	E	B	E	D	0	1	0	1	1	0	0	0	3	School no.3
96	A	B	D	A	A	C	B	B	0	1	0	1	0	0	0	0	2	School no.3
97	A	B	E	C	D	C	B	C	0	1	1	0	0	0	0	0	2	School no.3
98	A	D	D	A	E	D	E	D	0	0	0	1	1	1	0	0	3	School no.3
99	A	E	E	D	C	B	C	D	0	0	1	0	0	0	1	0	2	School no.3
100	A	D	D	A	B	D	E	D	0	0	0	1	1	1	0	0	3	School no.3
101	A	E	E	D	E	E	C	D	0	0	1	0	1	0	1	0	3	School no.3
102	A	B	D	B	E	E	C	D	0	1	0	0	1	0	1	0	3	School no.3
103	A	B	D	A	D	E	C	D	0	1	0	1	0	0	1	0	3	School no.3
104	A	B	C	B	D	C	E	A	0	1	0	0	0	0	0	0	1	School no.3
105	A	B	E	A	E	C	E	B	0	1	1	1	1	0	0	0	4	School no.3
106	A	B	C	A	E	C	E	B	0	1	0	1	1	0	0	0	3	School no.3
107	A	B	C	A	A	B	B	B	0	1	0	1	0	0	0	0	2	School no.3
108	A	A	E	B	A	C	E	B	0	0	1	0	0	0	0	0	1	School no.3
109	A	A	E	B	A	C	B	E	0	0	1	0	0	0	0	1	2	School no.3
110	A	X	D	A	E	D	E	B	0	0	0	1	1	1	0	0	3	School no.3
111	A	B	E	D	C	E	B	B	0	1	1	0	0	0	0	0	2	School no.3
112	A	A	A	B	A	C	C	E	0	0	0	0	0	0	1	1	2	School no.3
113	A	A	C	D	C	C	B	C	0	0	0	0	0	0	0	0	0	School no.3
114	A	A	A	A	E	C	E	D	0	0	0	1	1	0	0	0	2	School no.3
115	A	B	B	A	E	B	E	E	0	1	0	1	1	0	0	1	4	School no.3
116	A	B	D	E	C	E	C	D	0	1	0	0	0	0	1	0	2	School no.3
117	A	B	A	A	E	B	C	B	0	1	0	1	1	0	1	0	4	School no.3
118	A	B	D	E	C	E	C	D	0	1	0	0	0	0	1	0	2	School no.3
119	A	B	A	X	A	C	D	B	0	1	0	0	0	0	0	0	1	School no.3
120	A	A	E	B	A	C	B	D	0	0	1	0	0	0	0	0	1	School no.3
121	A	A	A	C	E	A	E	C	0	0	0	0	1	0	0	0	1	School no.3
122	D	B	C	A	D	B	C	B	1	1	0	1	0	0	1	0	4	School no.3
123	A	B	D	D	E	B	E	E	0	1	0	0	1	0	0	1	3	School no.3
124	A	B	C	A	A	E	E	B	0	1	0	1	0	0	0	0	2	School no.3
125	A	A	C	C	E	A	E	E	0	0	0	0	1	0	0	1	2	School no.3
126	D	E	C	A	D	B	C	B	1	0	0	1	0	0	1	0	3	School no.3
127	A	A	A	B	E	B	E	B	0	0	0	0	1	0	0	0	1	School no.3
128	A	A	E	B	E	C	E	E	0	0	1	0	1	0	0	1	3	School no.3
129	D	D	C	A	C	C	A	B	1	0	0	1	0	0	0	0	2	School no.3
130	A	A	C	A	A	C	B	B	0	0	0	1	0	0	0	0	1	School no.3
131	A	B	D	B	D	E	B	D	0	1	0	0	0	0	0	0	1	School no.3
132	E	B	C	A	E	B	E	E	0	1	0	1	1	0	0	1	4	School no.3
133	A	B	C	A	A	E	B	B	0	1	0	1	0	0	0	0	2	School no.3
134	A	D	A	B	D	B	A	D	0	0	0	0	0	0	0	0	0	School no.3
135	A	E	E	C	C	C	D	C	0	0	1	0	0	0	0	0	1	School no.3
136	A	C	A	B	D	C	B	*	0	0	0	0	0	0	0	0	0	School no.3
137	E	E	A	A	C	B	E	D	0	0	0	1	0	0	0	0	1	School no.3
138	A	D	C	B	D	C	B	B	0	0	0	0	0	0	0	0	0	School no.3
139	A	A	A	D	E	C	E	A	0	0	0	0	1	0	0	0	1	School no.3
140	A	A	E	E	C	C	B	B	0	0	1	0	0	0	0	0	1	School no.3
141	A	B	C	A	A	C	B	B	0	1	0	1	0	0	0	0	2	School no.3
142	A	B	C	A	A	C	B	B	0	1	0	1	0	0	0	0	2	School no.3

APPENDIX J2

PHASE 2: INDIVIDUAL STUDENT RESPONSES TO THE STD. 8 REACTIVITY QUESTIONNAIRE.

OBS	TW01	TW02	TW03	TW04	TW05	TW06	TW07	TW08	MCQ21	MCQ22	MCQ23	MCQ24	MCQ25	MCQ26	MCQ27	MCQ28	TOTW0	SCHOOL
1	E	B	C	C	B	C	A	C	0	1	0	0	0	0	0	0	1	School no.5
2	A	C	C	X	A	E	B	B	0	0	0	0	0	0	0	0	0	School no.5
3	A	B	E	A	E	C	E	A	0	1	1	1	1	0	0	0	4	School no.5
4	E	B	[illegible]	A	A	C	B	A	0	1	0	1	0	0	0	0	2	School no.5
5	A	D	[illegible]	A	D	E	D	D	0	0	0	1	0	0	0	0	1	School no.5
6	C	B	C	C	E	E	A	E	0	1	0	0	1	0	0	1	3	School no.5
7	A	B	D	D	E	E	E	A	0	1	0	0	1	0	0	0	2	School no.5
8	A	E	E	C	A	C	A	B	0	0	1	0	0	0	0	0	1	School no.5
9	A	E	C	C	A	C	A	B	0	0	0	0	0	0	0	0	0	School no.5
10	E	A	C	B	E	C	B	E	0	0	0	0	1	0	0	1	2	School no.5
11	A	D	C	A	E	D	C	E	0	0	0	1	1	1	1	1	5	School no.5
12	A	B	C	C	A	B	A	B	0	1	0	0	0	0	0	0	1	School no.5
13	A	A	E	C	A	B	C	A	0	0	1	0	0	0	1	0	2	School no.5
14	A	B	C	B	D	C	B	A	0	1	0	0	0	0	0	0	1	School no.5
15	A	A	D	A	D	B	B	A	0	0	0	1	0	0	0	0	1	School no.5
16	A	B	C	C	A	C	B	E	0	1	0	0	0	0	0	1	2	School no.5
17	A	B	C	D	A	D	E	D	0	1	0	0	0	1	0	0	2	School no.5
18	E	B	C	B	E	B	B	E	0	1	0	0	1	0	0	1	3	School no.5
19	E	B	C	C	D	C	A	C	0	1	0	0	0	0	0	0	1	School no.5
20	A	B	C	C	A	C	B	B	0	1	0	0	0	0	0	0	1	School no.5
21	D	B	C	A	A	C	E	A	1	1	0	1	0	0	0	0	3	School no.5
22	A	D	C	A	E	B	B	A	0	0	0	1	1	0	0	0	2	School no.5
23	E	B	E	C	D	E	B	A	0	1	1	0	0	0	0	0	2	School no.5
24	E	A	C	B	A	B	B	D	0	0	0	0	[illegible]	0	0	0	0	School no.5
25	A	B	C	X	D	C	B	C	0	1	0	0	0	0	0	0	1	School no.5
26	A	B	D	A	A	C	B	A	0	1	0	1	0	[illegible]	0	0	2	School no.5
27	A	B	C	A	D	C	D	A	0	1	0	1	0	0	0	0	2	School no.5
28	A	B	C	C	E	C	B	A	0	1	0	0	1	0	0	0	2	School no.5
29	A	B	C	B	E	C	C	A	0	1	0	0	1	0	1	0	3	School no.5
30	A	B	C	C	E	C	E	D	0	1	0	0	1	0	0	0	2	School no.5
31	A	B	C	B	A	C	D	D	0	1	0	0	0	0	0	0	1	School no.5
32	A	C	D	A	E	E	B	E	0	0	0	1	1	0	0	1	3	School no.5
33	D	B	C	A	A	D	C	A	1	1	0	1	0	1	1	0	5	School no.5
34	A	B	E	D	E	B	D	E	0	1	1	0	1	0	0	1	4	School no.5
35	D	C	D	A	B	E	B	D	1	0	0	1	0	0	0	0	2	School no.5
36	A	B	B	A	C	A	D	A	0	1	0	1	0	0	0	0	2	School no.5
37	A	E	C	A	B	E	B	A	0	0	0	1	0	0	0	0	1	School no.5
38	A	B	C	A	A	B	B	A	0	1	0	1	0	0	0	0	2	School no.5
39	D	E	C	D	D	E	C	D	1	0	0	0	0	0	1	0	2	School no.5
40	A	B	C	B	A	B	C	A	0	1	0	0	0	0	1	0	2	School no.5
41	D	D	B	B	D	D	C	A	1	0	0	0	0	1	1	0	3	School no.5
42	A	E	C	A	A	C	E	B	0	0	0	1	0	0	0	0	1	School no.5
43	A	E	C	C	E	C	E	E	0	0	0	0	1	0	0	1	2	School no.5
44	A	B	C	C	E	C	B	E	0	1	0	0	1	0	0	1	3	School no.5

APPENDIX J2

PHASE 2: FREQUENCY TABLES BY SCHOOL

TWO7	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	6	13.6	6	13.6
B	17	38.6	23	52.3
#C	7	15.9	30	68.2
D	8	18.2	38	86.4
E	6	13.6	44	100.0

TWO8	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	9	20.5	9	20.5
B	12	27.3	21	47.7
C	3	6.8	24	54.5
D	18	40.9	42	95.5
#E	2	4.5	44	100.0

PHASE 2: FREQUENCY TABLES BY SCHOOL

TWO2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	10	22.7	10	22.7
#B	23	52.3	33	75.0
C	3	6.8	36	81.8
D	2	4.5	38	86.4
E	2	4.5	40	90.9
X	4	9.1	44	100.0

TWO3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	2	4.5	2	4.5
B	1	2.3	3	6.8
C	37	84.1	40	90.9
D	3	6.8	43	97.7
#E	1	2.3	44	100.0

TWO4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
#A	20	45.5	20	45.5
B	3	6.8	23	52.3
C	11	25.0	34	77.3
D	8	18.2	42	95.5
E	2	4.5	44	100.0

TWO5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	11	25.0	11	25.0
B	3	6.8	14	31.8
C	2	4.5	16	36.4
D	7	15.9	23	52.3
#E	20	45.5	43	97.7
X	1	2.3	44	100.0

TWO6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
A	7	15.9	7	15.9
B	13	29.5	20	45.5
C	10	22.7	30	68.2
#D	5	11.4	35	79.5
E	9	20.5	44	100.0

357 - DELAYED AGAINST 138 - NOT DELAYED: Q7 CORRECT ANSWER E

Chi-Square test

MCQ27 GROUP

Frequency / Percent / Row Pct / Col Pct	DELAYED	NOT DEL	Total
0	280	117	397
	56.57	23.64	80.20
	70.53	29.47	
	78.43	84.78	
1	77	21	98
	15.56	4.24	19.80
	78.57	21.43	
	21.57	15.22	
Total	357	138	495
	72.12	27.88	100.00

STATISTICS FOR TABLE OF MCQ27 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	2.528	0.112
Likelihood Ratio Chi-Square	1	2.635	0.105
Continuity Adj. Chi-Square	1	2.144	0.143
Mantel-Haenszel Chi-Square	1	2.523	0.112
Fisher's Exact Test (Left)			0.070
(Right)			0.959
(2-Tail)			0.131
Phi Coefficient		-0.071	
Contingency Coefficient		0.071	
Cramer's V		-0.071	

Sample Size = 495

APPENDIX L2

ALTERNATIVE COMPARISON OF PHASE 2 DELAYED & UNDELAYED GROUPS ON THE STANDARD 8 REACTIVITY QUESTIONNAIRE

[Teaching delayed, (old & new; N=357) with teaching undelayed, (old & new; N=138]

Student's t-test

TTEST PROCEDURE

Variable: TOTTWO5

GROUP	N	Mean	Std Dev	Std Error
DELAYED	357	2.06162465	1.14735193	0.06072430
NOT DEL	138	1.60869565	1.03539395	0.08813859

Variances	T	DF	Prob>|T|
Unequal	4.2317	274.2	0.0001
Equal	4.0439	493.0	0.0001

For H0: Variances are equal, F' = 1.23 DF = (356,137) Prob>F' = 0.1618

[Teaching delayed (old; n=233) with teaching undelayed(new ; n=54): Questions 1,2,6 excluded]

Student's t-test

TTEST PROCEDURE

Variable: TOTTWO5

GROUP	N	Mean	Std Dev	Std Error
DELAYED	233	2.12017167	1.11152891	0.07281868
NOT DEL	54	1.75925926	1.02672193	0.13971916

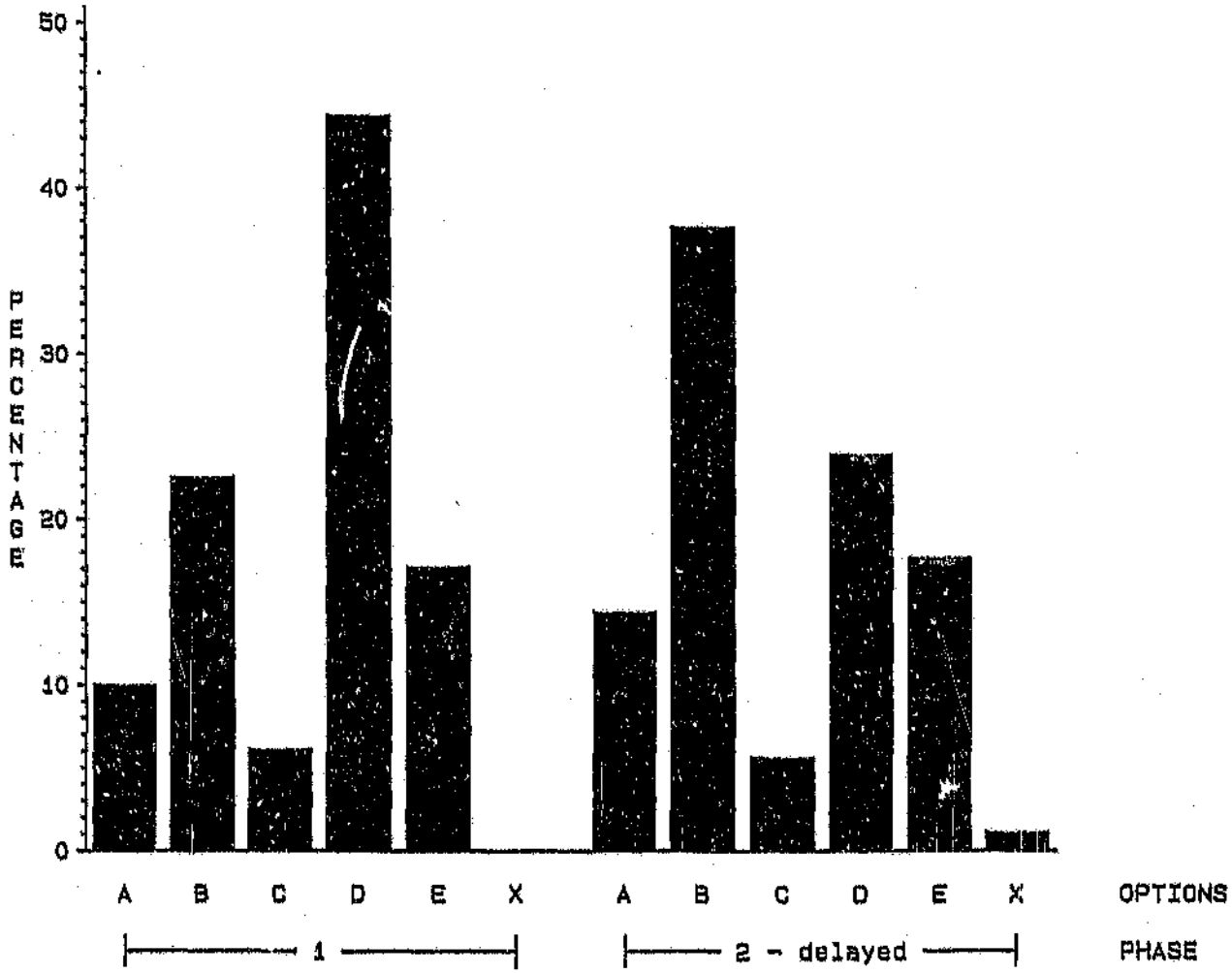
Vari...nces	T	DF	Prob>|T|
Unequal	2.2907	84.3	0.0245
Equal	2.1798	285.0	0.0301

For H0: Variances are equal, F' = 1.17 DF = (232,53) Prob>F' = 0.4976

APPENDIX L2

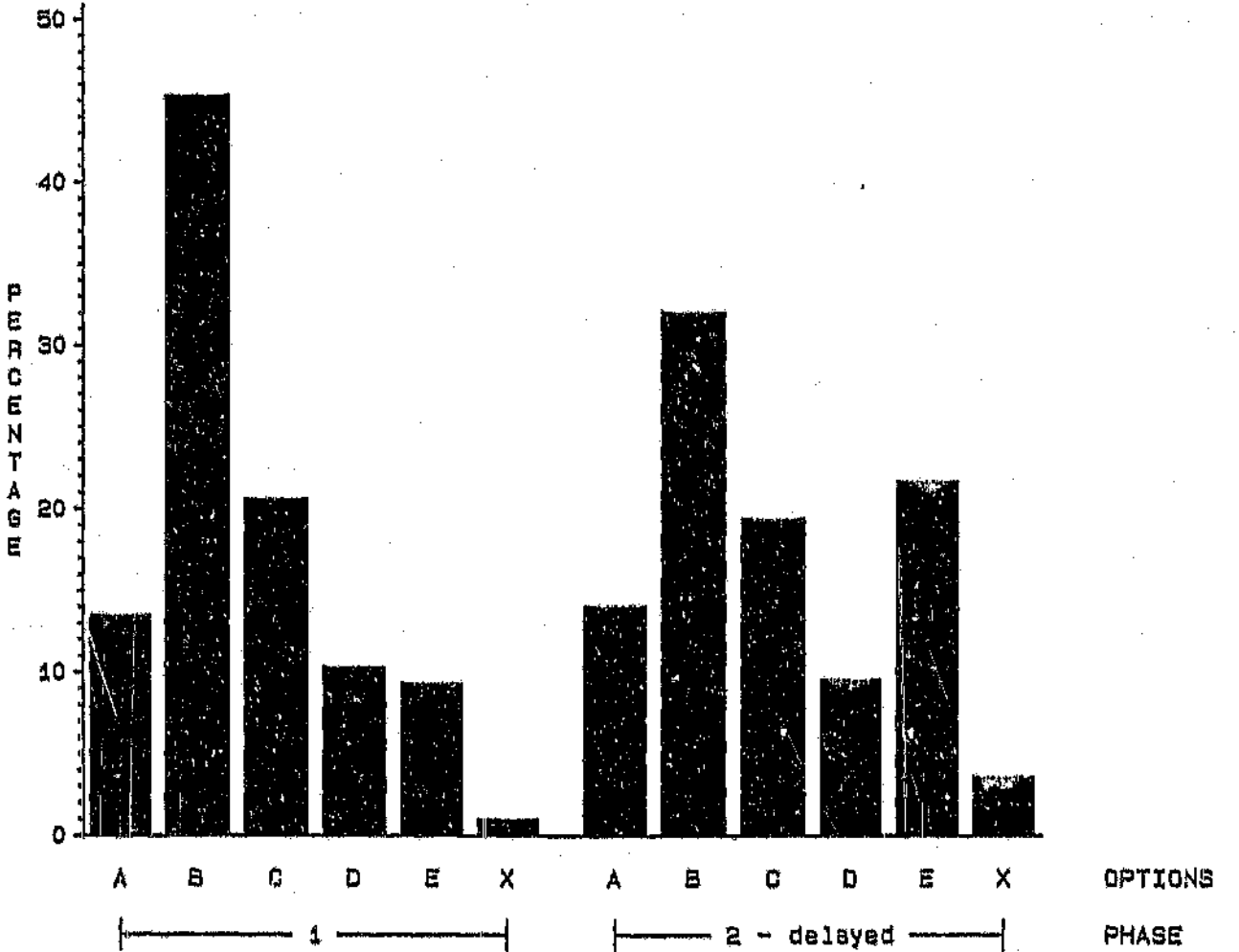
STD 8 QUESTIONNAIRE

QUESTION 8
CORRECT ANSWER IS E



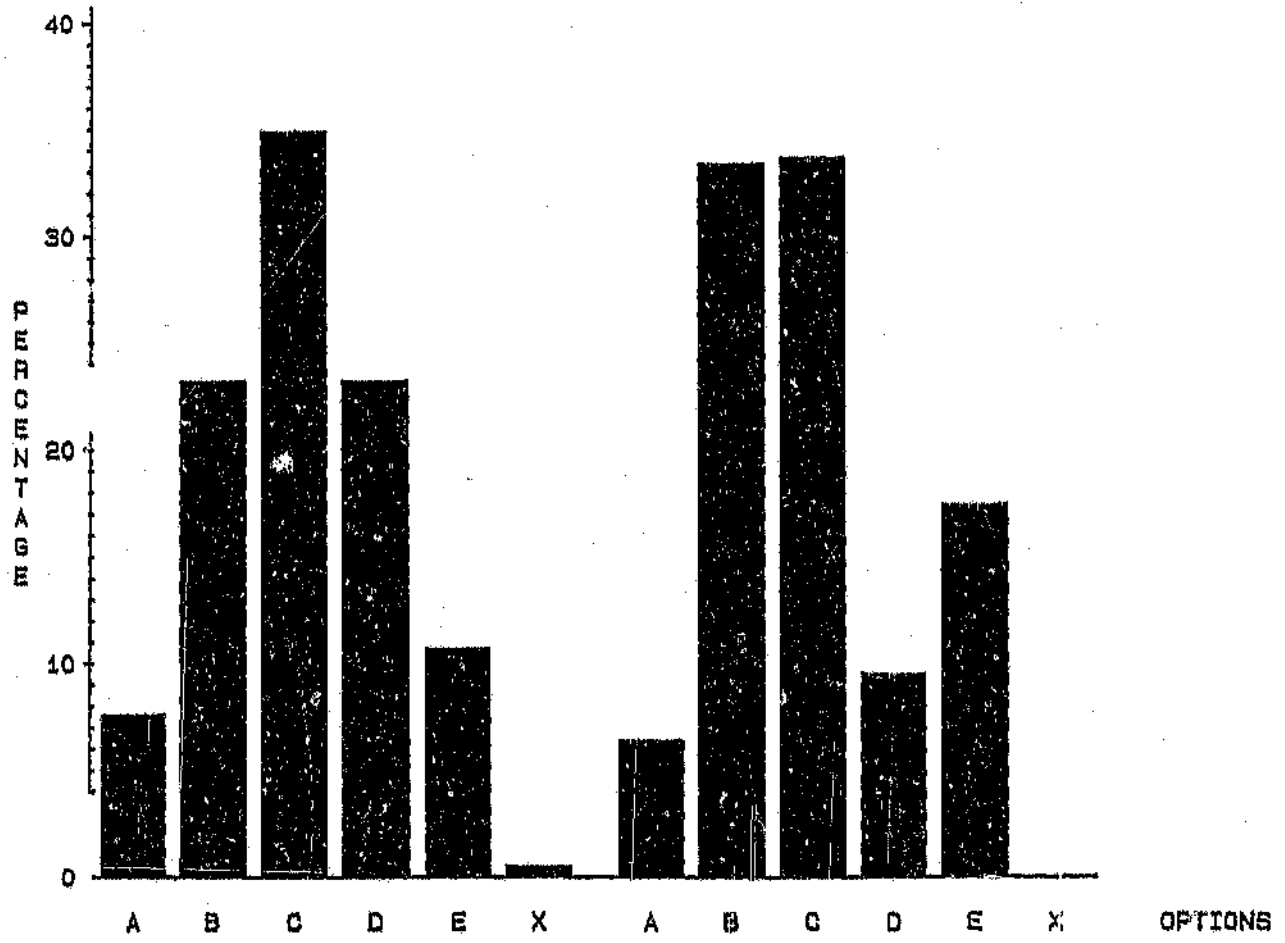
STD 8 QUESTIONNAIRE

QUESTION 7
CORRECT ANSWER IS C



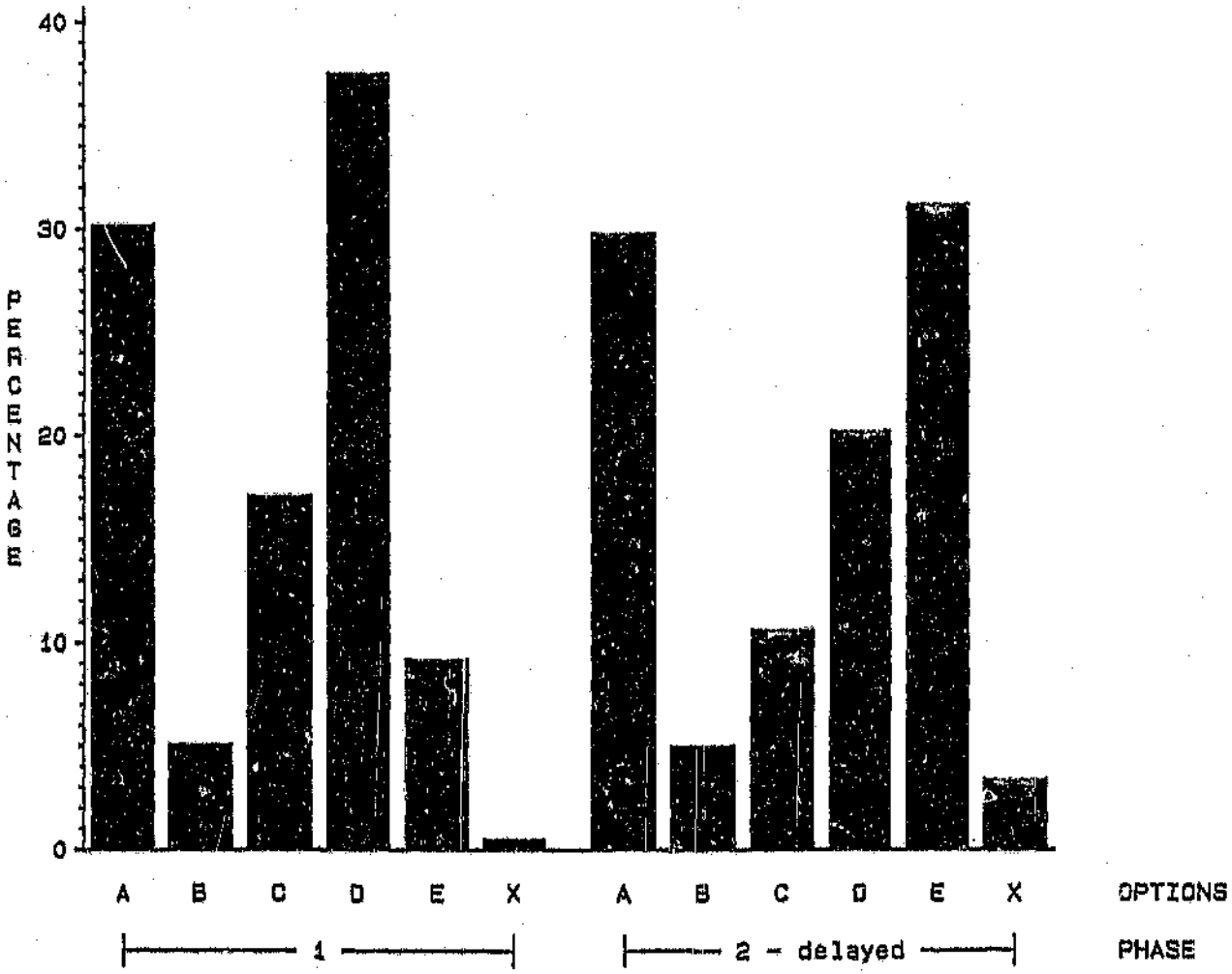
STD 8 QUESTIONNAIRE

QUESTION 6
CORRECT ANSWER IS D



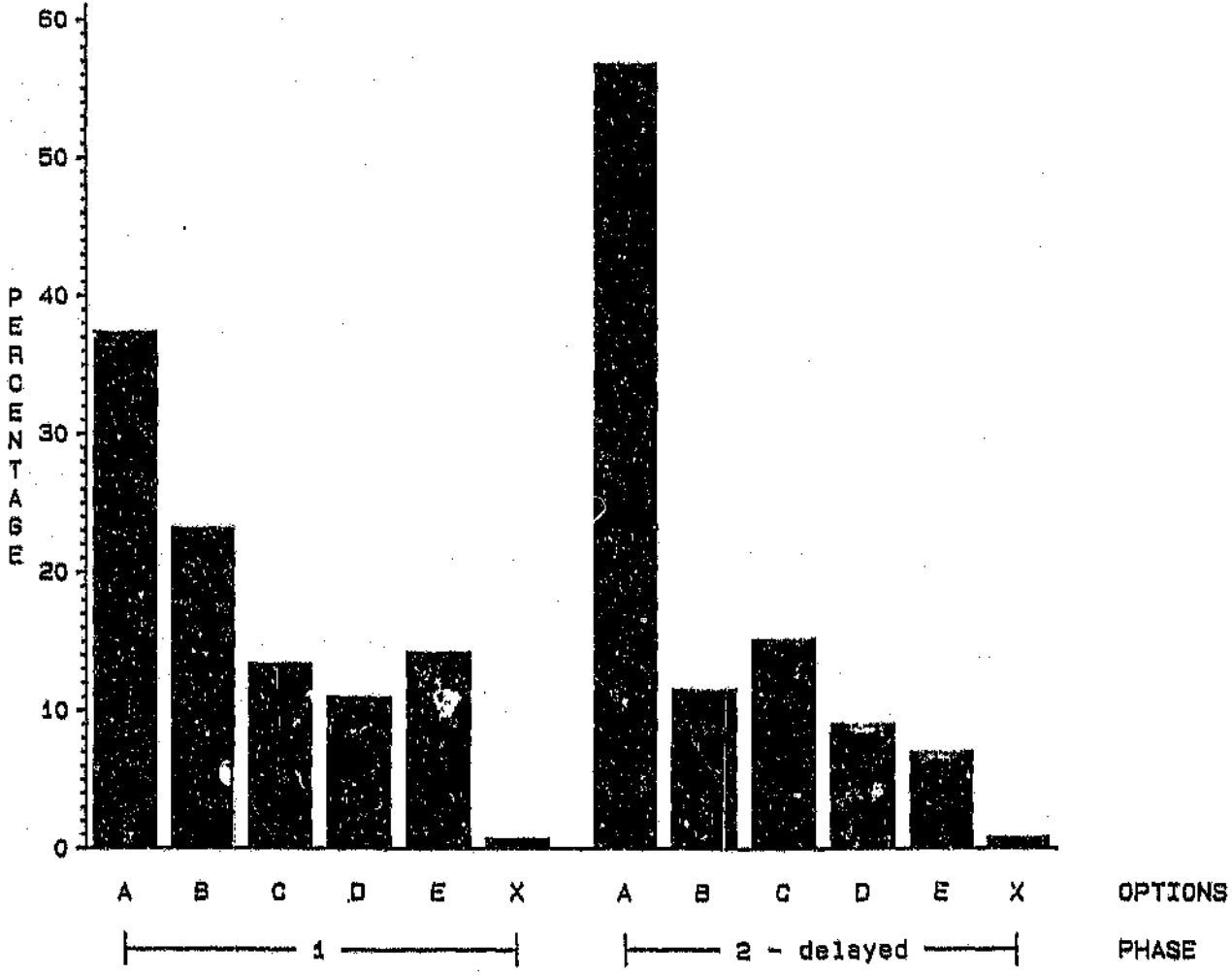
STD 8 QUESTIONNAIRE

QUESTION 5
CORRECT ANSWER IS E



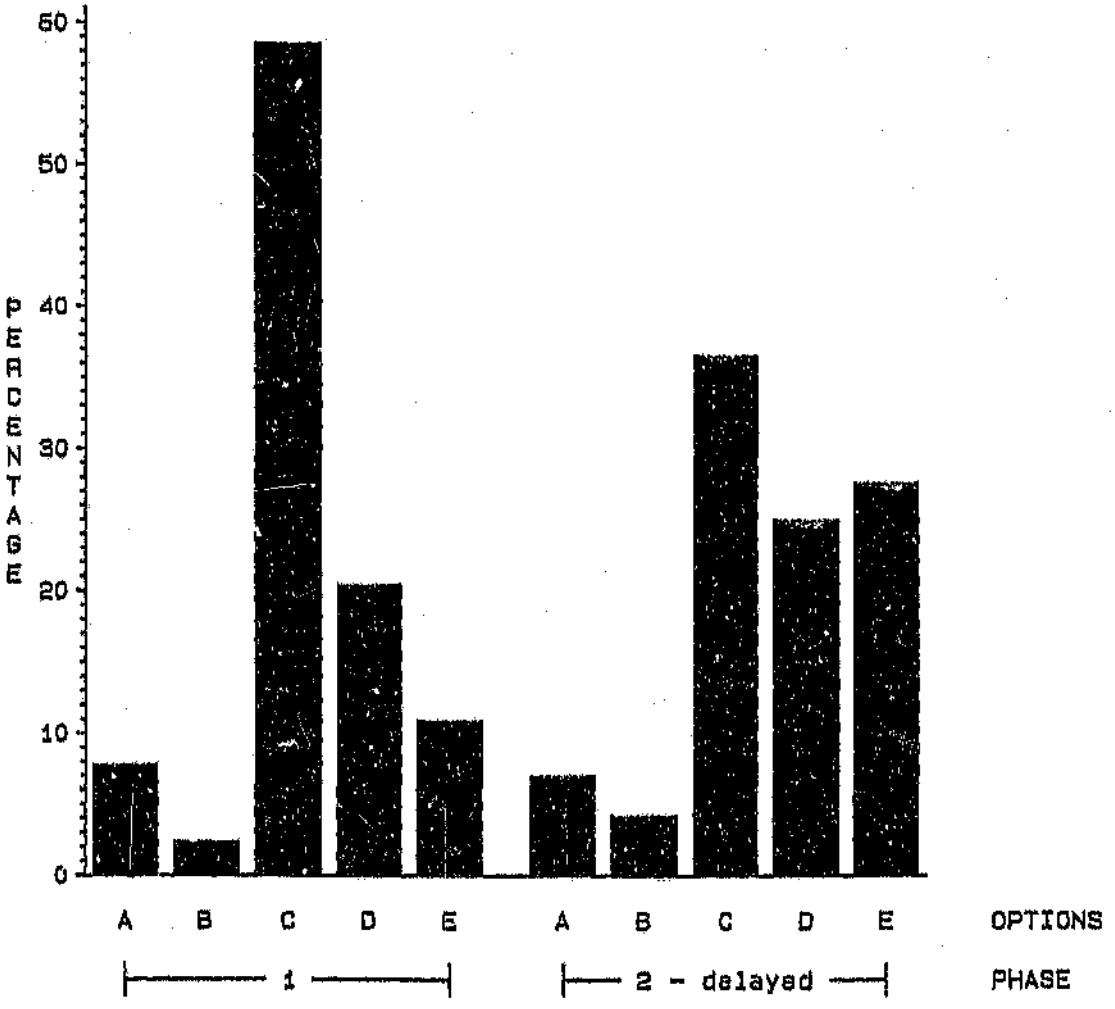
STD 8 QUESTIONNAIRE

QUESTION 4
CORRECT ANSWER IS A



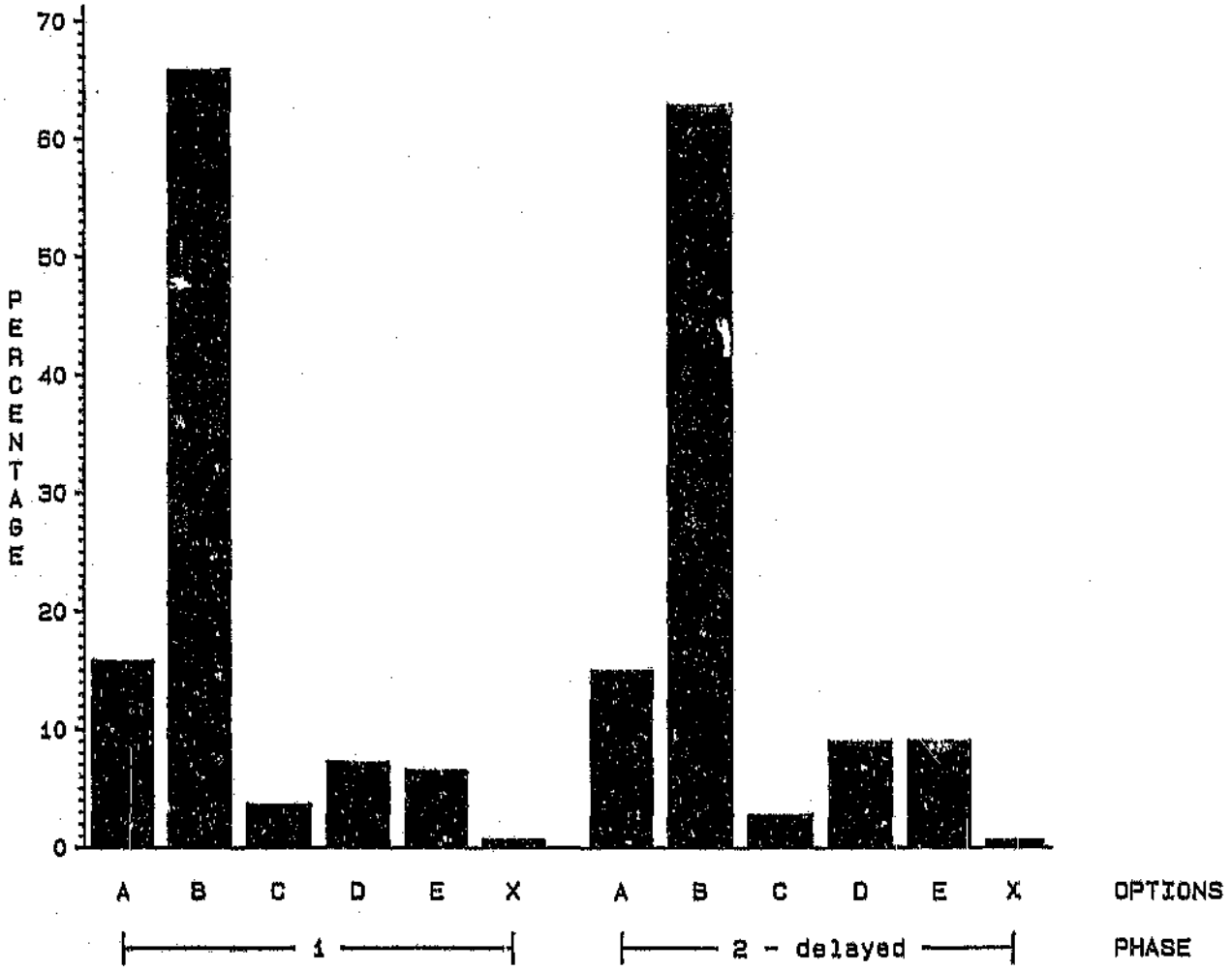
STD 8 QUESTIONNAIRE

QUESTION 3
CORRECT ANSWER IS E



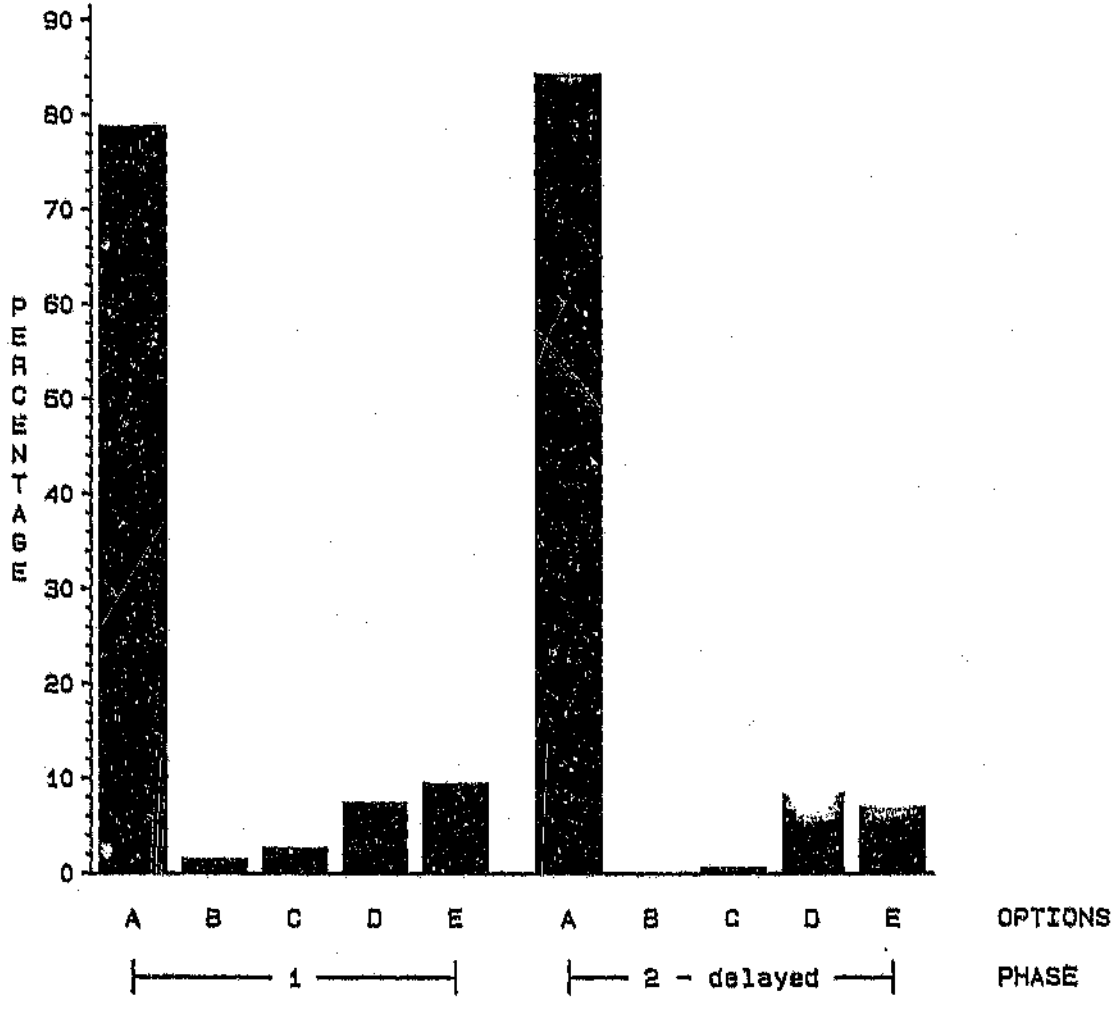
STD 8 QUESTIONNAIRE

QUESTION 2
CORRECT ANSWER IS B



STD 8 QUESTIONNAIRE

QUESTION 1
CORRECT ANSWER IS D



APPENDIX K2

[Phase 1, (N=411) with teaching delayed phase 2, (N=357)]

Students t-test

TTEST PROCEDURE FOR 8 MCQ'S

Variable: TOTAL

PHASE	N	Mean	Std Dev	Std Error
1	411	1.91240876	1.22060233	0.06020787
2	357	2.32773109	1.30325377	0.06897550

Variances	T	DF	Prob>|T|
Unequal	-4.5362	734.8	0.0001
Equal	-4.5572	766.0	0.0000

For H0: Variances are equal, F' = 1.14 DF = (356,410) Prob>F' = 0.1998

Students t-test

TTEST PROCEDURE FOR 8 MCQ'S

Variable: TOTAL

PHASE	N	Mean	Std Dev	Std Error
DEL	357	2.32773109	1.30325377	0.06897550
NOT DEL	138	2.00724638	1.16202929	0.09891850

Variances	T	DF	Prob>|T|
Unequal	-2.6576	277.4	0.0083
Equal	-2.5263	493.0	0.0118

For H0: Variances are equal, F' = 1.26 DF = (356,137) Prob>F' = 0.1182

APPENDIX M2

ALTERNATIVE COMPARISON OF PHASE 2 DELAYED & UNDELAYED GROUPS WITH PHASE 1 GROUP ON THE STANDARD 8 REACTIVITY QUESTIONNAIRE.

[Phase 1, (N=411) with teaching delayed phase 2, N=357): Excluding questions 1,2 & ,6]

Student's t-test

TTEST PROCEDURE

Variable: TOTAL

PHASE	N	Mean	Std Dev	Std Error
1	411	1.16058394	0.88538466	0.04367280
2	357	2.06162465	1.14735193	0.06072430

Variances	T	DF	Prob>|T|
Unequal	-12.0463	665.0	0.0001
Equal	-12.2633	766.0	0.0000

For H0: Variances are equal, F' = 1.68 DF = (356,410) Prob>F' = 0.0000

[Teaching undelayed, phase 1, (N=411) with teaching undelayed phase 2, N=138): Excluding questions 1,2 & ,6]

Student's t-test

TTEST PROCEDURE

Variable: TOTAL

PHASE	N	Mean	Std Dev	Std Error
1	411	1.16058394	0.88538466	0.04367280
2	138	1.60869565	1.03539395	0.08813859

Variances	T	DF	Prob>|T|
Unequal	-4.5556	208.3	0.0001
Equal	-4.9227	547.0	0.0000

For H0: Variances are equal, F' = 1.37 DF = (137,410) Prob>F' = 0.0203

APPENDIX M2

1General Linear Models Procedure

SCHOOL Comparison	Lower Confidence Limit	Difference Between Means	Upper Confidence Limit	
School no.7 - School no.2	-1.2793	-0.6982	-0.1171	***
School no.7 - School no.4	-1.0539	-0.5107	0.0325	
School no.7 - School no.3	-1.0213	-0.4633	0.0947	
School no.7 - School no.5	-0.7994	-0.2037	0.3920	
School no.7 - School no.6	-0.6478	-0.0354	0.5771	
School no.7 - School no.1	-0.4907	0.1306	0.7518	
School no.1 - School no.2	-1.2661	-0.8287	-0.3914	***
School no.1 - School no.4	-1.0268	-0.6413	-0.2557	***
School no.1 - School no.3	-1.0000	-0.5939	-0.1877	***
School no.1 - School no.5	-0.7909	-0.3343	0.1224	
School no.1 - School no.6	-0.6441	-0.1659	0.3123	
School no.1 - School no.7	-0.7518	-0.1306	0.4907	

lGeneral Linear Models Procedure

T tests (LSD) for variable: TOTTWO5

NOTE: This test controls the type I comparisonwise error rate not the experimentwise error rate.

Alpha= 0.05 Confidence= 0.95 df= 488 MSE= 1.241078
Critical Value of T= 1.96484

Comparisons significant at the 0.05 level are indicated by '***'.

SCHOOL Comparison	C	Lower fidence Limit	Difference Between Means	Upper Confidence Limit	
School no.2 - School no.4		-0.1294	0.1875	0.5043	
School no.2 - School no.3		-0.1068	0.2349	0.5765	
School no.2 - School no.5		0.0942	0.4945	0.8948	***
School no.2 - School no.6		0.2381	0.6628	1.0876	***
School no.2 - School no.7		0.1171	0.6992	1.2793	***
School no.2 - School no.1		0.3914	0.8287	1.2661	***
School no.4 - School no.2		-0.5043	-0.1875	0.1294	
School no.4 - School no.3		-0.2247	0.0474	0.3195	
School no.4 - School no.5		-0.0359	0.3070	0.6499	
School no.4 - School no.6		0.1042	0.4754	0.8465	***
School no.4 - School no.7		-0.0325	0.5107	1.0539	
School no.4 - School no.1		0.2557	0.6413	1.0268	***
School no.3 - School no.2		-0.5765	-0.2349	0.1068	
School no.3 - School no.4		-0.3195	-0.0474	0.2247	
School no.3 - School no.5		-0.1064	0.2596	0.6256	
School no.3 - School no.6		0.0354	0.4280	0.8205	***
School no.3 - School no.7		-0.0947	0.4633	1.0213	
School no.3 - School no.1		0.1877	0.5939	1.0000	***
School no.5 - School no.2		-0.8948	-0.4945	-0.0942	***
School no.5 - School no.4		-0.6499	-0.3070	0.0359	
School no.5 - School no.3		-0.6256	-0.2596	0.1064	
School no.5 - School no.6		-0.2762	0.1684	0.6129	
School no.5 - School no.7		-0.3920	0.2037	0.7994	
School no.5 - School no.1		-0.1224	0.3343	0.7909	
School no.6 - School no.2		-1.0876	-0.6628	-0.2381	***
School no.6 - School no.4		-0.8465	-0.4754	-0.1042	***
School no.6 - School no.3		-0.8205	-0.4280	-0.0354	***
School no.6 - School no.5		-0.6129	-0.1684	0.2762	
School no.6 - School no.7		-0.5771	0.0354	0.6478	
School no.6 - School no.1		-0.3123	0.1659	0.6441	

ALTERNATIVE COMPARISON OF ALL SCHOOLS RESULTS -DELAYED & UNDELAYED:

1General Linear Models Procedure
Class Level Information

Class	Levels	Values
SCHOOL	7	School no.5 School no.3 School no.7 School no.4 School no.2 School no.1 School no.6

Number of observations in data set = 495

1General Linear Models Procedure

Dependent Variable: TOTTWO5

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	30.2852190	5.0475365	4.07	0.0005
Error	488	605.6460941	1.2410781		
Corrected Total	494	635.9313131			

R-Square	C.V.	Root MSE	TOTTWO5 Mean
0.047623	57.56245	1.11404	1.93535

Source	DF	Type I SS	Mean Square	F Value	Pr > F
SCHOOL	6	30.2852190	5.0475365	4.07	0.0005

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SCHOOL	6	30.2852190	5.0475365	4.07	0.0005

1General Linear Models Procedure

T tests (LSD) for variable: TOTTWO5

NOTE: This test controls the type I comparisonwise error rate not the experimentwise error rate.

Alpha= 0.05 Confidence= 0.95 df= 353 MSE= 1.306981
Critical Value of T= 1.96671

Comparisons significant at the 0.05 level are indicated by '***'.

SCHOOL Comparison	Lower Confidence Limit	Difference Between Means	Upper Confidence Limit	
School no.2 - School no.4	-0.1380	0.1875	0.5129	
School no.2 - School no.3	-0.1161	0.2349	0.5858	
School no.2 - School no.7	0.1013	0.6982	1.2951	***
School no.4 - School no.2	-0.5129	-0.1875	0.1380	
School no.4 - School no.3	-0.2321	0.0474	0.3269	
School no.4 - School no.7	-0.0472	0.5107	1.0687	
School no.3 - School no.2	-0.5858	-0.2349	0.1161	
School no.3 - School no.4	-0.3269	-0.0474	0.2321	
School no.3 - School no.7	-0.1099	0.4633	1.0365	
School no.7 - School no.2	-1.2951	-0.6982	-0.1013	***
School no.7 - School no.4	-1.0687	-0.5107	0.0472	
School no.7 - School no.3	-1.0365	-0.4633	0.1099	

ALTERNATIVE COMPARISON OF SCHOOLS RESULTS-DELAYED TEACHING ON THE STD. 8 REACTIVITY QUESTIONNAIRE

1General Linear Models Procedure
Class Level Information

Class	Levels	Values
SCHOOL	4	School no.3 School no.7 School no.4 School no.2

Number of observations in data set = 357

1General Linear Models Procedure

Dependent Variable: TOTTWO5

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	7.27989761	2.42663254	1.86	0.1366
Error	353	461.36436010	1.30698119		
Corrected Total	356	468.64425770			

R-Square	C.V.	Root MSE	TOTTWO5 Mean
0.015534	55.45300	1.14323	2.06162

Source	DF	Type I SS	Mean Square	F Value	Pr > F
SCHOOL	3	7.27989761	2.42663254	1.86	0.1366

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SCHOOL	3	7.27989761	2.42663254	1.86	0.1366

ALTERNATIVE COMPARISON OF SCHOOLS RESULTS ON THE STANDARD 8 REACTIVITY QUESTIONNAIRE

[Teaching undelayed (old; n=54 with teaching undelayed (new; n=84):Excluding questions 1,2 & 6]

Student's t-test

TTEST PROCEDURE

Variable: TOTTWO5

TYPE	N	Mean	Std Dev	Std Error
NEW	84	1.51190476	1.03544470	0.11297628
OLD	54	1.75925926	1.02672193	0.13971916

Variances	T	DF	Prob>|T|
Unequal	-1.3766	113.9	0.1713
Equal	-1.3741	136.0	0.1717

For H0: Variances are equal, F' = 1.02 DF = (83,53) Prob>F' = 0.9606

[Teaching delayed(old; n=233) with teaching delayed, (new; n=124): Excluding Questions 1,2 & 6]

Student's t-test

TTEST PROCEDURE

Variable: TOTTWO5

TYPE	N	Mean	Std Dev	Std Error
NEW	124	1.95161290	1.20874079	0.10854813
OLD	233	2.12017167	1.11152891	0.07281868

Variances	T	DF	Prob>|T|
Unequal	-1.2896	233.5	0.1985
Equal	-1.3230	355.0	0.1867

For H0: Variances are equal, F' = 1.18 DF = (123,232) Prob>F' = 0.2774

233 - DELAYED AGAINST 54 - NOT DELAYED: Q8 ANSWER D

Chi-Square test

MCQ28 GROUP

Frequency / Percent / Row Pct / Col Pct	DELAYED	NOT DEL	Total
0	182	44	226
	63.41	15.33	78.75
	80.53	19.47	
	78.11	81.48	
1	51	10	61
	17.77	3.48	21.25
	83.61	16.39	
	21.89	18.52	
Total	233	54	287
	81.18	18.82	100.00

STATISTICS FOR TABLE OF MCQ28 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	0.297	0.585
Likelihood Ratio Chi-Square	1	0.305	0.581
Continuity Adj. Chi-Square	1	0.130	0.718
Mantel-Haenszel Chi-Square	1	0.296	0.586
Fisher's Exact Test (Left)			0.367
(Right)			0.764
(2-Tail)			0.713
Phi Coefficient		-0.032	
Contingency Coefficient		0.032	
Cramer's V		-0.032	

Sample Size = 287

1357 - DELAYED AGAINST 138 - NOT DELAYED: Q8 ANSWER D

Chi-Square test

MCQ28 GROUP

Frequency / Percent / Row Pct / Col Pct	DELAYED	NOT DEL	Total
0	272	96	368
	54.95	19.39	74.34
	73.91	26.09	
	76.19	69.57	
1	85	42	127
	17.17	8.48	25.66
	66.93	33.07	
	23.81	30.43	
Total	357	138	495
	72.12	27.88	100.00

STATISTICS FOR TABLE OF MCQ28 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	2.290	0.130
Likelihood Ratio Chi-Square	1	2.240	0.134
Continuity Adj. Chi-Square	1	1.956	0.162
Mantel-Haenszel Chi-Square	1	2.286	0.131
Fisher's Exact Test (Left)			0.947
(Right)			0.082
(2-Tail)			0.137
Phi Coefficient		0.068	
Contingency Coefficient		0.06[illegible]	
Cramer's V		0.06[illegible]	

Sample Size = 495

233 - DELAYED AGAINST 54 - NOT DELAYED : Q7 CORRECT ANSWER E

Chi-Square test

MCQ27 GROUP

Frequency / Percent / Row Pct / Col Pct	DELAYED	NOT DEL	Total
0	197	44	241
	68.64	15.33	83.97
	81.74	18.26	
	84.55	81.48	
1	36	10	46
	12.54	3.48	16.03
	78.26	21.74	
	15.45	18.52	
Total	233	54	287
	81.18	18.82	100.00

STATISTICS FOR TABLE OF MCQ27 BY GROUP

Statistic	DF	Value	Prob
Chi-Square	1	0.307	0.580
Likelihood Ratio Chi-Square	1	0.297	0.585
Continuity Adj. Chi-Square	1	0.121	0.728
Mantel-Haenszel Chi-Square	1	0.306	0.580
Fisher's Exact Test (Left)			0.780
(Right)			0.355
(2-Tail)			0.544
Phi Coefficient		0.033	
Contingency Coefficient		0.033	
Cramer's V		0.033	

Sample Size = 287

THE EXPERT OR SCIENTIFIC VIEW OF REACTIVITY IN THE PRE-COURSE SITUATIONS 65

HOMEWORK QUESTIONNAIRE 69

6. SESSION 3 -SPONTANEOUS REACTION. 72

ANSWERS TO HOMEWORK QUESTIONS 73

ONE MORE KEY IDEA ABOUT REACTIVITY 77

ACTIVITY CARDS

1. SPONTANEOUS REACTION 78
2. SOME ANCHORING EXAMPLES 80
3. SOME BRIDGING EXAMPLES 82
4. SOME BRIDGING EXAMPLES 83
5. SOME ANCHORING EXAMPLES 84
6. SOME BRIDGING EXAMPLES 85

FORMULATING AN EXPANDED CONCEPTION ABOUT SPONTANEOUS REACTION - MOVING TOWARDS THE SCIENTIFIC VIEW 86

SUMMARY OF IDEAS ABOUT CHEMICAL REACTIVITY DEALT WITH SO FAR-SESSIONS 1,2, & 3 88

HOMEWORK QUESTIONNAIRE 90

7. SESSION 4 93

ANSWERS TO HOMEWORK QUESTIONS 94

SUMMARY OF SESSIONS 1,2,3 AND 4 98

CONTENTS PAGE

1. PRE-COURSE WORK: ELICITING CHILDREN'S VIEWS 23

2. PROCEDURE TO FOLLOW WHEN INTERVIEWING: 25

3. PRE-COURSE WORK 26

CARD 1 - THE REACTION OF METALS WITH WATER 26

CARD 2 - THE REACTION OF METALS WITH OXYGEN 28

CARD 3 - THE REACTION OF METALS WITH AQUEOUS SOLUTIONS OF METAL SALTS 30

CARD 4 - THE REACTION OF HALOGENS WITH AQUEOUS SOLUTIONS OF METAL HALIDES 32

4. SESSION 1 -REACTIVITY 34

PREVIOUS RESEARCH ON PUPIL'S VIEWS ABOUT REACTIVITY 35

IDENTIFYING PUPIL'S VIEWS ABOUT REACTIVITY- PRACTICE EXERCISE 37

PREVIOUS RESEARCH ON SECONDARY TEACHERS VIEWS ABOUT REACTIVITY -RELATED CONCEPTS (RATE AND EQUILIBRIUM) 38

THE CONSTRUCTIVIST MODEL: AN APPROACH TO LEARNING SCIENCE 39

ACTIVITY CARDS

1. THE TARGET PROBLEM 42
2. SOME ANCHORING EXAMPLES 44
3. SOME BRIDGING EXAMPLES 45
4. FORMULATING AN EXPANDED CONCEPTION OF REACTIVITY -MOVING TOWARDS THE SCIENTIFIC VIEW 49

5. SESSION 2- REACTIVITY 50

THE EXPERT OR SCIENTIFIC VIEW ABOUT REACTIVITY 51

ACTIVITY CARDS

1. FIRST APPROACH FOR MEASURING REACTIVITY 52
2. SECOND APPROACH FOR MEASURING REACTIVITY 54
3. THIRD APPROACH FOR MEASURING REACTIVITY 60

SUMMARY: THE EXPERT OR SCIENTIFIC VIEW ABOUT REACTIVITY 64

APPENDIX 02

UNDERSTANDING REACTIVITY

CONTENTS

Introduction to the pack	1
Course leader's guide	2
Pre-course work	23
Session 1	34
Session 2	50
Session 3	72
Session 4	93

APPENDIX O2

Student's t-test

TTEST PROCEDURE

SCHOOL=School no.5

Variable: TOTAL

PHASE	N	Mean	Std Dev	Std Error
1	74	2.70270270	1.10701041	0.12868735
2	54	2.55555556	1.14375526	0.15564538

Variances	T	DF	Prob>|T|
Unequal	0.7286	112.2	0.4678
Equal	0.7324	126.0	0.4653

For H0: Variances are equal, F' = 1.07 DF = (53,73) Prob>F' = 0.7881

SCHOOL=School no.4

Variable: TOTAL

PHASE	N	Mean	Std Dev	Std Error
1	48	0.85416667	0.71427938	0.10309735
2	166	1.66867470	1.10310061	0.08561721

Variances	T	DF	Prob>|T|
Unequal	-6.0778	118.2	0.0001
Equal	-4.8270	212.0	0.0000

For H0: Variances are equal, F' = 2.39 DF = (165,47) Prob>F' = 0.0008

APPENDIX N2

ALTERNATIVE AND ORIGINAL COMPARISON OF THE OVERALL RESULTS OF PHASE 1 GROUP WITH THE PHASE 2 GROUP TEACHING DELAYED AND UNDELAYED GROUPS ON THE STANDARD 8 REACTIVITY QUESTIONNAIRE

[Teaching delayed, (old & new; N=357) with teaching undelayed, (old & new; N=138]

Student's t-test

TTEST PROCEDURE FOR 5 MCQ'S

Variable: TOTTWO5

GROUP	N	Mean	Dev	Std Error
DELAYED	357	2.06162465	1.14735193	0.06072430
NOT DEL	138	1.60869565	1.03539395	0.08813859

Variances	T	DF	Prob>|T|
Unequal	4.2317	274.2	0.0001
Equal	4.0439	493.0	0.0001

For H0: Variances are equal, F' = 1.23 DF = (356,137) Prob>F' = 0.1618

APPENDIX N2

1CHISQ Q8 FOR ANSWER D 411 V 138

TABLE OF PHASE BY Q8

PHASE Q8

Frequency / Percent / Row Pct / Col Pct	0	1	Total
1	230	181	411
	41.89	32.97	74.86
	55.96	44.04	
	70.55	81.17	
2	96	42	138
	17.49	7.65	25.14
	69.57	30.43	
	29.45	18.83	
Total	326	223	549
	59.38	40.62	100.00

STATISTICS FOR TABLE OF PHASE BY Q8

Statistic	DF	Value	Prob
Chi-Square	1	7.927	0.005
Likelihood Ratio Chi-Square	1	8.122	0.004
Continuity Adj. Chi-Square	1	7.373	0.007
Mantel-Haenszel Chi-Square	1	7.913	0.005
Fisher's Exact Test (Left)			3.05E-03
(Right)			0.998
(2-Tail)			5.04E-03
Phi Coefficient		-0.120	
Contingency Coefficient		0.119	
Cramer's V		-0.120	

Effective Sample Size = 549

1CHISQ Q7 WITH CORRECT ANSWER E 411 V 138

TABLE OF PHASE BY Q7

PHASE Q7

Frequency Percent Row Pct Col Pct	0	1	Total
1	373 67.94 90.75 76.12	38 6.92 9.25 64.41	411 74.86
2	117 21.31 84.78 23.88	21 3.83 15.22 35.59	138 25.14
Total	490 89.25	59 10.75	549 100.00

STATISTICS FOR TABLE OF PHASE BY Q7

Statistic	DF	Value	Prob
Chi-Square	1	3.841	0.050
Likelihood Ratio Chi-Square	1	3.592	0.058
Continuity Adj. Chi-Square	1	3.244	0.072
Mantel-Haenszel Chi-Square	1	3.834	0.050
Fisher's Exact Test (Left)			0.980
(Right)			0.039
(2-Tail)			0.057
Phi Coefficient		0.084	
Contingency Coefficient		0.083	
Cramer's V		0.084	

Effective Sample Size = 549

1CHISQ Q8 FOR ANSWER D

TABLE OF PHASE BY Q8

PHASE Q8

Frequency Percent Row Pct Col Pct	0	1	Total
1	230 29.95 55.96 45.82	181 23.57 44.04 68.05	411 53.52
2	272 35.42 76.19 54.18	85 11.07 23.81 31.95	357 46.48
Total	502 65.36	266 34.64	768 100.00

STATISTICS FOR TABLE OF PHASE BY Q8

Statistic	DF	Value	Prob
Chi-Square	1	34.534	0.000
Likelihood Ratio Chi-Square	1	35.159	0.000
Continuity Adj. Chi-Square	1	33.647	0.000
Mantel-Haenszel Chi-Square	1	34.489	0.000
Fisher's Exact Test (Left)			2.46E-09
(Right)			1.000
(2-Tail)			4.07E-09
Phi Coefficient		-0.212	
Contingency Coefficient		0.207	
Cramer's V		-0.212	

Effective Sample Size = 768

1CHISQ Q7 WITH CORRECT ANSWER E

TABLE OF PHASE BY Q7

PHASE Q7

Frequency Percent Row Pct Col Pct	0	1	Total
1	373 48.57 90.75 57.12	38 4.95 9.25 33.04	411 53.52
2	280 36.46 78.43 42.88	77 10.03 21.57 66.96	357 46.48
Total	653 85.03	115 14.97	768 100.00

STATISTICS FOR TABLE OF PHASE BY Q7

Statistic	DF	Value	Prob
Chi-Square	1	22.787	0.000
Likelihood Ratio Chi-Square	1	22.982	0.000
Continuity Adj. Chi-Square	1	21.829	0.000
Mantel-Haenszel Chi-Square	1	22.757	0.000
Fisher's Exact Test (Left)			1.000
(Right)			1.37E-06
(2-Tail)			2.40E-06
Phi Coefficient		0.172	
Contingency Coefficient		0.170	
Cramer's V		0.172	

Effective Sample Size = 768

Student's t-test

SCHOOL=School no.2
****

Variable: TOTAL

PHASE	N	Mean	Std Dev	Std Error
1	115	0.90434783	0.79443142	0.07408111
2	67	1.80597015	1.20904177	0.14770796

Variances	T	DF	Prob>|T|
Unequal	-5.4567	7	0.0001
Equal	-6.0647	180.0	0.0000

For H0: Variances are equal, F' = 2.32 DF = (66,114) Prob>F' = 0.0000

RUNNING THE ACTIVITY-SESSION 3

Have Session 2 handouts (9-19) ready to distribute.

Put out all the equipment and chemical solutions for the activity cards on spontaneous reactions.

14. Give out handout (9) and ask the teachers to check the answers against their own and those of any other adults who tried the questionnaire.

Ask the teachers:
(1) to identify in handout (9) any of the features of
(2) the children's or teachers' views they were introduced to in session 2.- reactivity considered animistically
(3) to discuss any correct scientific statements from handout (9) which give them particular conceptual difficulties or which they find difficult to accept.



15. Give out handouts (10-16):
Ask the teachers to read through handouts (10-11)

Ask teachers to complete the activities in handout (12) pertaining to spontaneous processes. Discuss outcome.

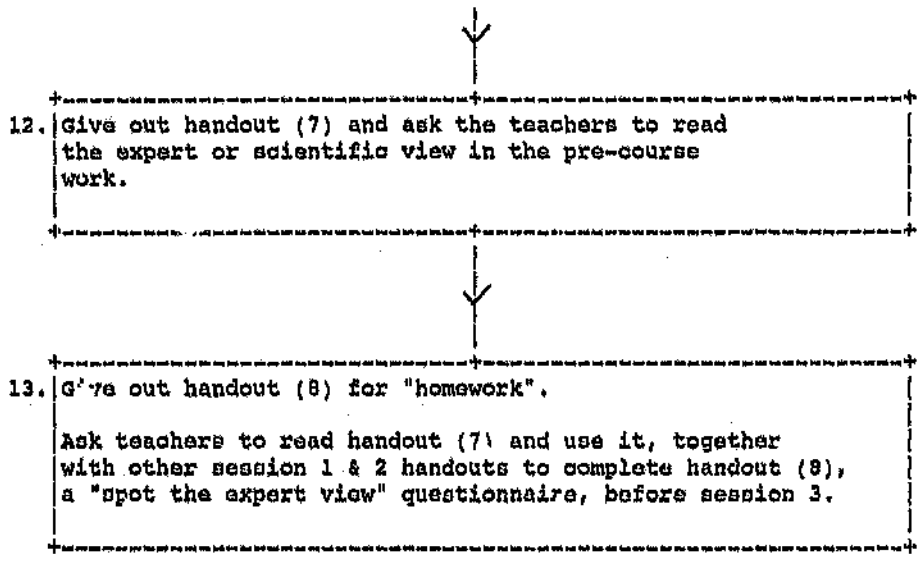
Ask teachers to complete the experiments on handouts (13-14) about endothermic and exothermic reactions are spontaneous and answer the questions that follow.



16. Complete and discuss the contents of handout (15) where the use of analogies indicate that rate is not an indicator of a spontaneous reaction.

Discuss the contents of handout (16) and compare this handout to handout (15)




12. Give out handout (7) and ask the teachers to read the expert or scientific view in the pre-course work.
13. Give out handout (8) for "homework".
Ask teachers to read handout (7) and use it, together with other session 1 & 2 handouts to complete handout (8), a "spot the expert view" questionnaire, before session 3.

RUNNING THE ACTIVITY-SESSION 2

Have Session 2 handouts (5-8) ready to distribute.

Put out all the equipment and chemical solutions for the activity cards on reactivity.

7. Give out handout (5a-5d)

   Ask teachers to read through handout (5a)

8. Ask them to perform the task on handout (5b)-First approach for measuring reactivity - reaction rate measurements.

   Discuss the outcome.

9. Ask them to perform the task on handout (5c)-Second approach for measuring reactivity - enthalpy measurements.

   Discuss the outcome.

10. Ask them to perform the task on handout (5d) -Third approach for measuring reactivity - voltage measurements.

    Discuss the outcome.

11. Give out handout (6)

    Briefly summarise the session-handout (6)

4. Give out handout (2)

Discuss how the view of SSTS compare with those of children

(this raises directly the question of course members' own understanding - if alarm is expressed reassure them that they are not alone)

↓

5. Give out handout (3)

Briefly go through it, emphasizing the four stages shown in the illustration:

1. elicitation
2. awareness and dissatisfaction
3. generation
4. understanding.

↓

6. Give out handout (4a-4d)
Ask teachers to read through 4a and to try some of the tasks in 4b and 4c and discuss the case made in 4d for reactivity, where different instruments are used to measure different outcomes.

RUNNING THE ACTIVITY-SESSION 1

Have Session 1 handouts (1-4) ready to distribute.

Procedure:

1. Briefly map out the course (use the course summary);

   Stress that the course is chiefly concerned with teachers'own understanding, rather than that of children.

↓

2. Give out handout (1)- go through it, stressing the features of children's views which are listed:

   Reactive metals have "zest"
   A metal is reactive it reacts with vigour.

   Discuss whether the examples given do illustrate each feature

   [Teachers may do the optional exercise here - follow the procedure in 3. below using the examples of childrens responses on handout 1a]

↓

3. Get the teachers to:

   (1) Identify features of children's views described in handout (1) which they can see in thei' own childrens responses written down on the reverse side of each interview card.

   (2)Copy an example of each feature- write the childs actual words onto a separate slip of paper or cut them from the interview card.

   (3)Collect examples of each particular feature from each course member and display them so that numerous examples of each feature are seen by the whole course.

THE ACTIVITY CARDS

Session 1	Activity card 1:	Reactivity - The target problem
	Activity card 2:	Reactivity - Some anchoring examples
	Activity card 3:	Reactivity - Some bridging examples
	Activity card 4:	Reactivity - Formulating an expanded conception - moving towards the scientific view.
Session 2	Activity card 1:	First approach for measuring reactivity - moving towards the scientific view.
	Activity card 2:	Second approach for measuring reactivity - moving towards the scientific view.
	Activity card 3:	Third approach for measuring reactivity - moving towards the scientific view.
Session 3	Activity card 1:	Spontaneous reaction-The target problem
	Activity card 2:	Spontaneous reaction-Some anchoring examples
	Activity card 3:	Spontaneous reaction-A bridging example
	Activity card 4:	Spontaneous reaction-A bridging example
	Activity card 5:	Spontaneous reaction-Some anchoring examples
	Activity card 6:	Spontaneous reaction-Some bridging examples

Group activity and discussion:	Handout (11-16):
	Activity card 1- Target problem Activity card 2- Some anchoring examples. Activity card 3- Some bridging examples Activity card 4- Some bridging examples. Activity card 5- Some anchoring examples Activity card 6- Some bridging examples.
	Handout (17): Formulating an expanded conception about spontaneous reaction- moving towards the scientific view.
	Handout (18):Summary of ideas dealt with in the course so far.
Homework' tasks	
Activity:	Handout (19): "Spot the expert view" questionnaire.
SESSION 4	Answers to homework questionnaire of session 3. Summary of key concepts of session 1,2 and 3.
Discussion	Handout (20): Answers to session 3 questionnaire. Handout (21): Summary about the ideas dealt with in session 1,2 & 3

SESSION 2	Various experimental approaches to measure reactivity. Expert view about reactivity in the pre-course work. "Spot the expert view" questionnaire.
Group activity and discussion:	Handout(5a-5d): Activity card 1-the expert or scientific view about reactivity Activity card 2-First approach for measuring reactivity Activity card 3-Second approach for measuring reactivity Activity card 4-Third approach for measuring reactivity Handout (6): Summary of ideas dealt with about reactivity in session 2.
Homework tasks	
Reading:	Handout (7): Expert view about reactivity in the pre-course work situations.
Activity:	Handout (8): "Spot the expert view" questionnaire
SESSION 3	More key scientific ideas about reactivity: Spontaneous reaction: Spontaneous exothermic reaction. Spontaneous endothermic reaction. Formulating an expanded conception about spontaneous reaction.
Discussion:	Handout (9): Answers to the session 2 questionnaire
Discussion:	Handout (10): One more key idea about reactivity-spontaneous reaction

SUMMARY OF THE COURSE WORK

PRE-COURSE WORK	Course members' own personal views about reactivity and related concepts Eliciting children's views
Activity:	Teachers considering their own personal views about reactivity
Classroom based enquiry:	Gaining an insight into childrens view about reactivity
SESSION 1	Children's views about reactivity Secondary teachers views about reactivity and related concepts A constructivist model for learning science Key aspects of the scientific or "expert" view: 1. Reactivity
Discussion:	Handout (1): Pupil's ideas about reactivity -research evidence
Group activity and discussion:	Handout (1a): Identifying features about your pupil's views about reactivity (optional practice exercise).
Discussion:	Handout (2): What is known about secondary teachers ideas about reactivity and related concepts: evidence from Wits research team.
Discussion:	Handout (3): An approach to learning science - the constructivist model
Group activity and discussion:	Handout(4a-4d): Activity card 1-Target problem Activity card 2-Anchoring examples Activity card 3-Bridging examples Activity card 4-Formulating an expanded conception about reactivity-moving towards the scientific view..

OUTLINE PLAN OF THE COURSE

PRE-COURSE WORK

Course members' own personal views about reactivity and related concepts
Eliciting children's views

SESSION 1

Pupil's views about reactivity

Secondary teachers' views about reactivity and related concepts

A constructivist knowledge for learning science.

Key aspects of the scientific or "expert" view:
1. Reactivity

SESSION 2

Key aspects of the scientific or "expert" view:

1. Reactivity (continuation)

SESSION 3

More key scientific ideas about reactivity:

1. Spontaneous reactions.

SESSION 4

Answers to homework questionnaire on spontaneous reaction.

Summary of session 1,2 and 3

UNDERSTANDING

REACTIVITY

Course leader's guide

Secondary School Teachers and Science (SSTS) project

INTRODUCTION TO THE PACK

The material in this pack has been designed to help [illegible]dary teachers develop their knowledge and understanding [illegible]tivity. It deals with chemical concepts found in the standard [illegible]al science syllabus.

The material is flexible and can be used:

- for school based INSET in one school
- by staff of a cluster of schools or interested individual teachers from a number of schools.
- for in-service work in teacher training institutions
- for initial teacher training, where it is particularly helpful in that it involves work with children as well as institution based sessions.

It is different from other material in that it starts from ideas about reactivity that secondary school teachers already have and builds on them.

Four sessions are required.

The pack highlights certain aspects of the scientific view of reactivity which are known from research to provide particular conceptual difficulties. Course participants are introduced to the misconceptions which pupils and many secondary teachers have and become aware of the nature of their own intuitive view about chemical reactivity. They are presented with the scientific interpretation of reactivity and perform a series of activities designed to persuade them of its validity. The emphasis throughout the course is on the personal construction of knowledge by each teacher at a level that is appropriate for that individual.

CONDUCTING YOUR ENQUIRY:

First arrange and test your tape recording equipment. Make sure that the pupils are sitting close enough to the recording equipment for their comments to be picked up clearly.

You should commence by explaining to the pupils that you are interested in the meanings they have for the word "reactivity" Explain to the pupils that you will be demonstrating four experiments. Then you will be asking them some questions about reactivity in each of the situations shown.

Stress that its not a test, there are no right or wrong answers, you are just interested in what pupils think.

PRE-COURSE WORK: ELICITING CHILDREN'S VIEWS

Children are not empty vessels - they have been shown to have a whole range of ideas about the world which may be firmly held and which can differ from those of scientists. Examples of such children's science are:

A metal is reactive only if it reacts with "zest". (15 yr old)

A metal is reactive if does not take it's own sweet time to react. (15 yr old)

A spontaneous reaction is one that takes place immediately and without delay. (15 yr old)

As an introduction to this course, in order to provide you with an insight into the ideas about reactivity and the meanings for the word "reactivity " and related concepts which children possess, you are asked to perform a small classroom based enquiry in which you interview a group of 5 or 6 boys and girls from your class.

You are requested to make a written record of the pupil's responses to the situations on the cards provided (in our experience the use of a tape recorder is advisable), using the space provided on the reverse side of each card. Write down quotes (i.e. actual words pupils used) which you think are representative and particularly interesting. Bring them (plus any other evidence, tapes, document, drawings etc.) to the first SSTS session where they will be collated and displayed with those of your colleagues for discussion.

The course will then be going on to also explore the views which adults (such as s ondary school teachers and scientists) have about reactivity and related concepts since these relate to the demands made of secondary teachers by the matric physical science syllabus.

Before starting with the pupils you are requested to consider your own personal view about reactivity in the situations on the cards which you will be presenting to them. Write your ideas on the reverse of each card. Please write your own individual view, not that of your spouse or colleagues or an explanation from a book.

The purpose of the exercise will become apparent towards the end of session 1 where the model for the learning of science upon which this course is based will be presented and discussed. It will be seen from this model that a pre-requisite for learning the ideas of science is an awareness of ones existing ideas prior to instruction.

SESSION 4

Aims of session 3

1. To discuss the scientific explanations of a spontaneous reaction in the instances presented in session 3 of the homework questionnaire.

2. To relate statements in session 3 homework questionnaire to the features of children's and teachers' views discussed in session 3

3. To summarize the salient aspects of reactivity-related concepts of session 1,2,and 3.

Resources provided by the course leader for the group.

Handouts: (20-21)

(20) Answers to homework questionnaire.
(21) Summary of session 1,2 and 3.

Timing:

1. Answers to session 3 homework questionnaire: 25 mins
2. summarising ideas dealt with in the course: 5 mins.

TOTAL TIME: 30 mins.

Handouts: (9-19)

(9) Answers to session 2 homewrk questionnaire.
(10) One more key idea about reactivity: Spontaneous reaction.
(11-16) Activity cards (1-6)
(17) Formulating an expanded conception about spontaneous reaction-moving towards a scientific view.
(18) Summary of ideas dealt with in the course so far.
(19) Homework questionnaire.

Homework task. Session 3 "spot the expert" view homework questionnaire

Timing:

Answers to session 2 homework questionnaire:	15 mins
Activities about energy changes in spontaneous processes:	20 mins
Experiment: Spontaneous exothermic reactions:	20 mins
Experiment: Spontaneous endothermic reactions:	20 mins
Analogy of spontaneous process in mechanical systems:	10 mins
Recognising spontaneous/non spontaneous reactions:	10 mins
summarising ideas dealt with in the course:	10 mins.

TOTAL TIME: 1hr and 45 mins.

SESSION 3

Aims of session 3

1. To discuss the scientific explanations of reactivity in the instances presented in session 2 of the homework questionnaire.

2. To relate statements in session 2 homework questionnaire to the features of children's and teachers' views discussed in session 2

3. To introduce further aspect of reactivity-related concept:

   a. an endothermic reaction can be a spontaneous reaction
   b. an exothermic reaction can be a spontaneous reaction
   c. time is not a criterion for a spontaneous reaction.

Resources provided by the course leader for the group.

Work cards: Activity cards (1-6).

The activity cards are sequenced in the following way:

1. Spontaneous reaction-The target problem.
2. Spontaneous reaction-Some anchoring examples.
3. Spontaneous exothermic reactions-moving towards the scientific view.
4. Spontaneous endothermic reactions-moving towards the scientific view.
5. Spontaneous reactions-Some anchoring examples.
6. Spontaneous reactions-Some bridging examples.

Equipment list: Equipment associated with the follwing activity cards:

Activity 3: a. 1g potassium permanganate
b. 1cm^3 glycerol
c. asbestos mat or tile

Activity 4: a. 32g barium hydroxide [$Ba(OH)_2.8H_2O$]
b. 17g ammonium nitrate
c. 250 cm^3 conical flask
d. Thermometer that allows measurement of temperature less than 0^{o}C
e. small block of wood.
f. glass stirring rod.

Activity 3: a. Fresh potato
b. Voltmeter
c. Metal strips-copper, zinc, magnesium and lead.
d. Electrical leads and crocodile clips.

Handouts: (5-8)

(5a) The expert scientific view about reactivity.
(5b-5d) Activity cards 1-3.
(6) Summary: The expert or scientific view about reactivity.
(7) The expert or scientific view about reactivity in the pre-course work.
(8) Homework questionnaire.

Homework tasks: a. The expert scientific view about reactivity - session 2 summary
b. The expert or scientific view of reactivity in the pre-course work
c. "Spot the expert view" questionnaire

Timing:

Secondary teachers' views about reactivity:	10 mins
First approach for measuring reactivity:	25 mins
Second approach for measuring reactivity:	30 mins
Third approach for measuring reactivity:	25 mins
Summary of session:	10 mins
Discussion of pre-course situations:	15 mins

TOTAL: 1 hr and 55 mins.

SESSION 2

Aims of session 2

1. To expand teachers conceptions of reactivity towards the "expert" or scientific view that:

   (a) different approaches can be used to measure reactivity
   (b) a "fair test" for measuring reactivity should be used.

2. To explain the pre-course situations in terms of this expanded view.

3. To ask teachers to distinguish between scientific and everyday usage of the term "reactivity" and to make judgments about the correct scientific use of the word in various situations.

Resources provided by the course leader for the group.

Work cards: Activity cards (1-3)

The activity cards are sequenced in the following way:

1. First approach for measuring reactivity - Moving towards a scientific view.
2. Second approach for measuring reactivity - Moving towards a scientific view.
3. Third approach for measuring reactivity - Moving towards a scientific view.

Equipment list: Equipment associated with each activity.

Activity 1: a. Stopwatch
b. Calcium granules an calcium powder
c. 250 cm^3 beaker
d. Test tube
e. Glass funnel

Activity 2: a. Polystyrene cup
b. Thermometer - range 0^0C to 50^0C
c. 2g zinc powder
d. test-tube
e. 100 cm^3 of 0.2M copper sulphate solution.

Timing:

Mapping out course:	5 mins
Children views:	25 mins
Collating own children's views:	20 mins.
Teachers' views:	20 mins.
A constructivist model for learning science:	10 mins.
Activity cards (4a-d)	25 mins

TOTAL : 1hr and 45 mins.

SESSION 1

Aims of session 1

1. To map out the course for participants(see course summary).
2. To introduce teachers to what is known from research about pupil's ideas about reactivity and related concepts, mainly when dealing with chemical reactions.
3. To enable teachers to identify features in their pupil's responses which are known from research, to be commonly held by most other pupils.
4. To become aware of features present in views of children interviewed by other course members.
5. To cause teachers to contrast their own views with those of children and to begin to evaluate their own understanding.
6. To enable teachers to compare their own views about reactivity with those known from, research to be held by other secondary school teachers.
7. To introduce teachers to the constructivist model for the learning of science.

Resources provided by the course leader for the group.

Work cards: Activity cards (1-4)

The activity cards are sequenced in the following way:

1. Reactivity - The target problem.
2. Reactivity - Some anchoring examples.
3. Reactivity - Some bridging examples.
4. Reactivity - Formulating an expanded conception-moving towards the scientific view.

Handouts: (1-4)

(1) Pupils ideas about reactivity- research evidence.
(2) Secondary teachers'ideas about reactivity and related concepts.
(3) An approach to learning science- the constructivist model.
(4a-d) Activity cards (1- 4)

PRE-COURSE WORK

Aims of the session

1. To elicit the teachers' own views about reactivity and related concepts.
2. To elicit pupil's views about reactivity

Resources to be provided by course leader for the group.

Instruction sheet for conducting an enquiry into children's views

Interview card 1 to 4

Number of participants

1 teacher and 4 children

Running the activity

Preparation: Have one set of course materials to give to each teacher.

Procedure: Distribute the folders.

Point out to the teachers that full instructions are given(page ?) concerning:

(a) The conditions under which *teachers themselves* are to respond to the instances (i.e. provide *their own views* about the role of reactivity-related concepts in the situations shown on the cards.)
(b) Practical arrangements for conducting the enquiry with children.
(c) Procedure to follow when interviewing.

Experience has shown the use of a voice operated tape recorder is advisable.

The importance of teachers making a *written* record of their own and children's views on the reverse of each interview card should be pointed out(it will be instructive for them to return to these initial views and evaluate any development that has taken place in their understanding later in the course.

Timing

Distributing folders and discussing their contents:	10 mins.
Teachers writing own views:	20 mins.
Conducting interviews with pupils :	45 mins - 1 hr

TOTAL : 1hr and 30 mins.

RUNNING THE ACTIVITY-SESSION 4

Have Session 2 handouts (20-21) ready to distribute.

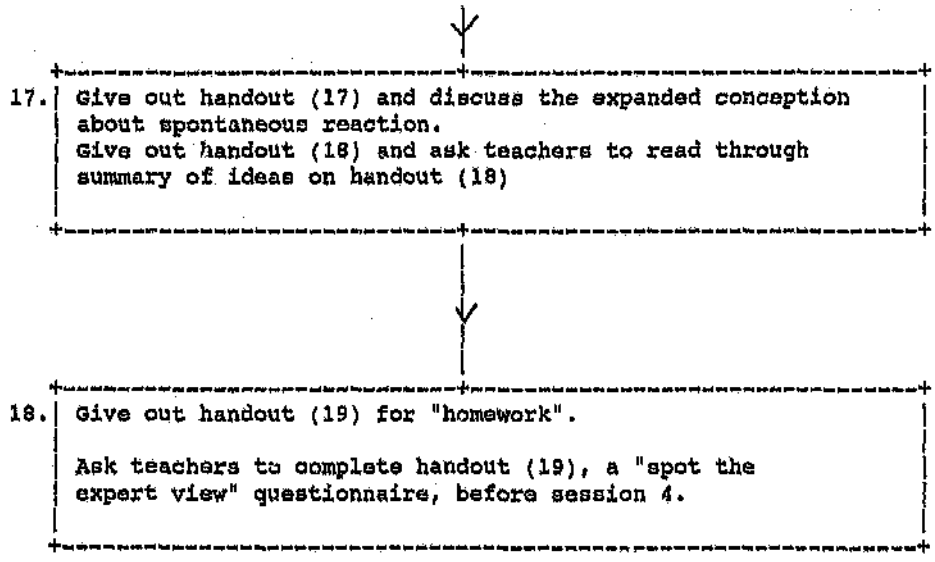
19. Give out handout (20) and ask the teachers to check the answers against their own and those of any other adults who tried the questionnaire.

Discuss any correct scientific statements from handout (20) which give them particular conceptual difficulties or which they find difficult to accept.



20. Give out handout (21)

Briefly summarise the session-Handout (21).


17.
Give out handout (17) and discuss the expanded conception about spontaneous reaction.
Give out handout (18) and ask teachers to read through summary of ideas on handout (18)
18.
Give out handout (19) for "homework".
Ask teachers to complete handout (19), a "spot the expert view" questionnaire, before session 4.

5. Reactivity series is invariant.(Order of elements does not change)

   Some pupils see the order of the elements in a reactivity series as invariant irrespective of the type of substance the elements react with.

   " The order of the elements in the reactivity series does not change"

The notions illustrated above are known, from research, to be characteristic of pupil's views about reactivity. They are provided here as a guide to enable you to identify the kind of responses, your pupils may make when discussing the situations presented to them.

To summarise they are:

1. Methods used to measure reactivity unclear
2. Reactivity is considered anthropomorphically
3. Reactivity series - A circular description
4. A spontaneous reaction linked to rate
5. Reactivity series is invariant (Order of the elements never changes)
6. Other views

In handout 1(a) that follows, you will be requested to identify features such as those above in the views of children which you obtained in the pre-course work. You should do this in groups so that you can compare the views obtained by colleagues with those you collected.

REACTIVITY - SESSION 1 - Handout (1)

PREVIOUS RESEARCH ON PUPIL'S VIEWS ABOUT REACTIVITY

The information pupils use to construct their concepts comes from different sources: public knowledge as presented in texts and lectures; and informal prior knowledge from everyday experience, parents, peers, commercial products and the common meanings of scientific terms. Thus pupils have already developed a range of ideas sometimes called children's science which are often stubbornly held and resistant to change and may adversely affect children's efforts to understand the orthodox scientific view.

Recent research studies have investigated pupil's views about the concept reactivity and related concepts. Some findings from these studies are shown below. The quotations are std 8 pupil's remarks made during an interview session after the pupils had completed the experimental work on reactivity. Certain features of their notions about reactivity became clear from their interview responses:

1. Methods used to measure reactivity unclear.

   Many pupils did not know what the experimental basis for measuring reactivity was. Some quotations to illustrate the above are given:

   " The brightness of the flame and the vigour of the reaction gives the reactivity"
   " The readiness of the reaction indicates the reactivity"

2. Reactivity is considered anthropomorphically (Description uses human characteristics).

   Many children had a human centered view of reactivity.

   "A metal is reactive if it reacts with zest".
   "A metal is reactive if it reacts with vigour".
   "A metal is reacti e if the reaction is powerful"

3. Reactivity series - A circular description

   Many pupils description of a reactivity series was simply a series reflecting how reactive a metal is without understanding what the term reactivity meant.

   " A reactivity series is a series arranged from highest reactivity to lowest reactivity..err.. from the strongest to the weakest.

4. A spontaneous reaction linked to rate:

   " A spontaneous reaction is a fast reaction",
   " A spontaneous reaction takes place without delay"
   " A spontaneous reaction does not require a catalyst"

UNDERSTANDING

CHEMICAL REACTIVITY

SESSION 1

Handout 1	Previous research about pupil's views about reactivity.
Handout 1a	Identifying pupil's views about reactivity-practice exercise.
Handout 2	Previous research of secondary teachers' views about reactivity-related concepts (rate and equilibrium).
Handout 3	The constructivist model: an approach to learning science.
Handout 4a	Activity card 1- Reactivity
Handout 4b	Activity card 2- Reactivity
Handout 4c	Activity card 3- Reactivity
Handout 4d	Activity card 4- Formulating an expanded conception of reactivity-moving towards the scientific view.

CARD 4 - THE REACTION OF HALOGENS WITH AQUEOUS SOLUTIONS OF METAL HALIDES.

1 - teacher's view

(to be completed before interviewing pupils)

2 - pupil(s) views

CARD 4 - THE REACTION OF HALOGENS WITH AQUEOUS SOLUTIONS OF METAL HALIDES.

Explanation:

"I am going to be demonstrating the reaction of halogens named on your card with excess dilute aqueous solutions of metal halides.

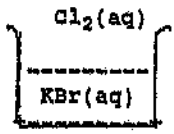
Indicate with a tick if a reaction takes place; I want you to tell me about reactivity and jot down your observations in the space provided."

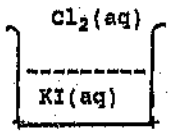
The teacher inserts indicated quantities of the halogens tabulated below into three sets of metal halides solutions of approximately molar concentrations as shown in the diagram.

Halogens	KCl(aq)	KBr(aq)	KI(aq)
5 cm^3- chlorine water			
5 cm^3- Bromine water			
5 cm^3- Iodine water			

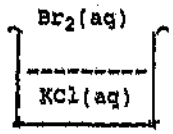
Experiment:

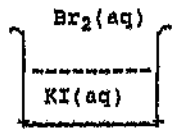
Set 1



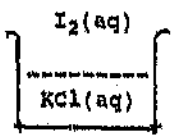


Set 2





Set 3





Focus questions:

1. "Give the order of increasing reactivity of the halogens with solutions of metal halides."
2. "How did you arrive at your choice?"
3. "Is there any visible reaction of iodine with potassium chloride solution? Is there any way of telling?"

Remember: Make a written record of children's typical, interesting or unusual responses (quoting children's actual words).

CARD 3 - THE REACTION OF METALS WITH AQUEOUS SOLUTIONS OF METAL SALTS.

1 - teacher's view

(to be completed before interviewing pupils)

2 - pupil(s) views

CARD 3 - THE REACTION OF METALS WITH AQUEOUS SOLUTIONS OF METAL SALTS.

Explanation:

"I am going to be demonstrating the reaction of the metals named on your card with aqueous solutions of metal salts of equal concentrations.

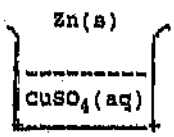
Indicate with a tick if a reaction takes place; I want you to tell me about reactivity and jot down your observations in the space provided."

The teacher inserts indicated quantities of the elements tabulated below into three sets of aqueous solution of metal salts of approximately molar concentrations as shown in the diagram.

Element	Quantity	Copper sulphate	Zinc Sulphate	Ferrous Sulphate
Zinc	1 cm square pieces foil			
Iron	3 cm iron wire or nail			
Copper	1 cm square pieces foil			

Experiment:

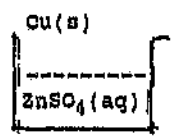
Set 1



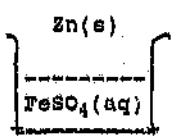


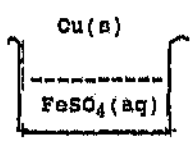
Set 2





Set 3





Focus questions:

1. "Which is the most reactive metal?"
2. "Give the order of increasing reactivity of metals with solutions of metal salts."
3. "How did you arrive at your choice?"
4. "Is there any visible reaction of copper with iron sulphate solution? Is there any way of telling?"

Remember: Make a written record of children's typical, interesting or unusual responses (quoting children's actual words).

CARD 2 - THE REACTION OF METALS WITH OXYGEN

1 - teacher's view

(to be completed before interviewing pupils)

2 - pupil(s) views

CARD 2 - THE REACTION OF METALS WITH OXYGEN

Explanation:

"I am going to be demonstrating the reaction of the metals named on your card with oxygen. I want you to tell me about reactivity and jot down your observations in the space provided."

The teacher demonstrates by successively heating indicated quantities of the elements in a deflagarating spoon and then inserting it into a gas jar already full of oxygen as shown in the diagram.

Element	Quantity and state	Observation
Sodium	2mm cube	
Magnesium	10 cm ribbon	
Potassium	2mm cube	
Calcium	1cm long turning	



Focus questions:

1. "Which is the most reactive metal?"
2. "Which is the least reactive metal?"
3. "Give the order of the metals in terms of increasing reactivity with *oxygen*".
4. "How did you arrive at the order in (3)?"

Remember: Make a written record of children's typical, interesting or unusual responses (quoting children's actual words).

CARD 1 – THE REACTION OF METALS WITH WATER

1 – teacher's view

(to be completed before interviewing pupils)

2 – pupil(s) views

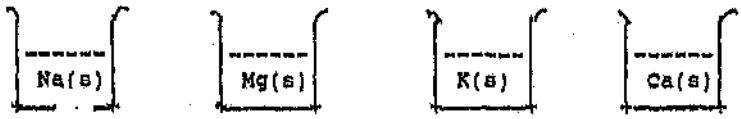
CARD 1 - THE REACTION OF METALS WITH WATER

Explanation:

"I am going to be demonstrating the reaction of the metals named on your card with water. I want you to tell me about reactivity and jot down your observations in the space provided."

The teacher demonstrates by inserting successively indicated quantities of the metals tabulated below in water as shown in the diagram

Element	Quantity and state	Observation
Sodium	2mm cube	
Magnesium	10 cm ribbon	
Potassium	2mm cube	
Calcium	1cm long turning	



Focus questions:

1. "Which is the most reactive metal?"
2. "Which is the least reactive metal?"
3. "Give the order of the metals in terms of increasing reactivity with water."
4. "How did you arrive at the order in (3)?"

Remember: Make a written record of children's typical, interesting or unusual responses (quoting childrens actual words).

PROCEDURE TO FOLLOW WHEN INTERVIEWING:
(Remember to switch on the tape recorder!)

Example: Card 1-The reaction of metals with water

Show the pupils card 1 and tell them what you want them to do:

"I am going to be demonstrating the reaction of the metals appearing on your card with water. I want you to tell me about reactivity and jot down your observations."

Ask the focus questions:
1. "Which is the most reactive metal?"
2. "Which is the least reactive metal?"
3. "Give the order of the metals in terms of increasing reactivity with *water*."
4. "How did you arrive at the order in (3)?"

You must be patient and allow the pupils time to answer after putting each question to them. If pupils are very doubtful give encouragement by repeating or rephrasing the question, and emphasizing again your interest in their understanding of reactivity.

Responses for each focus question can be probed further by asking:

That's interesting -why do you say that?
or by asking any other question (neutral, not leading; penetrating, not superficial) you think necessary to clarify in your own mind the nature of the pupil's views.
Do not be judgmental. Resist the urge to teach the pupils. Try to eliminate bias inherent in your tone of voice, gesture or facial expression and try to strike a balance between friendliness and objectivity.

Ensure that all views of pupils have been obtained by asking:

5. *"Anything else you would like to say about reactivity related to the experiment?"*

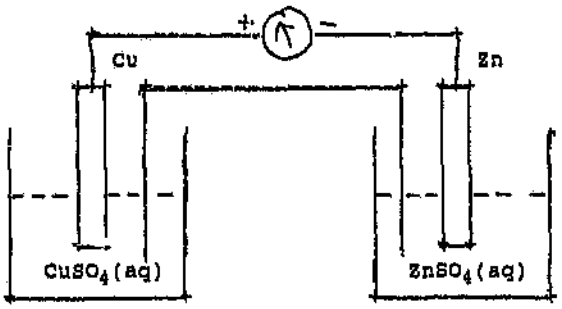
Later make a written record of the pupil's responses (on the reverse of the card) picking out views which are typical and those that seem particularly interesting.

(Note: all pupils do not have to answer all the questions but encourage as many as possible to respond in each case).
Repeat this procedure with each of the remaining cards; use the recommended initial focus questions shown on each card about the understanding of reactivity in the different experiments.
Ask any further questions that you think are necessary in order to make clear the nature of the pupil's views.

<u>Remember to make a written record (quoting the pupils words) of pupil's views which are representative and of any which are particularly interesting or unusual, on the reverse side of each card.</u>

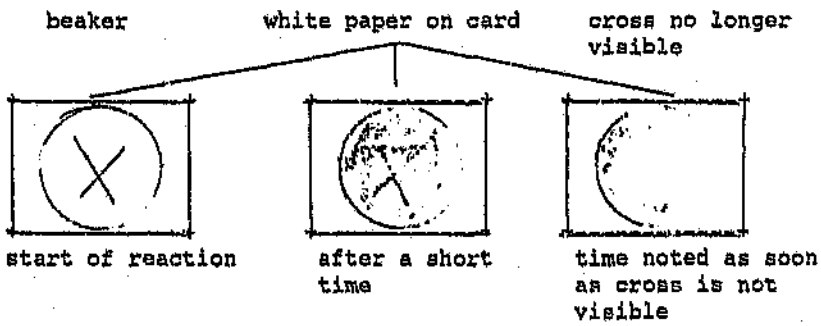
(e) Cell voltage.

Reaction $Zn(s) + CuSO_4(aq) \longrightarrow ZnSO_4(aq) + Cu(s)$



(f) The reaction of dilute hydrochloric acid and sodium thiosulphate produces a precipitate of sulphur.

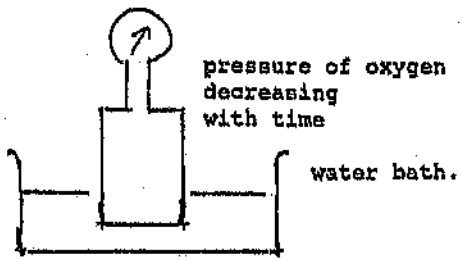
Reaction $Na_2S_2O_3 + 2\ HCl \longrightarrow 2\ NaCl + S + SO_2 + H_2O$



A cross marked on the card becomes less visible with time when viewed from above. The time taken for the disappearance of the cross when viewed from above is noted.

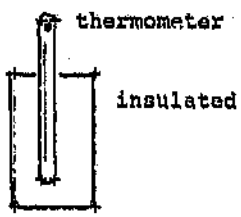
(d) Pressure of oxygen decreasing with time(assume temperature constant)

Reaction $2\ Mg(s) + O_2(g) \longrightarrow 2\ MgO(s)$



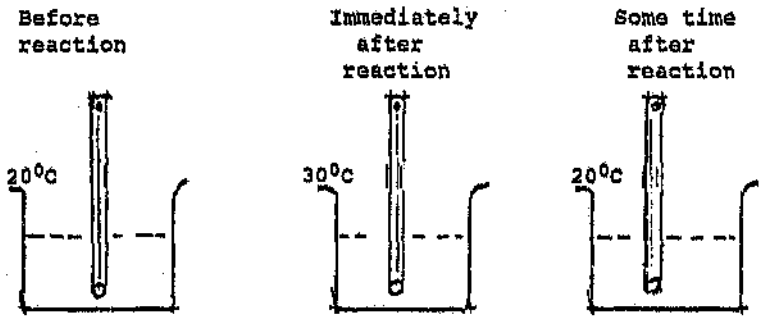
(d) The final temperature after the reaction is complete

Reaction $2\ Mg(s) + O_2(g) \longrightarrow 2\ MgO(s)$



(b) calorimetric measurement

Reaction $Zn(s) + CuSO_4(aq) \longrightarrow ZnSO_4(aq) + Cu(s)$



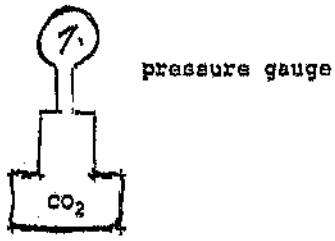
100 cm^3 of 0.2M $CuSO_4(aq)$

Reaction is complete and and ppt. of copper has formed in colourless $ZnSO_4(aq)$

Apparatus and contents cooled to room temperature.

(c) Pressure of CO_2 measured at various times.

Reaction $2\,HCl + CaCO_3 \longrightarrow CaCl_2 + H_2O + CO_2$



REACTIVITY - SESSION 1 - Handout (4c)

ACTIVITY CARD 3

SOME BRIDGING EXAMPLES

An attempt is made here to bridge the gap between disbelief (in the case of the target problem) and acceptance of the anchoring examples by considering similar aspects when dealing with chemical reactions.

What to do

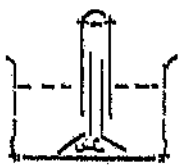
The activities described on the anchoring problems were related to daily tasks. This card presents a series of examples related to chemical reactions which may appear to be unrelated to the earlier examples. However closer scrutiny will indicate otherwise.

You are asked to look at the examples given. Then ask yourself: Which outcome is of interest?

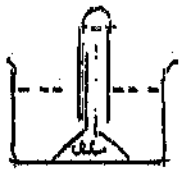
(a) How fast? (b) How far (extent of reaction).

(a) Hydrogen released at various time intervals.

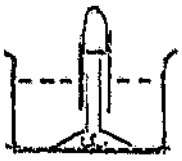
Reaction $Mg(s) + 2\ H_2O \longrightarrow Mg(OH)_2(aq) + H_2(g)$



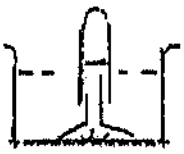
t=1s



t=2s



t=3s



t=4s

REACTIVITY - SESSION 1 - Handout (4b)

ACTIVITY CARD 2

SOME ANCHORING EXAMPLES

A description is given here of some anchoring examples involving concepts related to sporting events which will later be related to reactivity-related concepts. These examples are in agreement with most peoples intuitive beliefs and also correspond to the scientific view.

There are many activities which are performed sometimes during ones lifetime. Such activities are given below.

Try conceptualising or performing some of the jobs described below and ask yourself what you are measuring in each case.

In the examples given below, which outcome is of interest:

(a) How fast? (b) How far? (extent)



(a) A sprinter sprinting 100m



(b) An athlete throwing a discuss.



(c) An athlete throwing a javelin.



(d) An athlete doing long jumps

Another way of looking at the problem

In order to dispel these views it is necessary to expand ones view of the meaning of the term reactivity.

What is the nature of this expanded view?

We shall start by developing the notion that there are a number of different aspects of a chemical reaction we would want to know about.

We would like to know:

Whether a reaction can occur?
How fast does the reaction occur?
How far does the reaction go? (The extent of the reaction)

Reactivity is an idea that is related to a chemical reaction.

Arising from the above we will give an idea as to the experimental approaches that can be used to measure reactivity, so as to initiate an understanding of the concept reactivity.

REACTIVITY - SESSION 1 - Handout (4a)

ACTIVITY CARD 1 - REACTIVITY

THE TARGET PROBLEM

This card describes a target problem concerning reactivity-related concepts which some people find difficult.

The problem

The Wits research team found evidence that some teachers have difficulty in distinguishing questions of rate from questions of equilibrium. Example statements to illustrate the above are cited below:

1. A spontaneous reaction is a fast reaction
2. E^{O} values assumed to give kinetic information
3. ΔH values give kinetic information
4. Electrochemical series is a rate series

Possible causes of the problem

Major sources of instruction.

Teachers and textbooks provide ambiguous and incorrect messages about reactivity at a standard 8 level. Reactivity is explained anthropomorphically by many textbook authors. (Description uses human characteristics).

Experimental approaches used to measure reactivity are not clearly differentiated and do not emphasize the distinction between the rate (kinetic) and energy (thermodynamic) aspects of reactivity in a meaningful way.

The syllabus.

The standard 8 physical science syllabus does not link the concept of reactivity dealt with at that level to the concepts of rate and equilibrium dealt with at a standard 10 level and vice versa.

Technical use of words in science and everyday use of words probably not emphasized.

(a) had failed to enable the teachers to fully distinguish questions of rate from questions of equilibrium, and
(b) were seen by teachers themselves to be inconsistent or contradictory and could not be applied across a range of situations.

In terms of the constructivist model described above the researcher as teacher had achieved stage 1 (eliciting the learner's views) and the teacher's as learners might be said to be at stage 2 (aware of their existing ideas and dissatisfied with them).
As a result of the pre-course work and these early discussions in the first session you may feel yourself to be in a similar position as this. Having reflected upon your own views about reactivity, in the light of those expressed by your pupils, and having now considered the views held by other secondary teachers, you may also feel some dissatisfaction with the existing state of your knowledge.

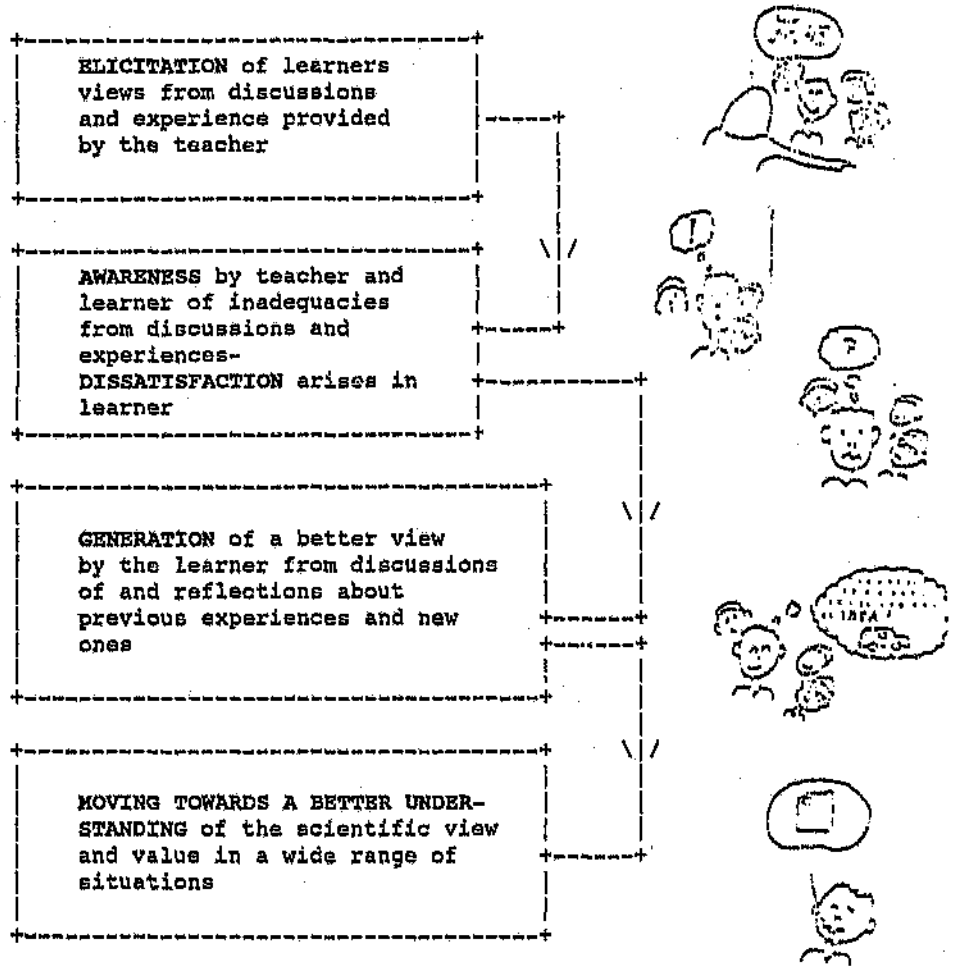
In this and later sessions we shall be going on to stage 3 and 4 of the constructivist model and will be providing you with some activities in which the expert view can be explored.

What is this "expert" or scientific view?

In session 2 you will be given handouts in which some key aspects of the scientific view of reactivity are explained. You will be asked to answer a variety of questions about reactivity using the scientific view to answer them. A handout interpreting the instances you presented to your pupils in terms of the scientific view will also be provided. You are asked to take this away and consider their contents as preparation for session 3 of the course when the ideas about reactivity will be developed further.
Use them also to help you with the other "homework task"- a questionnaire containing statements about situations similar to the ones you have looked at so far, in which you are asked to "spot the expert view".

In session 3 we will be discussing the answers to this questionnaire, performing further activities to develop the scientific view of "spontaneous reaction" -a reactivity related concept-and considering the difficulties raised by this view.

This model for learning of scientific ideas can be summarised as follows:



How can this model be applied to the secondary teacher who seeks to improve his or her own understanding of reactivity?
The first stage is for each teacher as "learner" to become aware of his or her own personal views about the concept reactivity in a variety of chemical reactions.

Some recent research into secondary teachers' ideas about reactivity-related concepts involved the completion of an in-depth questionnaire. For a good number of teachers an outcome of their participation in the research was that many of them became aware of gaps in their understanding of concepts related to reactivity. They expressed dissatisfaction with their existing ideas since these:

THE CONSTRUCTIVIST MODEL: AN APPROACH TO LEARNING SCIENCE

The aim of this course is to help you develop views about reactivity which correspond more closely to the scientist's. The course draws upon a view of learning in which the learner actively engages in the construction of meaning from experience and takes responsibility for the development of his or her own understanding.

A constructivist model for learning about reactivity

It is a basic principle of the approach to learning which underpins this course that, for an understanding of reactivity to be developed it is necessary for both teacher and learner to:

(1) first become aware of the ideas about reactivity which the learner already possesses.

Instruction then consists, not merely of adding on new bits of knowledge to this prior knowledge but of facilitating development of the learner's existing ideas.

This development may involve:

(a) the changing of existing views,
(b) the discarding of them in favour of new views, or
(c) the acceptance of new views which co-exist with previously held views but are applied only in a scientific context.

(2) This development of ideas is facilitated by:
providing experiences and discussions which cause the learner to consider any inadequacies in his or her existing views and to become dissatisfied with them;

(3) Providing experiences and discussions which enable the learner to construct an idea or explanation which is more satisfactory and makes better sense of the experiences.

(4) Moving the learner as he/she engages in the process of constructing new knowledge, towards the scientific view by presenting the latter in such a way that:

(a) it can be understood,
(b) it is believable,
(c) it is seen to apply consistently to a wide range of situations- not just in one limited context or in a few particular situations,
(d) it seems to be useful for the solving of problems,
(e) it is able to explain situations more satisfactorily than previously held views.

REACTIVITY - SESSION 1 - Handout (2)

PREVIOUS RESEARCH OF SECONDARY TEACHERS VIEWS ABOUT REACTIVITY-RELATED CONCEPTS (RATE AND EQUILIBRIUM).

You are asked to read through this brief account of some findings from research into secondary teacher's views about reactivity-related concepts (i.e. rate and equilibrium). A range of levels of understanding was found amongst the teachers who took part in the research. Consider how your own views compare with those shown below - how would you assess your own level of understanding?

The research was conducted in 1989 by the University of the Witwatersrand team. Ideas which some secondary teachers and standard 10 students have about rates and equilibrium were investigated. Twenty teachers and approximately 200 standard 10 pupils responses were elicited using a multiple-choice questionnaire.

The outcomes below lead to a focus on the concept of reactivity dealt with at a standard 8 level as many of these misconceptions are implicitly related to the term reactivity. These views emphasize the difficulty teachers and pupils have in distinguishing questions of rate from questions of equilibrium. This may be because these concepts were not meaningfully differentiated when dealing with the concept of reactivity.

It was found that a large number of these secondary teachers had views which were different from those currently held by scientists. Furthermore the teacher's views were similar to those which are known to be prevalent amongst standard 10 pupils:

1. A spontaneous reaction is a fast reaction
2. $E^{\ominus}$ values assumed to give kinetic information
3. ΔH values give kinetic information
4. Electrochemical series is a rate series
5. A catalyst affects the yield of a reaction.

It is likely that individual intuitive views about reactivity, such as those described above are held by many secondary teachers and standard 10 pupils or other members of the adult population who have not specialised in science during their education. Some of these ideas were regarded as correct by scientists living in earlier times.

It may be comforting to know that these views have also been found amongst university students who have received a specialist education in science. This is probably due to the difficulties people have in (a) grasping the more rigorous, scientific meanings of the term reactivity and (b) dissociating these scientific meanings from the wealth of other meanings the word has acquired from everyday social usage.

IDENTIFYING PUPILS' VIEWS ABOUT REACTIVITY - PRACTICE EXERCISE

This document gives you some practice in sorting out features of children's responses which have been described in handout 1 by giving you further extracts from interviews conducted with students.

You may care to consider these and attempt to identify any features described in handout 1, together with any other features not listed there, which you feel to be present. Please discuss this process with other colleagues since the purpose of the exercise is to familiarise you with the main types of response or kinds of ideas that are evident in *your* students.

[If you feel able to proceed directly, without practice, to identify features of your own student's interview responses which you obtained in your pre-course assignment, this section can be omitted.]

Examples:

> A reactive metal is one that reacts with power.

The student's response shows an anthropomorphic view of reactivity (feature 2).

> A reactive metal is higher in the series than one that is less reactive.

The student's response indicates a circular description. The meaning of the term reactivity is not explained.(feature 3).

Now try to identify any of the features from handout 1 present in the responses made by your student's during the interviews.

ACTIVITY CARD 3

THIRD APPROACH FOR MEASURING REACTIVITY-MOVING TOWARDS THE SCIENTIFIC VIEW

This approach involves an observation of whether the reaction will take place or not. Again it tells us nothing about the rate at which the reaction will take place.

A scenario is depicted here

A 11 year old child who is already a keen scientist. He saw MacGyver in one of his favourite television programmes obtain an electric current by sticking two wires into a nearby cactus. He wanted to know if he could do the same.

This led to a series of experiments with various plants and vegetables. The highest voltage was obtained by sticking his wires into a potato, so I suggested that he then try various other metal combinations, each with a potato. He carefully recorded the resultant cell EMF's in a suitable grid with a sign to indicate which way the current flowed. His results with copper, zinc, lead and magnesium were sufficiently consistent to provide a reactivity series showing an ease of electron loss in the order Cu<Pb<Zn<Mg. His maximum reading was for the Mg-potato-Cu cell, the electrons flowing round the external circuit from the magnesium.

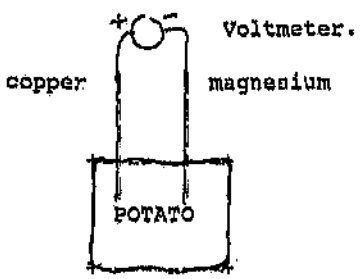
These cell EMF's differ from those obtained under *standard* conditions but the results give the right order of reactivity for successful predictions of redox reactions between the four metals and aqueous solutions of their metal salts.

Task

Measure the voltages between pairs of metal electrodes and tabulate your results in the table provided.

Items required

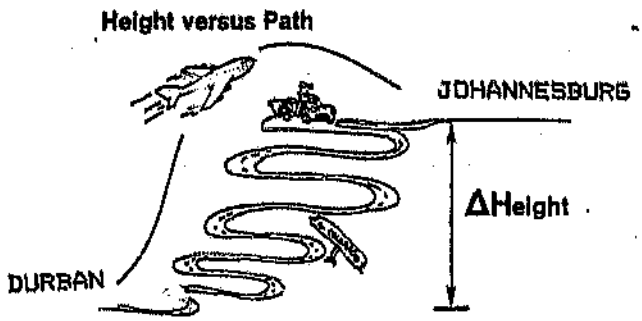
1. Fresh potato
2. voltmeter.
3. copper, zinc, magnesium and lead strips.
4. leads



STUDY THE FOLLOWING ANALOGY SHOWING THE DISTINCTION BETWEEN RATE AND ENERGY CHANGE.

ENERGY VS RATE

Height vs path



Analogy that contrasts enthalpy change with a rate pathway

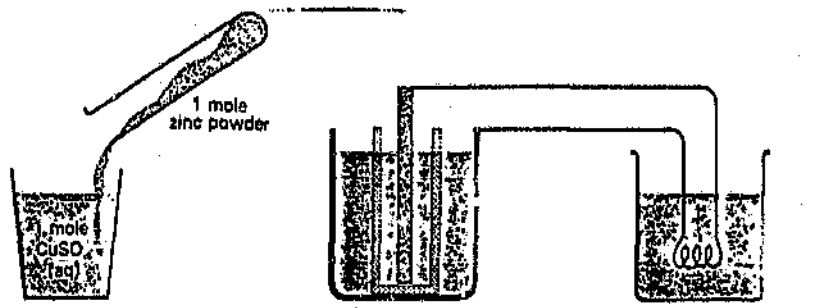
The enthalpy difference between the reactants and products can be compared to the altitude difference between two geographic points.

No matter how one gets from one point to another the final *difference* in altitude remains the same, just as the enthalpy difference between initial and final states of a reaction mixture is fixed.

On the other hand, very different amounts of time and work may be needed to actually travel from one place to another depending on the route taken and the mode of transportation used. The time required for the change and pathways that are followed both relate to the rate of the change.

Thus for a destination to be reached various paths can lead to the same end. Similarly a reaction can be fast or the reaction can be slow but the difference in energy between a particular set of products and reactants will always be the same.

Different information is obtained from the different experimental techniques (i.e. tasks 1 and 2 respectively). The one measures rate and this is related to the path taken by the reaction. The other gives information about the total amount of energy transfered in a reaction and this is related to the difference in energy between reactants and products.



The table below shows the heat energy lost to the surroundings when two moles of electrons are transferred per mole of Cu^{2+} ions discharged from various metals.

		/\H
Magnesium	$Mg(s) + CuSO_4(aq) \longrightarrow Cu(s) + MgSO_4(aq)$	- 526 kJ
Aluminium	$2Al(s) + 3CuSO_4(aq) \longrightarrow 3Cu(s) + Al_2(SO_4)_3(aq)$	- 414 kJ
Zinc	$Zn(s) + CuSO_4(aq) \longrightarrow Cu(s) + ZnSO_4(aq)$	- 216 kJ
Iron	$Fe(s) + CuSO_4(aq) \longrightarrow Cu(s) + FeSO_4(aq)$	- 152 kJ
Lead	$Pb(s) + CuSO_4(aq) \longrightarrow Cu(s) + PbSO_4(aq)$	- 63 kJ

All the reactions above involve the same half reaction: the transfer of 2 moles of electrons to $Cu^{2+}(aq)$ ions. The heat energy in this half reaction makes a constant contribution to the total heat energy change in each of the five reactions.

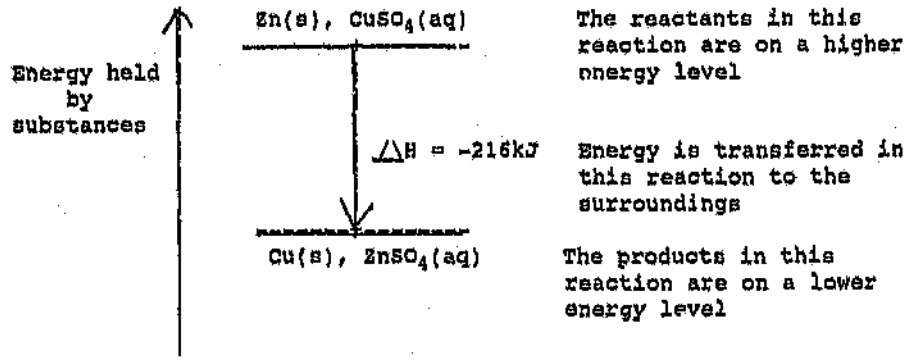
$$2e + Cu^{2+}(aq) \longrightarrow Cu(s)$$

The heat energy changes in the other half reaction are different in each case. The complete reaction using magnesium is most exothermic because the most exothermic of the half reactions below is the one involving magnesium.

$Mg(s) \longrightarrow Mg^{2+}(aq) + 2e$	most exothermic half reaction
$Al(s) \longrightarrow Al^{3+}(aq) + 3e$	
$Zn(s) \longrightarrow Zn^{2+}(aq) + 2e$	
$Fe(s) \longrightarrow Fe^{2+}(aq) + 2e$	
$Pb(s) \longrightarrow Pb^{2+}(aq) + 2e$	least exothermic half reaction.

The energy liberated in each case can be used to rank the *elements* in terms of their chemical reactivity.

Representing the information by means of an energy level diagram.



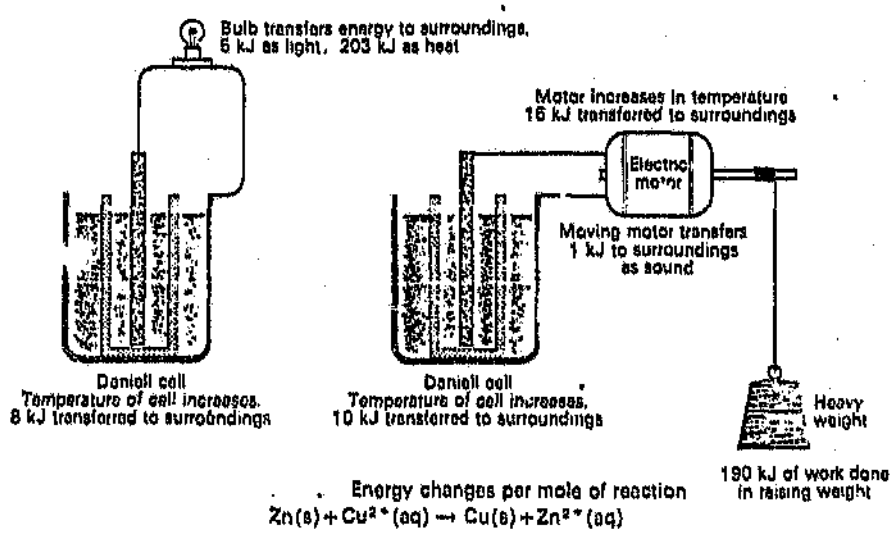
The total energy change in this reaction is always 216 kJ per mole. This energy can appear in many ways.

1. All the energy can appear as heat energy which is transferred to the surroundings.

2. Some of the energy (but never more than 212 kJ/mole) can appear as electrical energy. When this happens some of the energy (but never less than 4 kJ/mole) always appears as heat. The temperature of the Daniell cell increases slightly and the heat is transferred to the surroundings.

3. The electrical energy (never more than 212 kJ/mole) can be converted to other forms of energy such as light, sound, heat or work.

Some of the ways in which the 216 kJ/mole can appear are shown below:



For water and for *dilute* aqueous solutions it is known that about 4.2 joules of energy is transferred to the surroundings when the temperature of $1cm^3$ decreases by 1^0C.

Sources of error in the experiment

There are several sources of error in this simple experiment to find the energy transfer to the surroundings during a chemical reaction.

The sources of error include the following:

-Some energy is transferred to the surroundings before the maximum temperature is reached. If this energy transfer could be prevented the temperature rise would be a little more than 10^0C
- Some energy is transferred to the container and the thermometer as their temperature rises by 10^0C. This energy was not considered in the calculation.
- The energy transferred to the surroundings when the temperature of $1cm^3$ of an aqueous solution drops by 1^0C is not exactly 4.2J .The energy transferred varies slightly from solution to solution.

Calculation

<u>Energy lost by solution to the surroundings on cooling by 10^0C</u>

= mass of water x decrease in temperature x specific heat capacity of water.
= 100 X 10 X 4.2
= 4200 J

This is the energy lost to the surroundings when 0.02 mole of $CuSO_4$ is used. Therefore when 1 mole of the compound is used the energy lost is 210kJ

Repeat the experiment but this time use the same mass of zinc granules instead of zinc powder.

If the sources of error are eliminated, it is always found that one mole of copper and one mole of aqueous zinc sulphate contain 216kJ less energy than 1 mole of zinc and 1 mole of aqueous copper sulphate at the same temperature. It does not matter whether the zinc granules or powder is used.

Writing this information in equation form:

$$Zn(s) + CuSO_4(aq) \longrightarrow Cu(s) + ZnSO_4(aq) \quad \Delta H = -216\ kJ$$

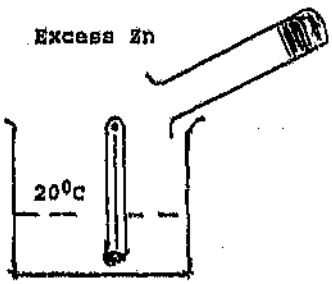
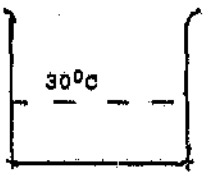
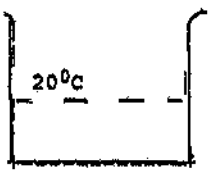
Questions

1. How does the amount of energy transferred compare when zinc powder or zinc granules are used with the same solution?

2. Was the rate affected when zinc granules instead of zinc powder was used? Explain.

Method.

A diagram indicating the stages during the experiment is shown.

before reaction	immediately after reaction	some time after reaction
		
$100cm^3$ of 0.2M $CuSO_4$	reaction is complete: precipitate of copper and colourless zinc sulphate solution has formed	Apparatus and contents have cooled to room temperature

1. Record the temperature of the solution before the zinc powder is added.

   Temperature of copper sulphate solution = ^0C

2. Pour the zinc powder into the polystyrene cup containing the copper sulphate solution. Record the maximum temperature.

   Max temperature of mixture = ^0C

3. Record the rise in temperature. = ^0C

When the reaction between zinc and aqueous copper sulphate is complete the temperature has increased by about 10^0C. The mixture then gradually loses energy to the surroundings and the temperature goes back to room temperature. The products of the reaction at *room* temperature (copper and aqueous zinc sulphate) contain less energy than the original reactants at the same temperature (zinc and aqueous copper sulphate). The energy has not disappeared: it has been transferred from the reaction mixture to the surroundings and the reaction is described as exothermic.

REACTIVITY - SESSION 2-handout (5c)

ACTIVITY CARD 2

SECOND APPROACH FOR MEASURING REACTIVITY-MOVING TOWARDS THE SCIENTIFIC VIEW

This approach is a measure of the energy of the products minus the energy of the reactants- i.e ΔH.

In practice speed also comes into the visual judgement. For example, most pupils will say that that magnesium powder + oxygen reaction liberates more energy, the magnesium ribbon + oxygen, even if equal masses of magnesium have been used. The powder reacts faster than the ribbon.

You are already familiar with energy transfers in physical systems. The ideas arising there will help you in determining the energy transfer in chemical systems.

The energy transferred during a chemical reaction at constant pressure is known as the enthalpy change and the symbol for enthalpy change is ΔH.

How does one measure the energy transferred during a chemical reaction?

In most cases calorimetric measurements are used.

As a chemical reaction takes place there *usually* is a change in the *temperature* of the reaction mixture because bonds within molecules are being broken and formed. When bonds are broken energy is absorbed and when bonds are formed energy is released.

To help you along a small task is given whereby you can determine in a practical and more quantitative manner the *amount* of energy transfer in a chemical reaction.

Task

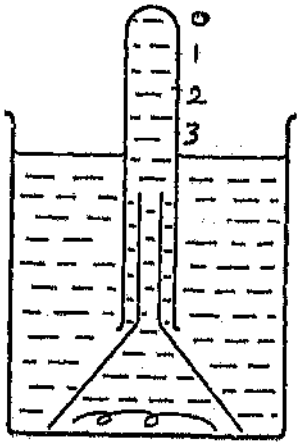
Apparatus and reagents required.

The following equipment is needed.

1. polystyrene cup
2. thermometer
3 2g zinc powder (this should be in excess)
4. test-tube.
5. 100 cm^3 of 0.2M copper sulphate solution.

Determine the energy released when excess zinc powder has reacted with 100 cm^3 of the copper sulphate solution. The chemical equation for the reaction is given to assist you with your calculation.

$$Zn(s) + CuSO_4(aq) \longrightarrow Cu(s) + ZnSO_4(aq)$$



Results

time in sec.	height of gas column with calcium granules	height of gas column with calcium powder
10		
20		
30		
40		
25		

Give possible ways in which the rate of this reaction can be defined.

(i) rate of chemical reaction = $\frac{\Delta}{\Delta}$

(ii) rate of chemical reaction = $\frac{\Delta}{\Delta}$

(iii) rate of chemical reaction = $\frac{\Delta}{\Delta}$

Questions

1. Is the rate of the reaction affected by whether a calcium granule or calcium powder is used?

REACTIVITY - SESSION 2 handout (5b)

ACTIVITY CARD 1

An exposition of the three different approaches for measuring reactivity is given.

FIRST APPROACH FOR MEASURING REACTIVITY-MOVING TOWARDS THE SCIENTIFIC VIEW

This approach is clearly connected with reaction rate. The speed (rate) of a reaction is linked with the path the reaction takes but has no link with the total amount of energy transferred during a reaction.

(1) What is meant by the term rate?

(a) The term rate means the number of occurrences of some event per unit time. The units of rate always include $(time)^{-1}$,eg s^{-1}(per second).

Different events occurring per unit time are indicated below:

(i) Speed = Δ position/Δtime i.e rate at which position changes.

(ii) Power = amount of work done/time taken

(iii) Current = amount of charge moved /time taken

In each of the above situations, what is the common variable used to measure rate? .....

Which instrument is used to measure the above variable?
.....

Now how would you define the rate of a chemical reaction? Some measurable property of the reaction must be changing per unit time.

To help you along a small task is given, together with the chemical equation for the reaction.

$$Ca(s) + 2H_2O(g) \longrightarrow Ca(OH)_2(s) + H_2(g)$$

Task

Arrange the beaker, funnel and test-tube as shown in the diagram. Mark the test tube by using a flow marker in intervals of 1 cm.

Place small pieces of calcium granules of known mass in a beaker half-filled with water. It will sink and a stream of bubbles will be seen coming to the surface. Measure the volume of gas that is given of every 10 seconds.

Try the same task using the same mass of calcium powder and compare the rate of the reaction with the earlier one.

REACTIVITY - SESSION 2 handout (5a)

THE EXPERT OR SCIENTIFIC VIEW ABOUT REACTIVITY.

In session 1 the constructivist model was drawn to your attention. You also became aware of the student's and your own views about reactivity. Towards the end of session 1 your attention was drawn to why the understanding of chemical reactivity is important.

Secondary teachers ideas about reactivity (Rate and equilibrium)

A large number of teachers could not clearly distinguish questions of rate from those of equilibrium:

-The electrochemical series was perceived to give rate information.

-/\H values were interpreted to give kinetic information.

- Only exothermic reactions were considered to be spontaneous.

The scientific view about reactivity.

Reactivity is the tendency or not the tendency of a reactant to form products in a chemical reaction.

The word tendency implies that the system is poised to undergo a certain natural change. Although poised for change the change may not be realised and furthermore the rate at which the change will take place is not referred to.

Tendency or readiness can be interpreted in either a kinetic sense or a thermodynamic sense.

The observed reactivity of a substance is frequently related to the rate at which energy is liberated rather than the total amount of energy evolved over the prolonged period of time.

How is reactivity measured?

Three approaches to the measurement of reactivity have been used in school:

1. Visual judgement of the speed of the reaction.
2. Judgement of the heat liberated (warm, hot, red-hot etc.)
3. Measurement of the voltage of a cell.

No explicit distinction is made in textbooks between the different approaches foor measuring reactivity. We shall attempt to give a clearer distinction so as to initiate an understanding of the different ways of measuring reactivity.

The approaches given are an attempt to examine the evidence. It is not intended that this material should be taught; it is intended to be considered by teachers so that what is taught will be closer to the truth than would be otherwise.

UNDERSTANDING

CHEMICAL REACTIVITY

SESSION 2

Handout 5a Reactivity: the expert or scientific view about reactivity

Handout 5b Activity card 1- reactivity

Handout 5c Activity card 2- reactivity

Handout 5d Activity card 3- reactivity

Handout 6 Summary: The expert or scientific view about reactivity

Handout 7 The "expert or scientific view about reactivity in the pre-course situation.

Handout 8 Homework questionnaire.

ACTIVITY CARD 4 - REACTIVITY

FORMULATING AN EXPANDED CONCEPTION OF REACTIVITY -MOVING TOWARDS THE SCIENTIFIC VIEW.

The implications of the exercise undertaken previously are discussed and related to the scientific view about reactivity.

An expanded view about a chemical reactivity.

What aspects of a chemical reaction do we want to know about?
If you have considered the reactions that have been shown in activity card 3, you would realise that the following are important:
(a) The rate of the reaction (something happening per unit time)
(b) Whether the reaction will proceed in a given direction (energy change in a reaction & extent of reaction)

In the case of the sporting events different outcomes were being measured and different instruments used:

Outcome	*speed*	*distance covered*
Instrument	*" tch*	*ruler/tape measure*

Similarly different outcomes are also measured during a chemical reaction:

Outcome	*rate*	*energy change*
Instrument	*watch*	*thermometer*

A distinction is made between rate and energy change aspects when dealing with chemical reactions. Energy change falls in the domain of thermodynamics and cannot tell you anything about rate, which falls in the domain of kinetics.

The scientific view about a chemical reactivity.

A useful starting point would be to think of reactivity being measured by different techniques. Each provides specific information.

Why is understanding the type of information chemical reactivity gives important?

Careful consideration of reactivity is important because it helps to differentiate between the more general concepts such as rate, energy change and equilibrium that are dealt with in standard 10. The concepts are:

Rate	Energy change
(i) rates of reaction	(i)exothermic and endothermic reactions.

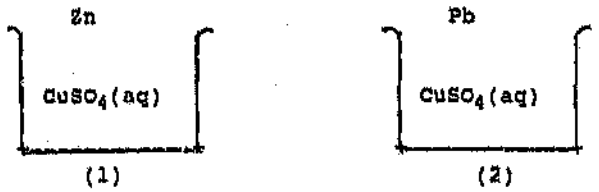
Equilibrium
(i) chemical equilibrium
(ii) electrochemistry

UNDERSTANDING REACTIVITY

SESSION 3

Handout 9	Answers to session 2 homework questionnaire.
Handout 10	One more key idea about reactivity: Spontaneous reaction.
Handout 11	Activity card 1- Spontaneous reaction
Handout 12	Activity card 2- Spontaneous reaction
Handout 13	Activity card 3- Spontaneous reaction
Handout 14	Activity card 4- Spontaneous reaction
Handout 15	Activity card 5- Spontaneous reaction
Handout 16	Activity card 6- Spontaneous reaction
Handout 17	Formulating an expanded conception about spontaneous reaction-moving towards a scientific view.
Handout 18	Summary of ideas about chemical reactivity
Handout 19	Homework questionnaire
Handout 20	Answers to session 3 homework questionnaire.

12. Equal numbers of moles of lead and zinc are placed in the same concentrations of copper sulphate solutions in respective beakers.(see diagram)



A: $Zn(s) + CuSO_4(aq) \longrightarrow ZnSO_4(aq) + Cu(s)$

B: $Pb(s) + CuSO_4(aq) \longrightarrow PbSO_4(aq) + Cu(s)$

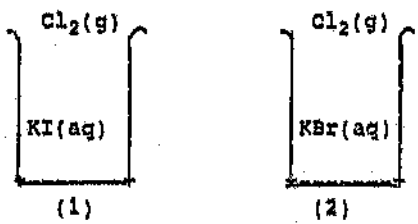
Zinc will react faster then lead with the copper sulphate solution.

NO YES

13. Copper will be deposited more rapidly in beaker (1) than in beaker (2) because zinc displaces copper ions faster than lead does.

NO YES

14. Chlorine is bubbled at the same rate through solutions of KI and KBr, in the respective test tubes (1) and (2). The solutions are of equal concentrations and equal volume. From the halogen reactivity series based on energy change, the following can be concluded:



Halogen reactivity series
F_2
Cl_2
Br_2
I_2

Reaction in test tube (1) will take place faster than in test tube (2) because bromine is more reactive than iodine.

NO YES

15. Cell voltages indicate the direction which the overall reaction will proceed.

NO YES

[Remember, in these examples, you ring "NO" if the statement is scientifically incorrect or is a statement other than a scientific one]

2. Zinc is more reactive than copper because zinc reacts with copper sulphate solution and copper does not react with zinc sulphate solution.

   NO YES

3. Reaction in beaker A indicates that the forward reaction is favoured but not the reverse reaction. Therefore the reagents in beaker B do not react.

   NO YES

4. Zinc is more reactive than copper because zinc reacts with more zest.

   NO YES

5. Zinc is more reactive than copper because zinc is more powerful.

   NO YES

6. Enthalpy changes give rate information.

   NO YES

7. Looking at the following balanced equation.

   $4Na(s) + O_2(g) \longrightarrow 2Na_2O(s)$

   doubling the amount of Na would double the speed of the reaction.

   NO YES

8. The reaction of zinc powder with hydrochloric acid will be faster than the reaction of zinc granules, because zinc powder has a larger surface area.

   NO YES

9. When the same mass of calcium powder or calcium granules react with water, the energy change in the respective reactions differ.

   NO YES

10. A reactivity series is a series representing an approximate "batting order" of metals. The order of the metals depend on the criterion used to measure so-called reactivity.

    NO YES

11. The cell voltage indicates the rate of the overall or net reaction.

    NO YES

REACTIVITY - SESSION 2 handout (8)

HOMEWORK QUESTIONNAIRE

The goal of this exercise is to introduce you to a range of views about the concept reactivity as related to chemical reactions like those you have already met, including "expert" or "scientific" explanations.

This questionnaire contains pictures of several situations similar to those which you encountered during your pre-course enquiry. Each drawing of a situation is accompanied by a number of statements about it. Most of these statements will be scientifically "incorrect" or the type of statement about which science cannot make a judgement. One or more of them will constitute an "expert" view about reactivity.

Your task is to "spot the expert view(s)" among the statements about each situation.

You are asked to try this yourself (without the help of your spouse, colleagues or a book). You might also like other adults to have a go.

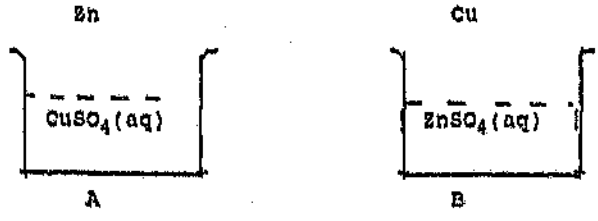
Bring the completed questionnaire to session 3 which will be commencing with a discussion of the responses.

Put a ring around YES if you think the statement is a correct scientific explanation.

Ring NO if you think the statement is scientifically incorrect or is a type of statement other than a scientific one.

The diagram below relates to questions 1,2 & 3.

Beakers A and B contain copper sulphate and zinc sulphate solutions. Zinc and copper are added respectively to the solutions.



A: $Zn(s) + CuSO_4(aq) \longrightarrow Cu(s) + ZnSO_4(aq)$

B: $Cu(s) + ZnSO_4(aq) \not\longrightarrow$ no reaction

1. Zinc is more reactive than copper sulphate.

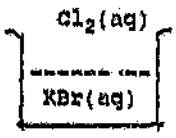
NO YES

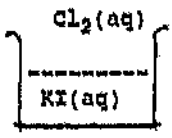
CARD 4 - THE REACTION OF HALOGENS WITH AQUEOUS SOLUTIONS OF METAL HALIDES.

Halogens	KCl(aq)	KBr(aq)	KI(aq)
5 cm^3- chlorine water			
5 cm^3- Bromine water			
5 cm^3- Iodine water			

Experiment:

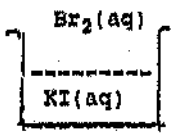
Set 1



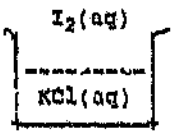


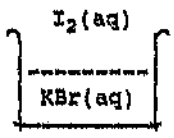
Set 2





Set 3





Discussion

Energy viewpoint

Qualitatively the amount of energy given off in a reaction is difficult to judge. However calorimetric measurements (using calorimeter and thermometer) would indicate which reaction given off the most energy during the displacement reactions.

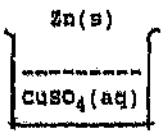
If one uses the amount of energy given off during the displacement as a criterion for determining reactivity then the order of the elements would be: $Cl_2 > Br_2 > I_2$. Voltage measurements would give the same order as well. This order will be the same whether the metals are in powder form or solid form. For a rate comparison the concentrations of the salt solutions and those of the halogens are important.

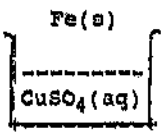
CARD 3 - THE REACTION OF METALS WITH AQUEOUS SOLUTIONS OF METAL SALTS.

Element	Quantity	Copper sulphate	Zinc Sulphate	Ferrous Sulphate
Zinc	1 cm square pieces foil			
Iron	3 cm iron wire or nail			
Copper	1 cm square pieces foil			

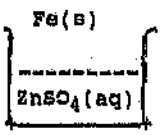
Experiment:

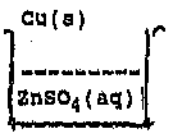
Set 1



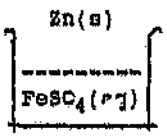


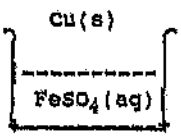
Set 2





Set 3





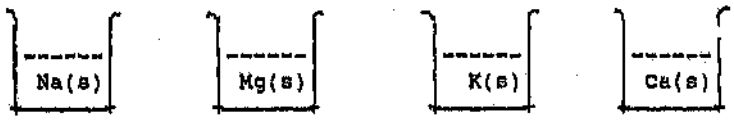
Discussion

Total energy viewpoint

Qualitatively the quantity of energy given off in a reaction is difficult to judge. However calorimetric measurements (using calorimeter and thermometer) would indicate which reaction gives off the most energy during the displacement reactions.
If one uses the quantity of energy given off during the displacement as a criterion for determining reactivity then the order of the elements would be: Fe > Zn > Cu. Voltage measurements would give the same order as well. However /\H and voltage measurements *do not* necessarily give the same order.

This order will be the same whether the metals are in powder form or solid form. For a rate comparison the physical state of the metals used is important however.

CARD 2 - THE REACTION OF ELEMENTS WITH OXYGEN



$4\ Na(s) + O_2(g) \longrightarrow 2\ Na_2O(s)$

$2\ Mg(s) + O_2(g) \longrightarrow 2\ MgO(s)$

$4\ K(s) + O_2(g) \longrightarrow 2\ K_2O(s)$

$2\ Ca(s) + O_2(g) \longrightarrow 2\ CaO(s)$

Discussion

Qualitatively the reactivity is judged according to the rate at which heat is given off. An alternative could be to judge according to the total amount of energy released.

Rate viewpoint

$$\text{rate of reaction} = \frac{\Delta \text{ energy transfer}}{\Delta \text{time}}$$

The rate of reaction can be used if:

(a) equal amounts of metals are used
(b) surface area of metals exposed to solution are the same.
(c) the time is recorded accurately.

If one uses the rate of energy released as a basis of comparison of reactivity then the *approximate* order of the elements reactivity with oxygen seems to be K > Na > Mg > Ca indicating that potassium is the most reactive and calcium the least reactive.

Total energy viewpoint

Qualitatively the total quantity of energy given off in a reaction is difficult to judge. However quantitatively calorimetric measurements (using calorimeter and thermometer) would indicate which reaction gives off the most energy for the metal combustion with one mole of oxygen.

If one uses the quantity of energy given off by the combustion as a criterion for determining reactivity then the order of the elements would be

Ca > Mg > K > Na

This order will be the same whether the metals are in powder form or solid form. By contrast the physical state of the solid metals used is important when using the rate of energy release in comparing reactivity.

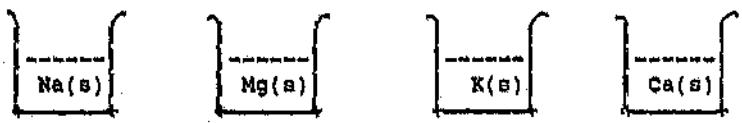
REACTIVITY - SESSION 2 handout (7)

THE "EXPERT OR SCIENTIFIC VIEW OF REACTIVITY IN THE PRE-COURSE SITUATIONS.

Hopefully our outcomes here may strengthen your understanding of the term reactivity in each of the situations which you presented to your pupils.

In each case a chemical equation is given and there is a discussion as to what could be the measure of the reactivity.

CARD 1 - THE REACTION OF METALS WITH WATER



$2\ Na(s) + 2\ H_2O(l) \longrightarrow 2\ NaOH(aq) + H_2(g)$

$Mg(s) + 2\ H_2O(l) \longrightarrow Mg(OH)_2(aq) + H_2(g)$

$2\ K(s) + 2\ H_2O(l) \longrightarrow 2\ KOH(aq) + H_2(g)$

$Ca(s) + 2\ H_2O(l) \longrightarrow Ca(OH)_2(aq) + H_2(g)$

Discussion

In this case the concept reactivity could be viewed from either a rate or an energy viewpoint.

Rate viewpoint

$$\text{rate of reaction} = \frac{\Delta \text{ volume of hydrogen produced}}{\Delta \text{time}}$$

The rate of reaction can be used if:

(a) equal amounts of metals are used
(b) surface areas of metals exposed to solution are the same.
(c) the time is recorded accurately.

If one uses the rate comparison as a basis of reactivity comparison then the *approximate* order of the elements seems to be K > Na > Ca > Mg indicating that potassium is the most reactive and magnesium the least reactive.

Hydrogen seems to be given off faster when potassium reacts with water than when calcium reacts with water.

REACTIVITY - SESSION 2 handout (6)

SUMMARY: THE EXPERT OR SCIENTIFIC VIEW ABOUT REACTIVITY

In the this session some key aspects of the scientific view of reactivity have been introduced and you have been asked to apply them to various situations during the activities. The ideas about reactivity dealt with so far are summarised.

What is reactivity?

Reactivity is the tendency or not the tendency of a reactant to form products in a chemical reaction. The word tendency implies that the system is poised to undergo a certain natural change. Although poised for change the change may not be realised and furthermore the rate at which the change will take place is not referred to.

Tendency or readiness can be interpreted in either a kinetic sense or a thermodynamic sense.

Why is reactivity important?

The concept reactivity is important because it is related to the more general topics such as rate, energy chane and equilibrium that are dealt with in standard 10. The topics are:

Rate
(i) rates of reaction

Energy change
(i)exothermic and endothermic reactions

Equilibrium
(i) chemical equilibrium
(ii) electrochemistry

Studies of reactivity should at the very least make pupils aware of the complexity of factors governing a chemical reaction.

What approaches can be used to measure reactivity?

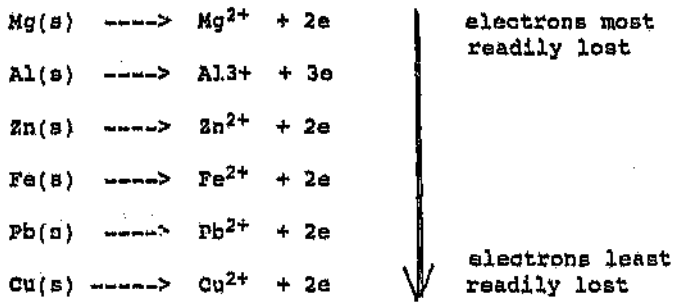
Various approaches can be used to measure reactivity:

a) The speed with which a substance reacts.
b) The total energy used or released when a substance reacts.
c) Voltage measurements on a reaction of a substance in an electrochemical cell.

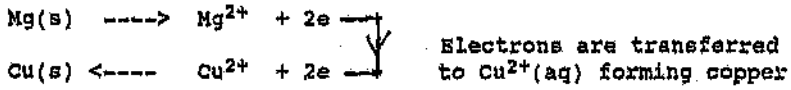
What is a reactivity series?

A reactivity series is a series in which the elements are put in an approximate "batting order". The order of the elements in the series will be dependent on what the criterion for ordering was. Either speed or total energy considerations may have been used for example

The metals are being compared for their ability to lose electrons. They all form the negative terminal of their cell because they all lose electrons more readily than copper does. The cell voltage is highest with magnesium because magnesium loses electrons more readily than any of the other metals.



The electrons lost by the metal(e.g. magnesium) are transferred to Cu^{2+}(aq) ions which become copper atoms and hence solid copper.



Using the above apparatus, the cell voltages for the metal electrodes used above show the same increase in ease of electron loss in the order Cu, Pb, Zn and Mg. In addition the cell voltages for aluminium and iron have also been included.

The following properties of the cell can be readily deduced:

a) the emf of the cell
b) the polarity
c) the direction of the electron flow in the external circuit
d) the associated cell reaction.

The table below shows the maximum voltages under *standard* conditions, together with the heat energy changes listed earlier.

The cell allows us to measure quantitatively the tendency for electron transfer to occur and *allows us to rank* these metals in terms of their ability to act as electron donors and/or electron acceptors. By using a voltmeter the voltage or EMF that impels this flow is measured. The EMF is not related to the rate at all.

Metal being tested against copper	Maximum voltage of cell formed with copper/ V	Maximum electrical energy which can be obtained per mole Cu^{2+} discharged by metal/ kJ	Heat energy lost to the surrounding per mole of $Cu^{2+}(aq)$ discharged by metal /kJ
Magnesium	2.71	521	526
Aluminium	2.00	523	414
Zinc	1.10	212	216
Iron	0.78	150	152
Lead	0.47	91	63

The electrical energy t[illegible]red per unit charge is large when the heat energy change per mo[illegible] large. When the electrical energy transferred per unit charge is small the heat energy change per mole is also small.

The voltage of the cell is a measure of the maximum electrical energy per unit charge which can be obtained from the electron transfer reactions taking place in the cell.

Method.

1. Stick the copper and magnesium strip into the potato. Connect the magnesium strip to the negative terminal of the voltmeter. Measure the voltage on the voltmeter.

2. Keep the copper strip and replace the magnesium with the zinc. Connect the zinc strip to the negative terminal of the voltmeter. Measure the voltage.

3. Keep the copper strip and replace the zinc with the lead. Connect the lead strip to the negative terminal of the voltmeter. Measure the voltage.

4. Check in which direction the voltmeter needle deflects.

Ensure that the distance between the strips is constant.

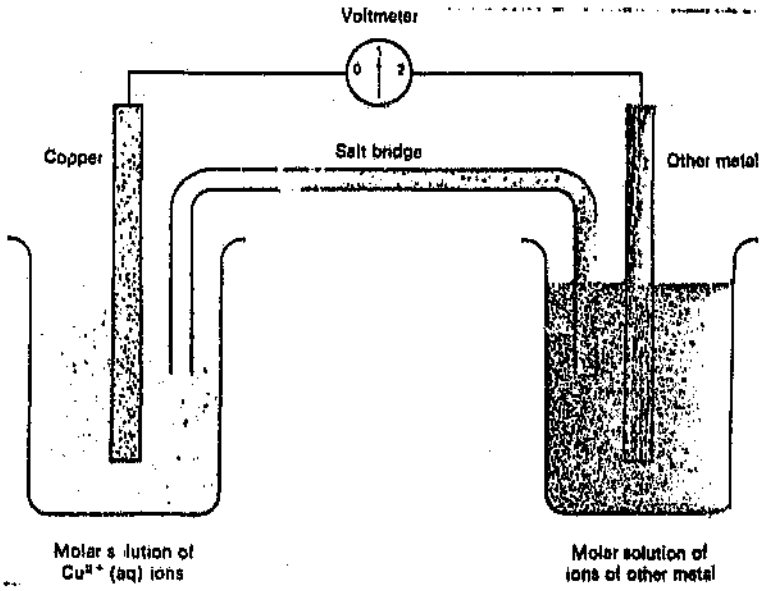
Table

Cell	Voltage reading
Mg-potato-Cu	
Pb-potato-Cu	
Zn-potato-Cu	

Arrange the above metals in a reactivity series.

Theory.

A more general apparatus for investigating electrical energy changes in electron transfer reactions is shown below.



REACTIVITY - SECTION 3-handout 15

ACTIVITY CARD 5

SOME ANCHORING EXAMPLES

A description is given here of some examples involving spontaneous processes that take place of their own accord in mechanical systems. Many people's intuitive interpretations would contain aspects of the scientific view. These ideas will later be related to a spontaneous reaction in chemical systems.

Try conceptualising the two analogies given below:

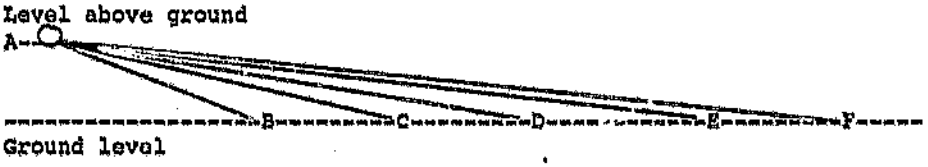
a) A ball on level ground.
b) A ball at a given height above the ground -it can reach ground level via the different inclines shown.

Answer the questions that follow and also indicate whether the ball should have an observable or measurable speed.

A ○ B

Ball on a level table

Does the ball have a tendency to roll towards B?



Ball rolling down different inclines

Take note of the various slopes and assume that the line representing ground level is infinitely long.

a) Does the ball have the tendency to roll in each case?

b) Which incline(pathway) will result in the longest time to reach ground level?

c) Assume that we make the slope of the incline less and less steep, what would happen to the time taken by the ball to reach ground level?

d) Would the speed of the ball for a given time interval be always observable speed irrespective of the pathway?

e) Is the final energy of the ball at ground level the same irrespective of the pathway? (assume surface is frictionless.)

REACTIVITY - SESSION 3-handout 14

ACTIVITY CARD 4

SOME BRIDGING EXAMPLES

An activity involving a chemical reaction that is endothermic is given here. The activity is an example involving a spontaneous process. The reverse of this process is not spontaneous.

Task no 2.

To demonstrate a "spontaneous endothermic reaction" which takes place at room temperature.

$Ba(OH)_2.8H_2O(s) + 2NH_4NO_3(s) \longrightarrow Ba(NO_3)_2(s) + 2NH_3(g) + 10H_2O(l)$

Requirements

1. 32 g barium hydroxide.
2. 17 g ammonium nitrate
3. conical flask
4. thermometer that allows measurements of temperatures less than 0^0C
5. small block of wood
6. glass stirring rod.

Method.

1. Place the pre-measured masses of solid barium hydroxide and solid ammonium salt in the conical flask.
2. Shake the flask gently to mix the reagents
3. Within about 30 seconds the odour of ammonia can be detected and a noticeable amount of liquid forms.
4. Observe the drop in temperature using a thermometer.
5. The drop in temperature may be displayed by wetting a small wooden block with a few drops of water and placing the conical flask on it. The flask will stick to the block as the water freezes and both may be lifted together.

Questions.

1. Was the reaction immediate?
2. Did the reaction take place naturally?
3. Is this an exothermic or an endothermic reaction?
4. Was the reaction fast?.
5. Is the above reaction spontaneous?
6. Does the temperature on a thermometer rise or drop for an endothermic reaction?

REACTIVITY - SESSION 3-handout 13

ACTIVITY CARD 3

SOME BRIDGING EXAMPLES

An activity involving a chemical reaction that is exothermic is given here. The activity is an example involving a spontaneous process. The reverse of this process is not spontaneous.

Task no 1.

To demonstrate a "spontaneous exothermic reaction" which takes place at room temperature.

$14KMnO_4 + 4C_3H_5(OH)_3 \longrightarrow 7K_2CO_3 + 14MnO_2 + 5CO_2 + 16H_2O$

Requirements

1. 1 g Potassium permanganate
2. 1 cm^3 glycerol
3. asbestos mat or tile.

Method.

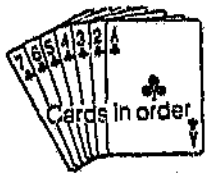
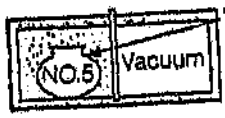
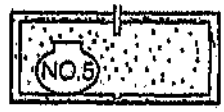
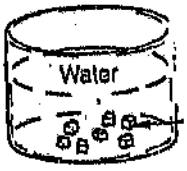
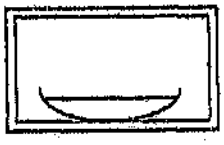
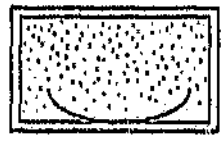
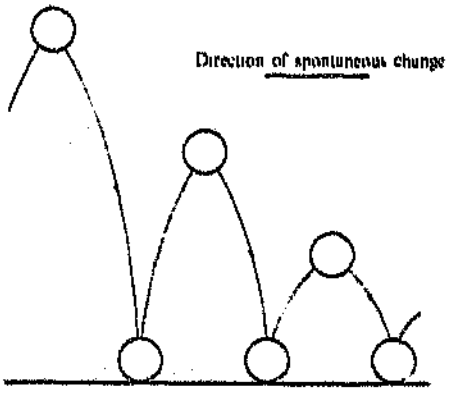
Place about 4 g of $KMnO_4$ in a heap on a piece of filter paper on an asbestos mat or tile.

Carefully pour $1cm^3$ of glycerine into a dent in the pile of $KMnO_4$.

Stand well back and wait.

Questions.

1. Was the reaction immediate?
2. Did the reaction take place naturally?
3. Is this an exothermic or an endothermic reaction?
4. Was the reaction fast?
5. Is the above reaction spontaneous?
6. Does the temperature on a thermometer rise or drop for an exothermic reaction?

Initial state	process	Final state.	$(E_f - E_i)$
	cards shuffled		ΔE_{card}
	partition removed		ΔE_{gas}
	sugar dissolved (heat given off to surrounding)		ΔE_{sys}
	water evaporates (heat flows from dish)		$\Delta E_{wat.0}$
			ΔE_{ball}

REACTIVITY - SESSION 3-handout 12

ACTIVITY CARD 2

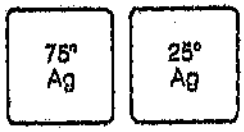
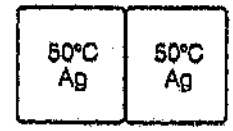
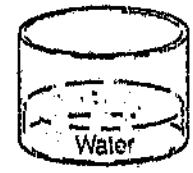
SOME ANCHORING EXAMPLES

A description is given here of some examples involving spontaneous processes. The reverse of these processes are not spontaneous. Many people's intuitive interpretations would contain aspects of the scientific view. These ideas will later be related to spontaneous reactions in chemical systems.

The illustrations show spontaneous processes. There seems to be some deep principle of nature at work. A spontaneous change appears to have something to do with fate and not rate. Indicate in each case whether that final state has:

1. the *same* energy as the initial state.
2. *more* energy than the initial state.
3. *less* energy than the initial state.

Where the final state has the same energy as the initial state. Why does the process go in one direction but not in the reverse direction. Use this as a clue to get an indication of the direction of spontaneous change.

Initial state	process	Final state.	$(E_f - E_i)$
	Heat flows between blocks		ΔE_{sys}
	ice melts (heat flows from water)		ΔE_{ice}

It would be confusing to talk in too formal terms about spontaneous and non spontaneous changes at a std.8 level. However the absence of any attempt to lay the basis of the understanding of the scientific meaning of spontaneity, allows misconceptions to remain.

Furthermore the standard 8 physical science syllabus does not link the concept of spontaneous reaction dealt with at that level to those of rate, equilibrium and electrochemistry dealt with at a standard 10 level and vice versa.

Technical use of words in science and everyday use of words probably not emphasized.

The everyday usage of the word spontaneous may suggest the meaning "instantaneous", in contrast to the scientific usage meaning "having the potential to occur on its own accord".

Another way of looking at the problem

In order to dispel these views it is necessary to look further at the meaning of the term "spontaneous reaction".

This will be done by giving examples of spontaneous processes that are intuitively accepted.

Furthermore the strong intuitive belief that a spontaneous reaction is not one that absorbs energy needs to be replaced by a view that both exothermic and endothermic reactions can be spontaneous.

Experiments showing that spontaneous reactions can be accompanied by the liberation of energy (exothermic reactions) as well as by the absorption of energy (endothermic reactions), will be demonstrated.

We shall continue by using analogies and developing further the notion that rate is not an indicator of a spontaneous change.

Indeed, if a reaction is not noticeably evident it does not necessarily mean that it not spontaneous. The reaction can be extremely slow.

Examples of spontaneous change in mechanical systems will be later extended to chemical systems.

REACTIVITY- SESSION 3 handout 11

ACTIVITY CARD 1 - SPONTANEOUS REACTION

THE TARGET PROBLEM

This card describes a target problem concerning the concept "spontaneous reaction" which some people find difficult.

The problem

Previous research indicates that some teachers are of the opinion that:

-Only reactions that give off energy (exothermic reactions) are spontaneous.
-Reactions that absorb energy (endothermic reactions) cannot be spontaneous.
- Speed is an indicator of a spontaneous reaction.

Pupils expressed the following views about a spontaneous reaction during an interview session.

"What I mean that a few of them did not ignite spontaneously. It took a *long time* before it ignited".

"A spontaneous reaction is one that takes place without a catalyst"

"A reaction that takes place immediately"

"Reactions taking place with *zest* and *vigour* are spontaneous".

" Spontaneous reactions begin at once as soon as contact between reactants is made".

Possible causes of the problem

Major sources of instruction.

Some teachers have wrong ideas and many textbooks provide ambiguous and incorrect messages about the concept "spontaneous reaction" at a standard 8 level.

Spontaneous reactions are described in [illegible]imistic terms by students.

The syllabus.

The standard 8 physical science syllabus mentions the term spontaneous but does not directly distinguish between spontaneous and non-spontaneous changes.

REACTIVITY - SESSION 3 -handout 10
ONE MORE KEY IDEA ABOUT REACTIVITY

The first key ideas relating to reactivity were introduced in session 1 and session 2.

1. Three approaches to the measurement of reactivity:

a. visual judgement of the speed of the reaction.
b. judgement of the total quantity heat liberated (warm, hot, red-hot etc.)
c. measurements of the voltage of a cell.

We saw that to measure reactivity energy as well as rate considerations were important.

This session looks at a further key idea "spontaneous reaction" which is needed to develop a better understanding of the concept reactivity.

2. The features of spontaneous reactions:

a. spontaneous reactions can absorb energy (endothermic reactions);
b. spontaneous reactions can give off energy (exothermic reactions);
c. whether or not a reaction is spontaneous is governed by the way the energy is distributed, if the reaction occurs.

Some teachers are of the opinion that only reactions that give off energy are spontaneous. These teachers think that reactions that absorb energy cannot be spontaneous.

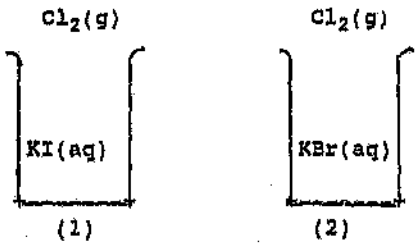
Some teachers think that spontaneous reactions are ones that happen quickly. This is not correct. The speed of a reaction is not an indicator of spontaneity of a reaction from a scientists point of view.

13. *Copper will be deposited more rapidly in beaker (1) than in beaker (2) because zinc displaces copper ions faster than lead does.*

    Incorrect scientific statement.

    Both zinc and lead will displace copper from a solution of copper sulphate. Zinc will have a greater tendency to react than lead. The speed with which copper will be deposited cannot be inferred from the reactivity series based on energy changes.

14. *Chlorine is bubbled at the same rate through solutions of KI and KBr, in the respective test tubes (1) and (2). The solutions are of equal concentrations and equal volume. From the halogen reactivity series based on energy changes given below, the following can be concluded:*



Halogen reactivity series
F_2
Cl_2
Br_2
I_2

    Reaction in test tube (1) will take place faster than in test tube (2) because bromine is more reactive than iodine.

    Incorrect scientific statement.

    Bromine and iodine will be displaced in the respective beakers. The speed at which the reactions will take place cannot be determined from the series based on energy changes.

15. *Cell voltages indicate the direction in which the overall reaction will proceed.*

    Correct scientific statement.

    Voltage measurements indicate whether a reaction is possible or not and the direction in which it will proceed.

(Remember, in these examples, you ring "NO" if the statement is scientifically incorrect or is a statement other than a scientific one)

9. *When the same mass of calcium powder or calcium granules react with water, the energy change for the respective reactions differ.*

   Incorrect scientific statement.

   The total amount of energy transferred is not affected by particle size. The rate of reaction is.

10. *A reactivity series is a series representing an approximate batting order of metals. The order of the metals depend on the criterion used to measure so-called reactivity.*

    Correct scientific statement.

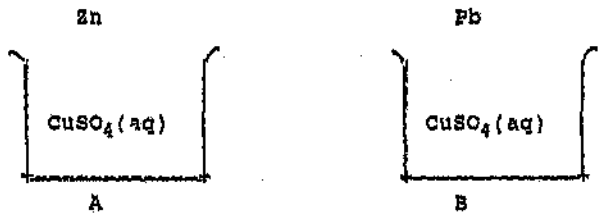
    The order of the metals is approximate. The order will not be invariant. It depends on the species it is reacting with and how the comparisons are done.

11. *Cell voltages are related to the rate of the overall or net reaction.*

    Incorrect scientific statement.

    Voltage measurements give an indication of whether a reaction will occur or not, but tells us nothing about the rate at which the reaction will occur.

12. *Equal number of moles of lead and zinc are placed in the same concentrations of copper sulphate solutions in respective beakers.(see diagram)*



A: $Zn(s) + CuSO_4(aq) \longrightarrow ZnSO_4(aq) + Cu(s)$

B: $Pb(s) + CuSO_4(aq) \longrightarrow PbSO_4(aq) + Cu(s)$

Zinc will react faster than lead with the copper sulphate solution.

Incorrect scientific statement.

The relative rates of the reactions cannot be determined. Both reactions will take place because of their relatively higher positions from copper in the reactivity series in which comparisons were based on energy changes.

2. *Zinc is more reactive than copper because zinc reacts with copper sulphate solution and copper does not react with zinc sulphate solution.*

   Correct scientific statement.

3. *Reaction in beaker A indicates that the forward reaction is favoured but not the reverse reaction; therefore the substances in beaker B do not react.*

   Correct scientific statement.

4. *Zinc is more reactive than copper because zinc reacts with more zest.*

   Not a correct scientific statement.

   Description of reactivity is human centered.(animistic)

5. *Zinc is more reactive than copper because zinc is more powerful.*

   Not a correct scientific statement.

   Description of reactivity is human centered.(animistic)

6. *Enthalpy changes give information about the rate of the reaction.*

   Incorrect scientific statement.

   The temperature change in a reaction gives information of the enthalpy change of a reaction. A watch or a timing device is not used when the enthalpy of a reaction is measured and thus the rate of the reaction is not given by the enthalpy change.

7. *Looking at the following balanced equation.*

   $4Na + O_2 \longrightarrow 2Na_2O$

   doubling the amount of Na would double the speed of the reaction.

   Incorrect scientific statement.

   Nothing can be deduced about the rate of a reaction from a chemical equation. It can only be determined experimentally.

8. *The reaction of zinc powder with hydrochloric acid will be faster than the reaction of zinc granules because zinc powder has a larger surface area.*

   Correct scientific statement.

   Particle size affects the rate of the reaction. If rate comparisons are to be used as a criterion of reactivity then the sizes of particles should at the very least have the same order of magnitude.

SESSION 3-handout 9

ANSWERS TO HOMEWORK QUESTIONS.

The purpose of the homework questionnaire was to introduce you to a range of statements about reactivity in situations analogous to those you encountered in your pre-course enquiry with student's.

Your task was to "spot the expert view" (or views) among the statements about each situation.

You were asked to try this yourself (without the help of your spouse, colleagues or a book) and then perhaps ask some other adults to have a go.

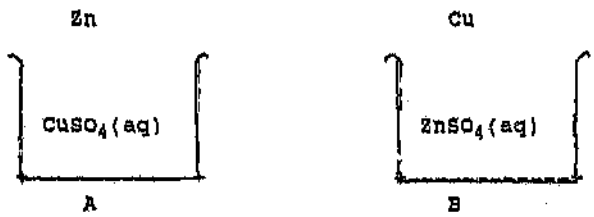
The "expert" response to each of the statements given below is at a simple level and is intended to:

(a) prompt discussion of your own and your colleagues' response to the questionnaire;.
(b) present a simplified scientific explanation in terms of aspects of reactivity covered in sessions 1 and 2;
(c) encourage you to consider any conceptual difficulties that the "expert" view presents for you personally.

[Remember, in these examples, you ring "NO" if the statement is scientifically incorrect or is a statement other than a scientific one.]

The diagram below relates to questions 1,2 & 3.

Beakers A and B contain copper sulphate and zinc sulphate solutions. Zinc and copper are added respectively to the solutions.



A: $Zn(s) + CuSO_4(aq) \longrightarrow Cu(s) + ZnSO_4(aq)$

B: $Cu(s) + ZnSO_4(aq) \longrightarrow$ no reaction

1. *Zinc is more reactive than copper sulphate.*

Incorrect scientific statement

Zinc is more reactive than copper and not copper sulphate. Zinc reacts with a copper sulphate solution but copper does not react with a zinc sulphate solution.

Incorrect scientific statement.

Energy absorbed or given off is not a criterion for spontaneity.

9. *The rate at which the reactions occur in test tube (1) and (2) will indicate which reaction is more spontaneous.*

Incorrect scientific statement.

The reactivity series indicate whether the reaction will occur or not. It does not give information about speed.

10. *A spontaneous reaction may correspond to the dispersal of matter.*

Correct scientific statement.

A gas mixes freely. A gas does not move on its own accord from a larger volume to a smaller volume.

11. *A spontaneous reaction may correspond to the dispersal of energy.*

Correct scientific statement.

A hot copper block eventually cools down.. The energy is transferred to the surrounding where it spreads out. A copper block does not suddenly get hot under there conditions on its own.

12. *All natural processes are spontaneous.*

Correct scientific statement. A natural process is spontaneous. Since it does not require the intervention of an external agency.

Examples 12-14 of various processes are given below:

13. *Ice melting at 25°C is an example of a spontaneous process.*

Correct scientific statement.

Process is natural. In a refrigerator water becomes ice. This process is not spontaneous. Work has do be done in this case.

14. *Gas mixing is an example of a spontaneous process*

Correct scientific statement. Process is natural.

15. *Ice cream vendors hot ice subliming is an example of a non spontaneous process.*

Incorrect scientific statement. Sublimation of dry ice is a natural process.

4. *Both exothermic and endothermic reaction can be spontaneous.*

   Correct scientific statement.

   Both types of reactions can be are spontaneous. When acid dissolves in water it proceeds naturally and the reaction is accompanied by the liberation of energy. When certain salts dissolve in water it proceeds naturally by absorbing energy from the surroundings.

5. *A spontaneous reaction is a fast reaction.*

   Incorrect scientific statement.

   The speed of the reaction is not a criterion for spontaneity. A spontaneous reaction is a reaction that has the potential to proceed naturally.

6. *A spontaneous reaction may not be observable because it does not have a measurable rate.*

   Correct scientific statement.

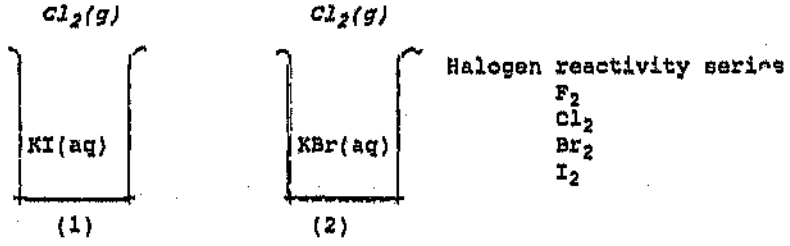
   Spontaneous reactions may be fast or very slow. The rate of the reaction if extremely slow will not be noticeable at all.

7. *A non spontaneous reaction can be made spontaneous by the addition of a catalyst.*

   Incorrect scientific statement.

   A catalyst only speeds up a reaction that is already a spontaneous reaction. If the reaction cannot occur under specified conditions then a catalyst will not speed up the reaction.

8. *Chlorine is bubbled at the same rate through solutions of KI and KBr, in the respective test tubes (1) and (2). The solutions are of equal concentrations and equal volume. From the halogen reactivity series given below, the following can be concluded:*



   Reaction of chlorine with both the solutions will not be spontaneous because no heat is supplied.

REACTIVITY - SESSION 4 handout 20

ANSWERS TO HOMEWORK QUESTIONS.

The purpose of the homework questionnaire was to introduce you to a range of statements about reactivity in situations analogous to those you encountered in your pre-course enquiry with student's.

Your task was to "spot the expert view" (or views) among the statements about each situation.

You were asked to try this yourself (without the help of your spouse, colleagues or a book) and then ask some other adults to have a go.

The "expert" response to each of the statements given below is at a simple level and is intended to:

(a) prompt discussion of your own and your colleagues' response to the questionnaire;.
(b) present a simplified scientific explanation in terms of aspects of reactivity covered in sessions 1 and 2;
(c) encourage you to consider any conceptual difficulties that the "expert" view presents for you personally.

[*Remember, in these examples, you ring "NO" if the statement is scientifically incorrect or is a statement other than a scientific one.*]

1. *All exothermic reactions are spontaneous.*

   Incorrect scientific statement.

   Energy given off during a reaction is not a criterion for spontaneity. The way the energy ca be distributed determines whether a reaction is spontaneous or not.

2. *All endothermic reactions are non spontaneous.*

   Incorrect scientific statement.

   Energy absorbed during a reaction is not a criterion for spontaneity. The way the energy can be distributed determines whether a reaction is spon.aneous or not.

3. *If a reaction is exothermic then it has to be spontaneous.*

   Incorrect scientific statement.

   Exothermicity is not a criterion for spontaneity.

UNDERSTANDING

REACTIVITY

SESSION 4

Handout 20 Answers to session 2 homework questionnaire.

Handout 21 Summary of ideas about chemical reactivity dealt so far.

14. Gas mixing is an example of a spontaneous process

NO YES

15. Ice cream vendors hot ice subliming is an example of a non spontaneous process.

NO YES

A series of examples are given below. Some take in energy from the surrounding and some give off energy to the surroundings.

16. Hydrated copper sulphate heated continuously is a spontaneous reaction.

$CuSO_4.5H_2O(s) \longrightarrow CuSO_4(s) + 5H_2O(l)$.

NO YES

17. Hoffmans voltameter: Electrical energy is supplied continuously at 25°C to decompose water. This is an example of a non spontaneous reaction.

$2H_2O(l) \longrightarrow 2H_2(g) + O_2(g)$

NO YES

18. Butane gas burning from a cigaretto lighter, once a spark is provided is an example of a spontaneous reaction.

$2C_4H_{10}(g) + 13O_2(g) \longrightarrow 8CO_2(g) + 10H_2O(g)$

NO YES

19. A spontaneous reaction has to take place immediately.

NO YES

20. A spontaneous reaction takes place without delay.

NO YES

[Remember, in these examples, you ring "NO" if the statement is scientifically incorrect or is a statement other than a scientific one]

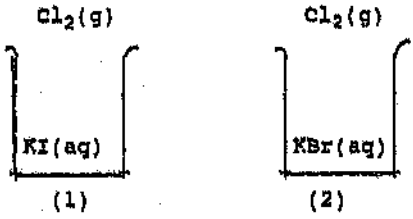
6. A spontaneous reaction may not be observed because it does not have a measurable rate.

NO YES

7. A non spontaneous reaction can be made spontaneous by the addition of a catalyst.

NO YES

8. Chlorine is bubbled at the same rate through solutions of KI and KBr, in the respective test tubes (1) and (2). The solutions are of equal concentrations and equal volume. From the halogen reactivity series given below, the following can be concluded:



Halogen reactivity series
F_2
Cl_2
Br_2
I_2

Reaction of chlorine with both the solutions will not be spontaneous because no heat is supplied.

NO YES

9. The rate at which the reactions occur in test tube (1) and (2) will indicate which reaction is more spontaneous.

NO YES

10. A spontaneous reaction may correspond to the dispersal of matter.

NO YES

11. A spontaneous reaction may correspond to the dispersal of energy.

NO YES

12. All natural processes are spontaneous.

NO YES

Examples 12-14 of various processes are given below:

13. Ice melting at 25°C is an example of a spontaneous process.

$H_2O(s) \longrightarrow H_2O(l)$.

NO YES

REACTIVITY - SESSION 3 handout 19

HOMEWORK QUESTIONNAIRE

The goal of this exercise is to introduce you to a range of views about the concept spontaneity as related to chemical reactions like those you have already met, including "expert" or "scientific" explanations.

This questionnaire covers the work done in session 2. Several statements are made in this questionnaire most of which will be scientifically "incorrect" or the type of statement about which science cannot make a judgement. One or more of them will constitute an "expert view" about reactivity.

Your task is to "spot the expert view(s)" among the statements about each situation.

You are asked to try this yourself (without the help of your spouse, colleagues or a book). You might also like other adults to have a go.

Bring the completed questionnaire to session 3 which will be commencing with a discussion of the responses.

Put a ring around YES if you think the statement is correct scientific explanation.

Ring NO if you think the statement is scientifically incorrect or is a type of statement other than a scientific one.

1. All exothermic reactions are spontaneous.

NO YES

2. All endothermic reactions are non spontaneous.

NO YES

3. If a reaction is exothermic then it has to be spontaneous.

NO YES

4. Both exothermic and endothermic reaction can be spontaneous.

NO YES

5. A spontaneous reaction is a fast reaction.

NO YES

The rate of a reaction can be increased by use of a catalyst.

However if a reaction is not spontaneous it would be futile to try to use a catalyst to speed up the reaction.

All natural changes are spontaneous.

What types of reaction are spontaneous reactions?

(a) Reactions that absorb energy to form products can be spontaneous
(b) Reactions that release energy when forming product can also be spontaneous.

There is a definite direction of spontaneous change. The reverse processes never proceed spontaneously under the same conditions.

Each of the spontaneous processes illustrated occurs of its own accord. You will have noticed that the minimisation of energy is not an adequate criterion for defining a spontaneous change.

The direction of change which leads to the greater dispersal of energy seems to underpin all the spontaneous processes:

REACTIVITY - SESSION 3 handout 18

SUMMARY OF IDEAS ABOUT CHEMICAL REACTIVITY DEALT WITH SO FAR.

Session 1,2 and 3

SESSION 1

Pupils are not empty vessels and new knowledge is not arbitrarily incorporated in their cognitive framework. New knowledge to be acquired depends on the child's existing knowledge.

SESSION 2

Reactivity is the tendency of a reactant to form products in a chemical reaction. The word tendency implies that the system is poised to undergo a certain natural change. Although poised for change the change may not be realised and furthermore the rate at which the change will take place is not referred to.

Tendency or readiness can be interpreted in either a kinetic sense or a thermodynamic sense.

Various approaches can be used to measure the reactivity of a substance:

a) The speed with which the substance reacts.
b) The total energy changes in a reaction.
c) Voltage measurements.

Reactivity series

A reactivity series is a series in which the elements are put in an approximate "batting order". The order of the elements in the series will be dependent on what the criterion for ordering was. Either speed or total energy considerations may have been used for example.

SESSION 3

A spontaneous reaction is a reaction that may proceed *without the assistance of an external agency.*

A reaction is described as spontaneous or non-spontaneous without reference to rate. The descriptions indicate whether a reaction may take place or not. An excerpt of a prosody encompasses the salient aspects of spontaneity.

Prosody

Spontaneity has nothing to state
When it comes to the question of rate
Any given reaction may reach it's fate
Tumbling fast or crawling willy nilly late.

The description spontaneous reaction has to do with fate not with rate.

A reaction is described as spontaneous or non spontaneous without reference to rate. A reference to spontaneity only indicates whether a reaction may take place or not.
You may have noticed in the mechanical system that many pathways (inclines) leadir to the same ultimate state(ground level) are possible. Furthermore the pathways dictate the rate.

The scientific view about a spontaneous reaction.

A useful starting point would be to think of a spontaneous reaction as a reaction which has the potential to proceed *without the assistance of an external agency*. It implies nothing about how *fast* it will proceed under given conditions. Indeed it may proceed so slowly that it appears not to proceed at all.

The description spontaneous reaction has to do with fate not with rate.

Why is understanding the term spontaneous reaction important?

The concept of spontaneous reaction is important to understand because:

we would not place compatible reagents next to each other -a spontaneous reaction that is exothermic may lead to a fire.

The rate of a reaction can be increased by use of a catalyst.

However if a reaction is not spontaneous it would be futile to try to use a catalyst to speed up the reaction.

All natural changes must be spontaneous. Understanding the term spontaneous as a scientist implies understanding all natural changes!

The direction of spontaneity remains a very important property of a chemical reaction.

REACTIVITY - SESSION 3 handout 17

FORMULATING AN EXPANDED CONCEPTION ABOUT SPONTANEOUS REACTION - MOVING TOWARDS A SCIENTIFIC VIEW

An expanded view about spontaneous reaction.

There are common features exhibited by the processes in activity card 2. They all include:

1. There is a definite direction of spontaneous change. The reverse processes never proceeds spontaneously under the same conditions.

   a) Water never freezes at 25^0C
   b) Shuffling the deck of cards never puts them in perfect order.
   c) A gas never concentrates itself in half its container.
   d) Sugar never concentrates and precipitates from a solution.

Each of the spontaneous processes illustrated occurs of its own accord. You will have noticed that the minimisation of energy is not an adequate criterion for defining whether a reaction will occur.

The direction of change which leads to a more probable dispersal of energy or greater disorder seems to underpin all the spontaneous processes:

- ordered cards become disordered
- confined gas diffuses
- sugar crystals dissolve and spread out
- water in a dish evaporates
- ball energy becomes dispersed.

What types of reaction are spontaneous reactions?

If you have considered the reactions that have been shown in activity cards 3 & 4, you would realise the following:

(a) Reactions that absorb energy to form products can be spontaneous.
(b) Reactions that release energy when forming product can also be spontaneous.
(c) Speed is not an indicator of a spontaneous reaction and a spontaneous reaction does necessarily take place immediately.

In the case of the examples in the mechanical system we saw that a spontaneous change takes place on its own accord.
(activity card 5 & 6)

When the ball was on a level table it had no tendency to move. As soon as there is a difference in the level the ball starts to roll.

ACTIVITY CARD 6

SOME BRIDGING EXAMPLES

An attempt is made here to bridge the gap between disbelief (in the case of the target problem) and acceptance of the anchoring examples by considering similar aspects when dealing with chemical reactions.

What to do

The aspects pertaining to the activities described on the anchoring problems were related tasks that you intuitively accept. This card presents examples related to chemical systems which may appear to be unrelated to the earlier examples. However closer scrutiny will indicate otherwise.

A number of examples of possible reactions are given below.

Indicate with reasons which reactions you would consider to be:

(a) Spontaneous
(b) Non-spontaneous
(c) Not sure whether spontaneous or non spontaneous.

1. diamond --------> graphite.

   Thousands of years are taken before diamond is converted graphite

2. $2H_2(g) + O_2(g)$ --------> $2H_2O(l)$

   A gaseous mixture of hydrogen and oxygen does not form observable amounts of water at room temperature

3. $Zn(s) + CuSO_4(aq)$ -----> $ZnSO_4(aq) + Cu(s)$

   zinc reacts with copper sulphate solution to form zinc sulphate solution + copper.

4. $Cu(s) + ZnSO_4(aq)$ -----> no reaction

   copper does not react with a zinc sulphate solution to form copper sulphate + zinc. (this is the reverse reaction of the above reaction)

5. $2H_2O_2(l)$-------> $2H_2O(l) + O_2(g)$

   The decomposition of hydrogen peroxide proceeds very slowly but becomes very rapid with a tiny bit of catalyst.