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Mega Speed Reading

by Howard Stephen Berg

Efficacy Study
July – August 1998

Prepared by

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Contents

1.0	Executive Summary	p. 2
2.0	Research Methodology	p. 2
3.0	Participant Groups	pp. 2-3
3.1	Control Group	
3.2	Experimental Group	
3.3	Children's Group	
4.0	Major Findings Overview	pp. 3-4
5.0	Explanation of Major Findings	pp. 4-10
5.1	Approach 1 – Control Between Groups	
5.2	Approach 2 – Statement of Relative Improvement	
6.0	Value of Specific Information	p. 10
7.0	Cautions	pp. 10-11

Appendix: Explanation of Methodology & Statistical Analyses

1.0 Executive Summary

This report represents results of an efficacy study conducted with 141 individuals (adults and children) from the Greater Chicagoland Area chosen at random using the following screener: 1) have not participated in the *Mega Speed Reading Course* by Howard Berg; 2) have an interest in improving reading speed and comprehension; and 3) were between the ages of 11 – 65 years old. Each participant in the experimental group was paid \$150 for his/her participation while each participant in the control group (no training) was paid \$50 for his/her participation.

2.0 Research Methodology

Experimental design served as the structure for the study (see appendix). The control group consisted of 40 individuals and the experimental group consisted of 101 individuals. The experimental group included the children's group (grade 5, 6, and junior high). The age quota was as follows:

- 17% between 11 and 17
- 36% between 18 and 34
- 35% between 35 and 54
- 12% between 55 and 65

3.0 Participant Groups

3.1 Control Group (21% of sample)

At the beginning of the session, the control group responded to a questionnaire designed to collect participant profiles of the sample. The group was then tested for initial reading rate and comprehension.

They were asked to read a passage as fast as they could while comprehending as much as they could for one minute at which time they were to mark the text where they finished (yielding reading rate per minute). They were then asked to repeat this exercise to collect a second measure of speed (again, for one minute).

When finished measuring speed, participants were then asked to continue reading and begin answering the comprehension questions at the end of the reading passages (not to refer back to the passages to answer the questions).

After completing the initial testing, participants in the control group were then given a writing exercise to complete.

Following the writing exercise, participants were then tested again for reading speed and comprehension using the format described above.

3.2 Experimental Group (79% of sample)

At the beginning of the session, the experimental group responded to a questionnaire designed to collect sociographic and psychographic profiles of the sample. The group was then asked to complete a writing exercise.

Following the writing exercise, participants were then tested for initial reading speed and comprehension utilizing the format described above (same as control group). Following initial testing, the experimental group participated in the *Mega Speed Reading Course* by Howard Berg (delivered via audio and videotape).

Following the course, participants were then tested for reading speed and comprehension utilizing the format described above (same as control group). When finished testing speed, participants were then asked to finish the passages and begin answering the comprehension questions at the end of the reading passages (not to refer back to the passages to answer the questions).

3.3 Children's Group (included in experimental group)

At the beginning of the session, the children's group (comprised of individuals who have completed grade 5, grade 6, and junior high last academic year 1998). The participants first responded to a questionnaire designed to collect sociographic and psychographic profiles of the sample. The group was then asked to complete a writing exercise.

Following the writing exercise, participants were then tested for initial reading speed and comprehension utilizing the format described above (same as control and experimental groups). Following initial testing, the experimental group participated in the *Mega Speed Reading Course* by Howard Berg (delivered via audio and videotape).

Following the course, participants were then tested for reading speed and comprehension utilizing the format described above (same as control group). When finished testing speed, participants were then asked to finish the passages and begin answering the comprehension questions at the end of the reading passages (not to refer back to the passages to answer the questions).

4.0 Major Findings Overview

On average, participants of Mega Speed Reading program designed by Howard Berg successfully increase their reading speed while they *still* score high on comprehension tests after *only 4 hours* of studying under Howard Berg's techniques.

In fact, the following are the results of a few individuals who completed the 4-hour program:

- 193% increase in reading speed with 2% increase in comprehension
- 146% increase in reading speed with 3% increase in comprehension
- 66% increase in reading speed with 50% increase in comprehension
- 27% increase in reading speed with 84% increase in comprehension
- 21% increase in reading speed with 6% increase in comprehension

Keep in mind that these results were realized after only 4 hours of practicing with the Mega Speed Reading program.

Adult Participants (high school – age 65) - On average, individuals who participated in the Mega Speed Reading Course by Howard Berg increased their reading rate 60-70% while reading comprehension among participants dropped approximately 10%. Although comprehension decreases, it is not nearly as significant as the increase in speed. Furthermore, the average number of words read increased 72% (from a raw score of 232 wpm to 398 wpm in the first minute and 62% increase from 480 to 778 in two consecutive minutes).

Children Participants (ages 11 – junior high) – On average, individuals who participated in the Mega Speed Reading Course by Howard Berg increased their reading rate 60% while improving comprehension (the average comprehension scores increased 10%). See appendix for further explanation regarding testing methodology and comments).

5.0 Explanation to Major Findings

We found that the speed reading training increased reading speeds on average by about 60%-70%, i.e., $(\text{post speed} - \text{pre speed}) / \text{pre speed}$ approximately equal to 65%. Another question of interest is how much can an individual improve his/her reading speed by using the training? What is the largest relative or absolute change that someone might realize as a result of completing this speed-reading course? The answer to this question is more difficult because two different readings were used to measure a subject's pre and post reading speeds and differences may be due to other factors such as one test being easier than the other.

The estimates listed in **Major Findings Overview** (see above, 60%-70% increase) did not involve comparing two different tests. Instead, we compared the readings speeds of people who took the Standard test in the morning with those who took it in the afternoon. The two groups consisted of different subjects, who were assigned at random to the two groups. Likewise, we compared the speeds of people who took the Orange test after training with the speeds of those who took the Orange test but were in the control group. Again, the subjects in these two groups were different. In this way we could eliminate the effects of other factors.

We shall investigate this question with two different approaches. The first approach will attempt to control for other possible factors by using the control group. This approach will give us estimates of the absolute difference in reading speed due to training, but it turns out that we cannot make statements about the relative improvement. The second approach will allow us to make statements about the relative improvement, but does not take into account other factors, such as the difference in difficulty of the two tests.

5.1 Approach 1 – Control between groups

Approach 1 adjusts the difference in reading speed using the results from the control group. By doing this we control for the difference in difficulty between the two tests. The average differences between the post and pre measures are given in the table below. Those in the control group, who did not receive the training, and took the Yellow test as a post measure, read 37.45 more words in the first minute on the Yellow test than they did on the Standard test. This is most likely due to the Yellow test being easier than the Standard test.

Average difference in reading speeds of subjects in control group, who took the Standard test as the pre measure and the Yellow or Orange test as the post measure.

Test	N	Speed 1	Speed 2	Comprehension
Yellow	20	37.45	67.65	27.87
Orange	20	76.15	70.85	11.65

The table below gives the reading speeds of those subjects who, like the control group, took the Standard test as a pre measure and the Yellow or Orange test as the post measure. The two most important columns are those labeled "Adj Diff Speed 1" and "Adj Diff Speed 2." The first row shows the results for **subject 82, who had the greatest absolute increase in reading speed after one minute.** His speed on the Standard test was 214. He took the Yellow test and had a score of 794. The raw difference in reading speed was $794 - 214 = 580$. If we adjust using the means from the control group his improvement is 542.55 words in the first minute. Likewise, his adjusted improvement after two minutes is 1456.35 words.

ID#	Pre Speed 1	Post Speed 1	Diff	Adj Diff Speed 1	Diff Speed 2	Adj Diff Speed 2	Gender/Age
82	214	794	580	542.55	1524	1456.35	Male/37
28	214	720	506	429.85	913	842.15	Fem/16
71	269	728	459	421.55	658	590.35	Male/52
90	285	728	443	405.55	817	749.35	Fem/41
25	214	635	421	344.85	672	601.15	Male/17
134	316	693	377	339.55	522	454.35	Fem/40
51	141	553	412	335.85	820	749.15	Male/16
70	285	691	406	329.85	805	734.15	Fem/20
64	171	572	401	324.85	911	840.15	Male/25
2	171	553	382	305.85	713	642.15	Fem/34
36	171	553	382	305.85	545	474.15	Male/16
65	214	555	341	303.55	589	521.35	Fem/49
96	156	482	326	288.55	548	480.35	Fem/18
50	285	608	323	285.55	470	402.35	Male/46
18	316	635	319	281.55	457	389.35	Fem/28
133	98	396	298	260.55	568	500.35	Fem/26
13	223	553	330	253.85	496	425.15	Fem/51
46	185	460	275	237.55	452	384.35	Fem/40
7	580	849	269	231.55	620	552.35	Male/38
81	98	349	251	213.55	511	443.35	Male/48
14	171	434	263	186.85	534	463.15	Male/15
114	171	390	219	181.55	424	356.35	Fem/27
116	329	541	212	174.55	289	221.35	Fem/36

122	114	315	201	163.55	314	246.35	Male/19
99	199	390	191	153.55	425	357.35	Male/17
92	223	451	228	151.85	353	282.15	Fem/63
4	114	319	205	128.85	527	456.15	Male/27
3	141	302	161	123.55	239	171.35	Fem/34
26	421	605	184	107.85	266	195.15	Fem/65
31	285	468	183	106.85	203	132.15	Fem/21
19	214	396	182	105.85	363	292.15	Male/30
129	214	396	182	105.85	319	248.15	Fem/54
45	241	377	136	98.55	213	145.35	Fem/40
15	241	363	122	84.55	227	159.35	Fem/61
60	269	415	146	69.85	212	141.15	Male/31
101	241	382	141	64.85	198	127.15	Male/18
131	386	482	96	58.55	277	209.35	Male/25
130	185	319	134	57.85	48	-22.85	Fem/26
111	285	377	92	54.55	155	87.35	Fem/49
49	269	396	127	50.85	300	229.15	Fem/55
35	171	252	81	43.55	155	87.35	Fem/37
80	199	306	107	30.85	166	95.15	Fem/35
76	303	368	65	-11.15	13	-57.85	Fem/21

It does not make sense to compute relative change scores. Consider again subject 82. The raw relative change score is $580/214 = 2.71$. The issue is how should we adjust for the difference in difficulty between the two tests? We could use 37.45 to adjust the pre score giving $580/(214+37.45) = 2.31$. Alternatively we could adjust the post score giving $542.55/214 = 2.54$. In other words, different percent changes occur, making relative comparisons non-meaningful. Therefore, only the absolute differences are meaningful.

The table below summarizes the adjusted reading speed after 1 minute and after 2 minutes, and also the adjusted difference in comprehension.

ID#	Adj Diff Speed 1	Adj Diff Speed 2	Adj Diff Comp	Gender/Age
82	542.55	1456.35	-64.2477	Male/37
28	429.85	842.15	-27.7491	Female/16
71	421.55	590.35	-30.1920	Male/52
90	405.55	749.35	-20.4397	Female/41
25	344.85	601.15	-39.5138	Male/17
134	339.55	454.35	-16.5697	Female/40
51	335.85	749.15	-2.8265	Male/16
70	329.85	734.15	-19.2351	Female/20
64	324.85	840.15	-29.6067	Male/25
2	305.85	642.15	-0.1949	Female/34
36	305.85	474.15	8.9382	Male/16
65	303.55	521.35	-21.8328	Female/49
96	288.55	480.35	-19.8205	Female/18
50	285.55	402.35	-19.8205	Male/46
18	281.55	389.35	-11.9257	Female/28
133	260.55	500.35	-26.9412	Female/26
13	253.85	425.15	-15.9844	Female/51
46	237.55	384.35	-11.9257	Female/40
7	231.55	552.35	-19.2013	Male/38
81	213.55	443.35	-23.0712	Male/48

14	186.85	463.15	-33.6314	Male/15
114	181.55	356.35	-13.1641	Female/27
116	174.55	221.35	-8.0558	Female/36
122	163.55	246.35	-15.6409	Male/19
99	153.55	357.35	2.6254	Male/17
92	151.85	282.15	-28.3683	Female/63
4	128.85	456.15	-8.8636	Male/27
3	123.55	171.35	-22.2972	Female/34
26	107.85	195.15	10.1766	Female/65
31	106.85	132.15	4.9135	Female/21
19	105.85	292.15	-12.1144	Male/30
129	105.85	248.15	-23.2599	Female/54
45	98.55	145.35	24.1424	Female/40
15	84.55	159.35	-4.0310	Female/61
60	69.85	141.15	14.0466	Male/31
101	64.85	127.15	-0.9689	Male/18
131	58.55	209.35	-25.5480	Male/25
130	57.85	-22.85	8.1642	Female/26
111	54.55	87.35	-8.6750	Female/49
49	50.85	229.15	-2.8265	Female/55
35	43.55	87.35	-9.2941	Female/37
80	30.85	95.15	-0.9689	Female/35
76	-11.15	-57.85	6.9259	Female/21

5.2 Approach 2 – Statement of Relative Improvement

The second approach involves comparing the pre and post scores, ignoring the differences in difficulty between the two tests. A conservative approach is to compare those who took the Yellow or Orange tests as the pre measure with those who took the Standard test as the post measure. Because the Standard test was found to be more difficult on average, any improvement we see between the two tests is more likely to be due to the training. Of course, it could still be due to other factors, such as the subject having a particular interest in the subject matter of the Standard test.

The results are shown in the table below. The table is sorted in descending order of their difference reading speed after 1 minute. Subject 119 improved his speed by 1.48 times = 521/352. The reading speeds after two minutes are also reported. Subject 69 improved his reading speed by 2.57 times after two minutes.

ID#	Pre1	Pre2	Post1	Post2	Diff1	Diff2	%1	%2	Gender/Age
119	352	675	873	1436	521	761	1.48	2.16	Male 34
69	271	537	627	1232	356	695	1.31	2.57	Male 45
105	168	368	372	741	204	373	1.21	2.22	Female 39
42	223	390	480	753	257	363	1.15	1.63	Female 29
104	227	396	480	873	253	477	1.11	2.10	Female 32
12	153	306	285	521	132	215	0.86	1.41	Female 26
139	238	390	421	850	183	460	0.77	1.93	Female 38
109	482	938	850	1614	368	676	0.76	1.40	Male 39
43	252	468	421	850	169	382	0.67	1.52	Female 30
112	196	497	303	640	107	143	0.55	0.73	Female 41
78	363	707	552	999	189	292	0.52	0.80	Female 51
98	415	765	627	1112	212	347	0.51	0.84	Female 45

72	468	857	698	1232	230	375	0.49	0.80	Male	35
1	162	334	241	449	79	115	0.49	0.71	Male	27
48	153	368	214	464	61	96	0.40	0.63	Female	59
95	336	605	464	986	128	381	0.38	1.13	Female	25
77	538	904	726	1349	188	445	0.35	0.83	Female	24
73	306	538	401	627	95	89	0.31	0.29	Female	25
39	334	651	436	863	102	212	0.31	0.63	Female	19
17	267	537	329	726	62	189	0.23	0.71	Female	21
135	315	571	386	741	71	170	0.23	0.54	Female	25
52	271	553	329	686	58	133	0.21	0.49	Female	30
61	319	541	372	839	53	298	0.17	0.93	Female	40
68	352	635	401	807	49	172	0.14	0.49	Female	47
106	196	390	223	464	27	74	0.14	0.38	Female	45
124	349	635	386	753	37	118	0.11	0.34	Female	16
138	377	608	401	818	24	210	0.06	0.56	Female	56
113	377	693	401	873	24	180	0.06	0.48	Male	35
16	271	553	285	627	14	74	0.05	0.27	Female	28
93	213	396	223	449	10	53	0.047	0.25	Female	50
100	252	452	256	640	4	188	0.016	0.75	Female	50
108	434	735	436	863	2	128	0.005	0.29	Female	28
120	315	589	316	616	1	27	0.003	0.09	Female	52
62	390	755	372	818	-18	63	-0.05	0.16	Female	36
34	227	434	214	386	-13	-48	-0.06	-0.21	Female	47
118	336	591	316	603	-20	12	-0.06	0.04	Male	43
74	414	755	386	863	-28	108	-0.07	0.26	Male	15
97	396	673	355	714	-41	41	-0.10	0.10	Female	50
140	269	476	241	464	-28	-12	-0.10	-0.04	Female	34
89	302	571	269	509	-33	-62	-0.11	-0.21	Female	41
59	377	589	285	449	-92	-140	-0.24	-0.37	Male	58
117	377	722	285	753	-92	31	-0.24	0.08	Female	32
126	377	667	269	616	-108	-51	-0.28	-0.14	Female	49
38	448	794	285	580	-163	-214	-0.36	-0.48	Female	44

The table below lists comprehension scores and percentage change from pre- and post-testing. Scores are computed on a 0 – 100 scale (with 100 being a perfect comprehension score). The scores in the table are arranged in descending order with 13.72% change for participant number 113 to 62.14% change for participant number 43.

ID#	Score on Yellow/Orange Test	Score on Standard Test	Difference	% Change
113	82.35294	71.05263	-11.3003	-0.13722
118	76.47059	65.78947	-10.6811	-0.13968
78	82.35294	68.42105	-13.9319	-0.16917
69	64.70588	52.63158	-12.0743	-0.1866
68	88.23529	68.42105	-19.8142	-0.22456
108	82.35294	63.15789	-19.195	-0.23308
59	76.47059	57.89474	-18.5759	-0.24291
126	94.11765	71.05263	-23.065	-0.24507
120	88.23529	65.78947	-22.4458	-0.25439
106	70.58824	52.63158	-17.9567	-0.25439
97	82.35294	57.89474	-24.4582	-0.29699
89	94.11765	65.78947	-28.3282	-0.30099
52	94.11765	65.78947	-28.3282	-0.30099

117	94.11765	65.78947	-28.3282	-0.30099
12	64.70588	44.73684	-19.969	-0.30861
39	82.35294	55.26316	-27.0898	-0.32895
73	82.35294	55.26316	-27.0898	-0.32895
38	70.58824	47.36842	-23.2198	-0.32895
135	94.11765	60.52632	-33.5913	-0.35691
48	82.35294	52.63158	-29.7214	-0.3609
93	88.23529	55.26316	-32.9721	-0.37368
140	88.23529	55.26316	-32.9721	-0.37368
138	76.47059	47.36842	-29.1022	-0.38057
98	94.11765	57.89474	-36.2229	-0.38487
74	64.70588	39.47368	-25.2322	-0.38995
72	100	60.52632	-39.4737	-0.39474
34	88.23529	52.63158	-35.6037	-0.40351
77	94.11765	55.26316	-38.8545	-0.41283
109	94.11765	55.26316	-38.8545	-0.41283
1	100	57.89474	-42.1053	-0.42105
124	100	57.89474	-42.1053	-0.42105
119	100	57.89474	-42.1053	-0.42105
95	76.47059	42.10526	-34.3653	-0.44939
112	82.35294	44.73684	-37.6161	-0.45677
62	94.11765	50	-44.1176	-0.46875
105	76.47059	39.47368	-36.9969	-0.48381
17	76.47059	39.47368	-36.9969	-0.48381
100	88.23529	44.73684	-43.4985	-0.49298
104	94.11765	44.73684	-49.3808	-0.52467
139	82.35294	36.84211	-45.5108	-0.55263
16	88.23529	39.47368	-48.7616	-0.55263
42	94.11765	36.84211	-57.2755	-0.60855
43	76.47059	28.94737	-47.5232	-0.62146

The following table combines both reading speeds and reading comprehension changes listed by participant number.

ID#	% Change Speed 1	% Change Speed 2	% Change Comp.	Gender/Age
1	0.487654	0.709877	-0.42105	Male/27
12	0.862745	1.405229	-0.30861	Female/26
16	0.051661	0.273063	-0.55263	Female/28
17	0.23221	0.707865	-0.48381	Female/21
34	-0.05727	-0.21145	-0.40351	Female/47
38	-0.36384	-0.47768	-0.32895	Female/44
39	0.305389	0.634731	-0.32895	Female/19
42	1.152466	1.627803	-0.60855	Female/29
43	0.670635	1.515873	-0.62146	Female/30
48	0.398693	0.627451	-0.3609	Female/59
52	0.214022	0.490775	-0.30099	Female/30
59	-0.24403	-0.37135	-0.24291	Male/58
62	-0.04615	0.161538	-0.46875	Female/36
68	0.139205	0.488636	-0.22456	Female/47
69	1.313653	2.564576	-0.1866	Male/45
72	0.491453	0.801282	-0.39474	Male/35
73	0.310458	0.29085	-0.32895	Female/25
74	-0.06763	0.26087	-0.38995	Male/15

77	0.349442	0.827138	-0.41283	Female/24
78	0.520661	0.804408	-0.16917	Female/51
89	-0.10927	-0.2053	-0.30099	Female/41
93	0.046948	0.248826	-0.37368	Female/50
95	0.380952	1.133929	-0.44939	Female/25
97	-0.10354	0.103535	-0.29699	Female/50
98	0.510843	0.836145	-0.38487	Female/45
100	0.015873	0.746032	-0.49298	Female/50
104	1.114537	2.101322	-0.52467	Female/32
105	1.214286	2.220238	-0.48381	Female/39
106	0.137755	0.377551	-0.25439	Female/45
108	0.004608	0.294931	-0.23308	Female/28
109	0.763485	1.40249	-0.41283	Male/39
112	0.545918	0.729592	-0.45677	Female/41
113	0.06366	0.477454	-0.13722	Male/35
117	-0.24403	0.082228	-0.30099	Female/32
118	-0.05952	0.035714	-0.13968	Male/43
119	1.480114	2.161932	-0.42105	Male/34
120	0.003175	0.085714	-0.25439	Female/52
124	0.106017	0.338109	-0.42105	Female/16
126	-0.28647	-0.13528	-0.24507	Female/49
135	0.225397	0.539683	-0.35691	Female/25
138	0.06366	0.557029	-0.38057	Female/56
139	0.768908	1.932773	-0.55263	Female/38
140	-0.10409	-0.04461	-0.37368	Female/34

6.0 Value of Specific Information

It is noted that participants were tested immediately following completion of the Mega Speed Reading Course by Howard Berg (delivered via video and audiotape).

It is further noted that in addition to testing for reading speed differences and reading comprehension differences, the tests were designed and conducted to measure and screen for:

Initial reading ability between groups (control and experimental), test findings conclude that *initial* reading ability (reading rate and comprehension prior to course administration) was similar between the groups; therefore, between-group comparisons can be made with statistical accuracy.

Evaluate the role of guessing in comprehension, test findings conclude that guessing did not influence test outcomes (see appendix).

Evaluate the role of skimming in comprehension, test findings conclude that skimming (vs. reading) did not influence test outcomes (see appendix).

7.0 Cautions

Children's Program Testing – it is noted that the findings for the children's group may be inconclusive in absence of a control group (see appendix).

Test Content Difficulty Variance – it is noted that the reading difficulty level and difficulty level of comprehension questions for the Standard Test is apparently higher versus the Yellow and Orange tests. The findings presented above are a result of participants who took the “easier” test as a pre-test (before program administration) and the “more difficult” test as a post-test (after program administration); therefore, yielding conservative estimates of the efficacy of Mega Speed Reading program. Under these conditions, the greatest increase in speed was 2.5 times initial reading speed while still scoring well on comprehension tests. Under the reverse conditions (i.e. taking the difficult test first and the easier test after), some participants scored 3, 4, and 5 times faster reading speed while still scoring well on comprehension tests.

Appendix

1 Analysis of Adult Data

1.1 Experimental design

To test the effectiveness of the speed-reading training program, we used the experimental design shown below. A marketing research recruiting agency provides a list of names that we used to recruit subjects. In total, 126 adults participated in the study. Each subject was paid \$150 for his/her participation. Subjects were assigned randomly to the treatment groups, which received the training, and control group, which did not receive any training. Forty subjects were assigned to the control group and the remaining 87 to the treatment group. Reading speed and comprehension were measured using a standard reading test (the Standard test¹) and a special reading test composed of a restaurant review. The latter contained reading material of the sort people would usually encounter in daily life. Two versions of the special test were created, labeled the Orange and Yellow versions. The Orange version contained slightly different information than the Yellow version. The two versions were used so that the role of guessing could be examined for the comprehension tests.

Those who were assigned to the control group first took the Standard test. No training was given to the control group. The control group was randomly split into two groups of twenty. One of the groups took the Yellow test and the other group took the Orange test. The treatment group was split randomly into four groups. The first group, consisting of 21 people,

¹Standard reading test, Riverside publishing company, by James Brown, Vivian Vick Fishco, Jerrald Hanna

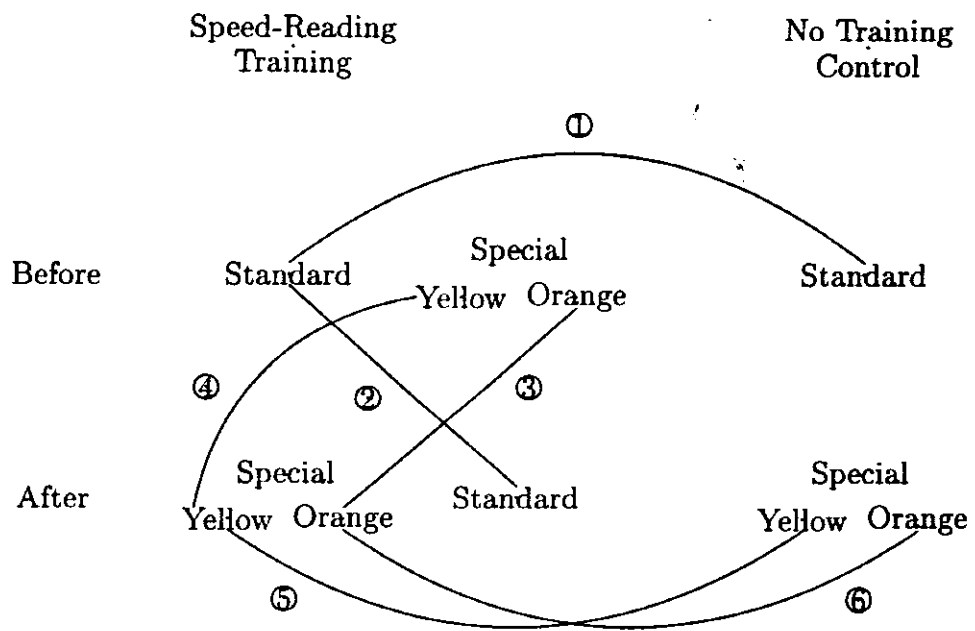


Figure 1: Design of the experiment

took the Yellow test in the morning, participated in training, and took the Standard test after the training. The second group took the Standard test in the morning, participated in training, and then took the Yellow test. The third group took the Orange test in the morning, participated in the training, and then took the Standard test. The fourth group took the Standard test in the morning, participated in the training, and then took the Orange test.

This experimental design allows for the evaluation of the speed-reading training based on before-after comparisons and on comparisons with a no-training control group. Specifically, we will analyze the resulting data with the following six sets of tests.

- *Test 1* compares the Standard pre-training test scores of the treatment and control groups. The purpose of this test is to make sure that the treatment and control groups have similar reading abilities to begin with. Random assignment was used to form the two groups, but there is always a chance that one of the two groups will have better readers assigned to it.
- *Test 2* compares the scores of people in the treatment group on the Standard test before and after training. This provides one measure of how effective the training was.
- *Test 3* compares the Orange test scores before and after training.
- *Test 4* compares the Yellow test scores before and after training.
- *Test 5* compares the Yellow scores of the treatment group to those in the control group after training.

- *Test 6* compares the Orange scores the treatment group to those in the control group after training.

1.2 Analysis methodology

The six sets of tests outlined in the previous section all involve between-subjects comparisons, i.e., we are comparing the scores of one group of subjects with the scores of another (independent) group of subjects. The results of these sets of tests are presented in sections 1.3 – 1.8. The alternative to a between-subjects comparison is a within-subject comparison, where the scores of a group of subjects before the training are compared with the scores of the *same* group after the training. Results from a within-group analysis are presented in section 1.9.

Independent sample *t*-tests are used to test all between-subjects comparisons, as implemented by PROC TTEST in SAS. We followed the steps below for all comparisons:

1. Test the null hypothesis that the variances of the two groups are equal against the two-tailed alternative that they are not equal. If the *P*-value for this test is less than .05, reject the null hypothesis and use a *t*-test assuming unequal variance to test the equality of means. Otherwise, use the *t*-test assuming equal variances.
2. Test the null hypothesis that the means of the two groups are equal against the two-tailed alternative that they are not equal. The *P*-values are reported.

1.3 Test 1: Compare of pre measures on Standard

The first set of tests involves comparing the scores of the treatment and control groups on the Standard test before the reading course. The purpose of this comparison is to evaluate whether or not the treatment and control groups have equal reading ability. If the two groups are found to be different, we will have to modify the subsequent tests.

The results of the comparison are summarized in table 1. None of the *P*-values are less than 0.05, indicating that the treatment and control groups have similar reading abilities.

Table 1: Test 1 — compare pre measures on Standard

Group	Tx Group		Control		<i>P</i> -value
	Mean	Std Err	Mean	Std Err	
Words read 1 min	232.37	13.8	233.90	13.2	0.9367
Words read 2 mins	480.07	24.9	488.43	26.4	0.8184
Standard test	59.67	1.64	56.71	1.69	0.2137
Standard test Qs 1-19	55.94	1.89	50.92	2.17	0.0843
Standard test Qs 20-38	63.40	1.94	62.50	1.89	0.7403

1.4 Test 2: Comparing Standard before and after treatment

The second test involves comparing the Standard test scores of people in the treatment group who took the test before the reading program with those who took the test after the reading program. Note that the subjects who took the Standard test before the program are different than those who took

it after the program (between-subjects comparison). This comparison will help us judge whether or not the program was effective in improving reading skills.

The results are summarized in table 1.4. The first two rows describe the reading speed of the two groups. The average number of words read in one minute increases from 232 to 398 (72% increase). The average for two minutes increases from 480 to 778 (62% increase). Both of these differences are significant at the .05 level. Therefore, the training seems to increase average reading speed by about 60-70%.

Table 2: Test 2 — compare Standard before/after Tx only

Group	Before		After		P-value
	Mean	Std Err	Mean	Std Err	
Words read 1 min	232.37	13.8	397.55	24.2	0.0001
Words read 2 mins	480.07	24.9	778.36	41.6	0.0001
Standard test	59.67	1.64	53.65	1.56	0.0094
Standard test Qs 1-19	55.94	1.89	46.77	1.56	0.0003
Standard test Qs 20-38	63.40	1.94	60.53	2.19	0.3299

The next three rows compare reading comprehension. Reading comprehension seems to decrease slightly after the training. For example, the scores on the overall test drop from 60 to 54 (10% decrease). The scores on the questions covering material in the part of the reading used to measure speed decreased from 56 to 47 (16% decrease). The scores on the questions covering material that was not used to measure reading speed decreased from 63 to 61 (3% decrease). Therefore, reading comprehension seems to decrease, but the decrease is not nearly as great as the increase in speed.

1.5 Test 3: Comparing Special reading test — Orange version before and after, Treatment group

Another way to judge the effectiveness of the reading program is to compare the scores on the Special reading test (Orange version) before and after training. Note that the people who took the Orange test before training are different from those who took it after training.

The scores are summarized in table 1.5. The number of words read in one minute increases from 303 to 480 (58% increase). The number of words read in two minutes increases from 561 to 920 (64% increase). This supports the conclusion from Test 2 that the training increases reading speed by about 60–70%. The scores on reading comprehension also decrease, but the size of the decrease is slightly greater than for Test 2.

Table 3: Test 3 -- compare Orange before/after Tx only

Group	Before		After		P-value
	Mean	Std Err	Mean	Std Err	
Words read 1 min	302.64	21.8	480.24	26.9	0.0000
Words read 2 mins	561.18	34.3	919.76	58.4	0.0001
Special test	84.49	2.10	63.87	3.92	0.0001
Special Qs 1-8	77.84	2.84	54.17	4.26	0.0001
Special Qs 9-17	90.40	1.97	72.49	4.38	0.0009

1.6 Test 4: Comparing Special reading test — Yellow version before and after, Treatment group

We also compared the scores on the Special reading test (Yellow version) before and after the training. The results are summarized in table 1.6. The results confirm the findings from the Standard and Orange tests. Reading speed increases and comprehension decreases slightly.

Table 4: Test 4 — compare Yellow before/after Tx only

Group	Before		After		P-value
	Mean	Std Err	Mean	Std Err	
Words read 1 min	327.67	18.8	503.00	36.9	0.0002
Words read 2 mins	605.81	33.6	961.77	76.7	0.0001
Special test	85.99	2.20	69.25	3.46	0.0002
Special Qs 1-8	85.12	2.94	64.20	4.53	0.0004
Special Qs 9-17	86.77	3.40	73.74	3.69	0.0132

1.7 Test 5: comparing Special reading test — Yellow version, treatment versus control

The analysis of the Special reading test (Yellow version) results confirms the conclusions from the other tests. The training increases reading speed, but reduces comprehension.

Table 5: Test 5 — Yellow after-only compare Tx and Control

Group	Tx Group		Control		P-value
	Mean	Std Err	Mean	Std Err	
Words read 1 min	503.00	36.9	274.75	16.7	0.0001
Words read 2 mins	961.77	76.7	539.05	32.4	0.0001
Special test	69.25	3.46	83.53	1.45	0.0007
Special Qs 1-8	64.20	4.53	83.13	3.77	0.0029
Special Qs 9-17	73.74	3.69	83.89	2.35	0.0263

1.8 Test 6: comparing Special reading test — Orange version, treatment versus control

The conclusions from Test 6 are consistent with those from the other tests. In this case, we cannot reject the null hypothesis that the comprehension scores are different in the treatment and control groups, although the sample averages in the control group are greater than the sample averages in the treatment group.

Table 6: Test 6 — Orange after-only compare Tx and Control

Group	Tx Group		Control		P-value
	Mean	Std Err	Mean	Std Err	
Words read 1 min	480.24	26.9	306.65	19.9	0.0000
Words read 2 mins	919.76	58.4	576.30	34.0	0.0001
Special test	63.87	3.92	69.41	2.98	0.2701
Special Qs 1-8	54.17	4.26	63.13	3.79	0.1253
Special Qs 9-17	72.49	4.38	75.00	4.10	0.6782

1.9 Within-subject analysis

Some people took the Standard test after training and the special test before training. Others did the reverse sequence, thereby allowing for differences in how easy the two tests were. We can control for this by using within-subject comparisons. For the subjects who took the Standard test in the morning and the Special test in the afternoon, we computed the raw difference and a ratio between the two scores. We then compared the differences and ratios of the treatment and control groups. The results are summarized in table 1.9. Consider the difference in the reading scores after one minute. The reading speed of the control group increased 56.80 words per minute on average. This is most likely due to a difference in the difficulty of the two readings. The difference in the treatment group is 259.61. Therefore we can conclude that the training increased reading speed by $259.61 - 56.80 = 202.81$ words per minute on average. Using the ratios after 1 minute, the control group read 1.30 times faster on the Special test than they did on the Standard test. Those who received speed-reading training read 2.29 times faster on the Special test than on the Standard test. The increase in reading speed is highly significant.

Table 7: Within-subject comparison of reading speed — Standard test as pre measure and Special test as post measure

Group	Tx Group		Control		P-value
	Mean	Std Err	Mean	Std Err	
Post-Pre (1 min)	259.51	19.52	56.80	11.08	0.0001
Post-Pre (2 mins)	461.19	43.03	69.25	15.70	0.0001
Post/Pre (1 min)	2.29	0.12	1.30	0.05	0.0001
Post/Pre (2 mins)	2.11	0.12	1.19	0.03	0.0001

1.10 Evaluating the role of guessing in comprehension

It is possible that subjects' performance on the comprehension test could have been inflated by guessing. People might have been able to determine the correct answer merely from the wording of the questions or from simply skimming the reading material.

After training the comprehension score on the Orange version was 53.17 (versus 81.06 before training). It is possible, however, that this 53.17 does not represent true comprehension but guessing. This can be evaluated as follows. If subjects guessed to achieve the 53.17 score, then they should have performed worse on the Yellow version for certain key comprehension questions. For these questions, answers that were correct for the Orange version would have been *incorrect* for the Yellow version.

Actually the scores on the key comprehension questions for the Yellow version were higher (72.73). Again, if people were guessing, they should have been the same or lower (see table 1.10). Guessing implies that people would have answered in the same way and this would have lowered their scores because what was correct had changed through the questions were the same. A parallel result was obtained with a treatment versus control comparison and is shown in the lower rows of the same table.

Table 8: Comparison of special reading test Orange versus Yellow versions for key comprehension questions

Group	Before		After		<i>P</i> -value
	Mean	Std Err	Mean	Std Err	
Before-After Orange version	81.06	2.96	53.17	5.59	0.0001
Yellow version	88.89	3.11	72.73	4.18	0.0037
After-only Orange version	53.17	5.59	63.33	4.93	0.1821
Yellow version	72.73	4.18	86.67	2.59	0.0076

2 Analysis of Kids Data

Summary statistics for the Kids data are given below. There were twelve subjects. Each subject did the following: took a test to measure reading speed and comprehension (pre-measure); participated in a program to improve their reading speed; and took a second test, different from the first one, to measure their reading speed and comprehension (post-measure). Two measurements of speed were recorded.

Both measures of speed increased, the first by 137 and the second by 272. Both of these increases are significantly different from zero². Observation 54 is extreme for both measures — it has value 439 for the first difference measure and 986 for the second. This extreme observation increases the means and also causes the distributions of the two difference measures to be non-normal³. After dropping observation 54, the distributions are more normally shaped and the difference is still significant at the .05 level. I also applied

²The differences were tested using a paired *t*-test and a two-tailed significance level of .05.

³The *t*-test used here assumes that the data come from a normal distribution. With such a small sample size it is important that this assumption be satisfied.

the signed-rank test to the data, which does not make any normality assumptions. The conclusions were the same — the reading program increases reading speed.

The difference between the comprehension scores is approximately 10, which is nearly significantly different from 0 $p = 0.0748$. Observation 22 is extreme on this measure — the comprehension score decreased by .3438 while the differences for all other subjects were between -0.0625 and 0.2813 . After dropping observation 22, the difference is significant at the .05 level. The conclusions from the signed-rank test were the same. The result is nearly significant at the .05 level.

The results of this study suggest that the reading program was effective in increasing both reading speed and comprehension. Because of the absence of the control group in this part of the study, further research is necessary.

Table 9: Results from kids data

Variable	N	Mean	Std Dev	P-Value	Sgn-Rank
Post-measure 1 speed	12	378.6667	144.5214		
Pre-measure 1 speed	12	241.7500	92.8069		
Diff speed measure 1	12	136.9167	112.0953	0.0014	0.0005
Diff w/o ob 54	11	109.4545	62.1842	0.0002	0.0010
Post-measure 2 speed	12	753.3333	303.7237		
Pre-measure 2 speed	12	481.2500	156.2179		
Diff speed measure 2	12	272.0833	270.5908	0.0051	0.0005
Diff w/o ob 54	11	207.1818	157.9246	0.0014	0.0010
Score on post-test	12	0.4010	0.1227		
Score on pre-test	12	0.3021	0.2290		
Difference score	12	0.0990	0.1742	0.0748	0.0684
Diff w/o ob 22	11	0.1392	0.1095	0.0018	0.0059