CHAPTER 4

RESULTS

A total of 98 studies that investigated the effectiveness of interventions on academic behaviors met the coding criteria and were included in this synthetic analysis.

A lag-1 autocorrelation analysis was conducted to determine the independence of effect sizes with different units. Lag-1 autocorrelation for effect sizes calculated from each pair of baseline-treatment phase (n=951) was larger than zero significantly ($r_{PEM} = .271$, p<.001; $r_{PND} = .293$, p<.001). Further, there was no lag-1 autocorrelation for the averaged effect sizes of each article ($r_{PEM} = -.127$, p=.216; $r_{PND} = .015$, p=.886, n=97). Hence, multiple effect sizes from an identical study were averaged into a new value to avoid autocorrelation. Table 2 lists the number, mean and standard deviation of effect sizes of each article.

TABLE 2

Effect Sizes Across Articles

	PEM			PND		Author's Judgment		
	N	M	SD	M	SD	N	M	SD
Ayllon & Robert (1974)	2	0.940	0.085	0.440	0.382	2	2.000	0.000
Babyak et al. (2000)	4	0.667	0.272	0.333	0.272	4	1.500	1.000
Billingsley (1977)	6	0.860	0.186	0.302	0.300	6	2.000	0.000
Blankenship & Baumgartner (1982)	33	0.838	0.284	0.838	0.284	33	1.818	0.465
Blick & Test (1987)	13	0.885	0.219	0.462	0.431	13	2.000	0.000
Bryant & Budd (1982)	9	0.798	0.213	0.628	0.334	9	1.556	0.882
Campbell et al. (1991)	4	0.929	0.143	0.366	0.423	4	2.000	0.000
Carr & Punzo (1993)	18	0.822	0.381	0.394	0.469	18	1.667	0.767
Case et al. (1992)	16	0.584	0.447	0.251	0.395	16	1.250	1.000
Chang (1993)	6	0.977	0.057	0.875	0.096	6	2.000	0.000
Chou & Jan (1995)	6	1.000	0.000	1.000	0.000	6	2.000	0.000
Chou & Lin (1996)	6	0.889	0.095	0.493	0.325	6	1.500	0.548
Christie et al. (1984)	2	0.900	0.000	0.750	0.212	2	2.000	0.000
Clark et al. (1984)	4	1.000	0.000	0.938	0.125	4	2.000	0.000
Copeland et al. (1974)	8	0.926	0.079	0.335	0.340	8	2.000	0.000
Coyne (1978)	16	0.688	0.375	0.229	0.398	5	2.000	0.000
Cushing & Kennedy (1997)	8	1.000	0.000	0.844	0.352	8	2.000	0.000
Davis & Hajicek (1985)	14	0.589	0.428	0.476	0.409	14	1.000	1.038

(Table continues)

TABLE 2

Effect Sizes Across Articles (Continued)

	PEM			PND		Author's Judgment		
	N	M	SD	M	SD	N	M	SD
De La Paz (1997)	3	1.000	0.000	1.000	0.000	3	2.000	0.000
Dugan et al. (1995)	6	0.944	0.136	0.944	0.136	6	2.000	0.000
Fantuzzo & Clement (1981)	36	0.883	0.259	0.783	0.362	36	1.667	0.756
Freeland & Noell (1999)	12	0.972	0.066	0.726	0.308	12	2.000	0.000
Freeman & McLaughlin (1984)	12	0.944	0.148	0.835	0.249	12	2.000	0.000
Gardill & Jitendra (1999)	12	0.875	0.311	0.708	0.450	12	1.833	0.577
Gillat (1994)	26	0.996	0.020	0.925	0.161	26	2.000	0.000
Glomb & West (1990)	4	0.500	0.346	0.050	0.100	4	2.000	0.000
Greenwood et al. (1987)	5	0.975	0.056	0.925	0.168	5	2.000	0.000
Gurney et al. (1990)	4	0.725	0.087	0.438	0.149	4	0.750	0.957
Hall, Lund, & Jackson (1968)	11	0.980	0.046	0.890	0.200	11	2.000	0.000
Hall, Panyan, Rabon, & Broden (1968)	2	1.000	0.000	1.000	0.000	2	2.000	0.000
Hallahan et al. (1981)	6	0.914	0.104	0.810	0.258	6	2.000	0.000
Harris (1986)	8	0.929	0.159	0.666	0.333	8	2.000	0.000
Harris & Graham (1985)	6	1.000	0.000	0.958	0.102	6	2.000	0.000
Harris et al. (1994)	16	0.953	0.075	0.627	0.293	16	2.000	0.000
Hasazi & Hasazi (1972)	2	0.785	0.106	0.355	0.502	2	2.000	0.000

(Table continues)

TABLE 2

Effect Sizes Across Articles (Continued)

	PEM			PND		Author's Judgment		
	N	M	SD	M	SD	N	M	SD
Hay et al. (1977)	6	0.848	0.287	0.714	0.452	6	1.333	1.033
Higgins & Boone (1990)	5	0.700	0.200	0.580	0.249	5	2.000	0.000
Houten & Houten (1977)	3	1.000	0.000	0.525	0.471	3	2.000	0.000
Houten et al. (1975)	4	0.783	0.435	0.732	0.489	4	1.250	0.957
Howell et al. (1987)	6	0.803	0.195	0.320	0.295	6	2.000	0.000
Humphrey & Karoly (1978)	2	1.000	0.000	0.200	0.283	2	2.000	0.000
Idol (1987)	7	0.871	0.168	0.562	0.326	7	2.000	0.000
Jolivette et al. (2001)	9	0.748	0.311	0.709	0.324	9	1.444	0.882
Joseph & Cooper (1991)	15	0.984	0.043	0.951	0.097	15	2.000	0.000
Kemps et al. (1994)	6	0.724	0.365	0.281	0.329	6	2.000	0.000
Kemps et al. (1995)	10	0.919	0.126	0.630	0.367	10	1.800	0.632
Kelley & Stokes (1982)	14	0.933	0.138	0.466	0.460	14	2.000	0.000
Kern et al. (1994)	3	1.000	0.000	0.713	0.497	3	2.000	0.000
Kirby & Shields (1972)	4	1.000	0.000	0.950	0.100	4	2.000	0.000
Kirby et al. (1981)	9	1.000	0.000	1.000	0.000	9	2.000	0.000
Knapczyk (1989)	9	0.907	0.169	0.629	0.388	9	2.000	0.000
Knapczyk & Livingston (1973)	2	0.980	0.028	0.774	0.246	2	2.000	0.000
Knapczyk, & Livingston (1974)	9	1.000	0.000	0.774	0.253	9	2.000	0.000

(Table continues)

TABLE 2

Effect Sizes Across Articles (Continued)

	PEM			PND		Author's Judgment		
	N	M	SD	M	SD	N	M	SD
Kraetsch (1981)	4	1.000	0.000	1.000	0.000	4	2.000	0.000
Lahey et al. (1973)	8	0.690	0.404	0.525	0.454	8	1.000	1.069
Lane et al. (2001)	9	0.916	0.112	0.699	0.335	9	2.000	0.000
Lenz & Hughes (1990)	24	0.584	0.475	0.427	0.486	24	1.167	1.007
Levendoski & Cartledge (2000)	14	0.929	0.267	0.876	0.304	14	1.857	0.535
Lin (1995)	30	0.725	0.265	0.454	0.268	30	1.367	0.928
Lloyd et al. (1982)	6	0.578	0.350	0.200	0.223	6	0.167	0.408
Lovitt & Hansen (1976)	3	0.719	0.132	0.579	0.091	3	2.000	0.000
Lu (2000)	3	1.000	0.000	1.000	0.000	3	2.000	0.000
Maheady et al. (1987)	26	0.967	0.062	0.792	0.269	26	2.000	0.000
Maki et al. (2002)	6	0.920	0.104	0.633	0.315	6	1.833	0.408
Martin & Manno (1995)	3	1.000	0.000	0.500	0.500	3	1.667	0.577
McDowell & Keenan (2001)	9	0.840	0.347	0.840	0.347	9	2.000	0.000
McGinnis et al. (1999)	9	0.889	0.236	0.667	0.441	9	1.667	0.500
McWhirter & Bloom (1994)	6	0.945	0.135	0.583	0.492	6	2.000	0.000
Miller & Kelley (1994)	16	0.979	0.083	0.759	0.320	16	2.000	0.000
Miller et al. (2003)	6	0.655	0.193	0.183	0.190	6	0.000	0.000
Miller et al. (1989)	5	0.950	0.068	0.950	0.068	5	2.000	0.000
Montague (1992)	12	0.764	0.320	0.528	0.421	12	1.333	0.985

(Table continues)

TABLE 2

Effect Sizes Across Articles (Continued)

	PEM			PND		Author's Judgment		
	N	M	SD	M	SD	N	M	SD
Montague & Bos (1986)	12	0.967	0.062	0.770	0.305	12	1.750	0.452
Newby et al. (1989)	10	0.655	0.210	0.366	0.270	8	1.125	0.991
Noell et al. (2000)	5	0.954	0.043	0.742	0.415	5	2.000	0.000
Noell et al. (1998)	7	0.619	0.394	0.486	0.410	7	0.571	0.787
Olympia et al. (1994)	29	0.647	0.297	0.306	0.369	29	1.035	1.017
O'Shaughnessy & Swanson (2000)	6	1.000	0.000	1.000	0.000	6	2.000	0.000
Pigott et al. (1986)	6	1.000	0.000	0.933	0.163	6	2.000	0.000
Prater et al. (1991)	4	0.875	0.250	0.688	0.375	4	1.500	1.000
Rivera & Smith (1988)	16	0.899	0.167	0.741	0.348	16	2.000	0.000
Roberts et al. (1987)	9	0.989	0.033	0.956	0.073	9	2.000	0.000
Robinson et al. (1981)	5	0.677	0.310	0.631	0.319	3	2.000	0.000
Rooney et al. (1985)	4	1.000	0.000	0.854	0.172	4	2.000	0.000
Rooney et al. (1984)	8	0.975	0.071	0.790	0.253	8	2.000	0.000
Salend & Nowak (1988)	3	1.000	0.000	0.933	0.115	3	2.000	0.000
Schumaker et al. (1977)	7	0.977	0.050	0.819	0.095	7	1.857	0.378
Stevenson & Fantuzzo (1984)	8	0.971	0.082	0.720	0.233	8	2.000	0.000
Stevenson & Fantuzzo (1986)	48	0.951	0.112	0.766	0.279	48	1.958	0.202

(Table continues)

TABLE 2

Effect Sizes Across Articles (Continued)

	PEM			PND		Author's Judgment		
	N	M	SD	M	SD	N	M	SD
Swanson (1981)	18	0.721	0.357	0.534	0.402	18	1.556	0.856
Thorpe et al. (1981)	2	1.000	0.000	1.000	0.000	2	2.000	0.000
Trammel et al. (1994)	8	1.000	0.000	0.938	0.133	8	2.000	0.000
Trap et al. (1978)	12	0.759	0.199	0.503	0.311	12	1.833	0.577
Weinstein & Cooke (1992)	4	0.970	0.043	0.889	0.167	4	2.000	0.000
Wolfe et al. (1986)	8	0.983	0.050	0.781	0.247	8	2.000	0.000
Wood et al. (1998)	18	1.000	0.000	1.000	0.000	18	2.000	0.000
Wood et al. (2002)	24	0.997	0.014	0.818	0.331	24	2.000	0.000
Wu (2001)	3	0.819	0.203	0.683	0.072	3	2.000	0.000

Note. The number of PND scores are the same as that of PEM scores.

Theoretically, a researcher can introduce the treatment phase only after the observations in the baseline phase are stable. If a treatment had no effect, the observations in the treatment phase would extend the stability of the observations of the baseline phase, and fluctuate around the median of the observations. Therefore, the probability of the data points being above the median of the treatment phase under the null hypothesis (i.e., the treatment has no effect) will be .5.

To decide whether a behavioral modification affects academic behaviors, the t-test

for a single sample（Pagano, 2001）was conducted. The mean of 98 PEM scores ($\overline{X}_{PEM} = 0.8808$, $SD_{PEM} = 0.1309$) was compared with the probability of 0.5.

$$t = \frac{ES - .5}{\frac{SD}{\sqrt{N}}} = \frac{.8808 - .5}{.01323} = 28.79$$

The result shows that averaged differences for the PEM deviate from 0.5 significantly ($t_{97} = 28.79, p < .001$). That is, behavioral modification has vital influence on academic behaviors. The same result was obtained when comparing the mean of 98 PND scores ($\overline{X}_{PND} = 0.6729$, $SD_{PND} = 0.2390$) with zero ($t_{97} = 27.87, p < .001$).

Characteristics of Study

The 98 studies included a total of 850 participants. 54% of the participants specified by their sex, 321 males and 138 females. The remaining 46% of the participants did not specify their sex.

The educational level of the participants was divided into preschool, elementary school, middle school, high school, and college levels. There were 113 participants did not be specified their educational level. Of the remaining 737 participants, most participants were elementary school students (78.29%), followed by middle school students (13.70%).

In addition, there were 173 participants did not be specified their diagnosis. Of the remaining 677 participants, 336 participants had been formally diagnosed as having learning difficulties, 83 with behavioral disorder, 26 with Attention Deficit Hyperactivity Disorder, 14 with emotional disturbance, and 8 with Autism.

TABLE 3

Participant Characteristics

Variable	N	Percent
Sex		
Male	321	69.93
Female	138	30.07
Total	459	100.00
Level of Education		
Preschool	3	0.41
Elementary School	577	78.29
Middle School	101	13.70
High School	40	5.43
College	16	2.17
Total	737	100.00

(Table continues)

TABLE 3

Participant Characteristics (Continued)

Variable	N	Percent
Classification		
Attention Deficit Hyperactivity Disorder	26	3.84
Autism	8	1.18
Behavioral Disorder	83	12.26
Emotional Disturbance	14	2.07
Learning Difficulties	336	49.63
Normal	210	31.02
Total	677	100.00

The settings in which the instruction occurred are described in Table 4. Almost all interventions took place in schools (84.69%), followed by interventions in institutions such as in a psycho-educational center, a mental health facility, or a clinic (10.21%) and home (3.06%). Two of the studies were carried out in both schools and homes (Stevenson & Fantuzzo, 1984; Stevenson & Fantuzzo, 1986).

The interventions were delivered in various different subject courses, a breakdown of academic subjects appears as Table 4. Language is the major subject supplying the context for the modification, at 61.22%, followed by mathematics at 38.78%. In addition, 5.10%, 2.04%, and 1.02% of the studies were conducted in social science,

science and educational psychology courses respectively.

Primary intervenors were classified as parent, peer, teacher (including tutor and principal), and researcher or experimenter. Most intervenors were teachers, tutors or principals (53.06%), followed by researchers or experimenters (30.61%), peers (14.29%), and parents (2.04%).

TABLE 4

Context Characteristics

Variable	N	Percent
Setting		
Home	3	3.06
Institution	10	10.21
School	83	84.69
Both Home and School	2	2.04
Total	98	100.00
Academic Subjects		
Educational Psychology	1	1.02
Language	60	61.22
Math	38	38.78
Science	2	2.04
Social Science	5	5.10
Total	106	108.16

(Table continues)

TABLE 4

Context Characteristics (Continued)

Variable	N	Percent
Intervenor		
Parent	2	2.04
Peer	14	14.29
Researcher/ Experimenter	30	30.61
Teacher/ Tutor/ Principal	52	53.06
Total	98	100.00

Note. The total percentage is more than 100 because 12 of 98 studies combined multiple academic subjects.

Reliability

To calculate the reliability of the coding procedure, 25 studies were selected as a random sample from the 98 studies by using a table of random numbers. The reliability of all coded variables between raters was 94.45%. In addition, the reliability of coding on the PEM scores, the PND scores, and ratings of original authors' judgments were 96.17%, 97.13%, and 89.95% respectively.

Validity

The Spearman rank order correlation coefficient was used as the index of validity because the rating from the original authors' judgments are of ordinal scaling. As

shown in Table 5, the values under the diagonal represent the correlations among PEM, PND, and ratings of the original authors' judgments with a single article as a unit for calculation. In addition, the values above the diagonal represent the correlations that were generated with a single pair of baseline-treatment as a unit of measurement. Results show that both the PEM and PND scores correlate with the ratings of judgments of primary authors significantly and the correlation coefficient between the PEM and the conclusions reached by original authors is higher than that between the PND and the authors' judgments. This finding demonstrates that the validity of the PEM is acceptable.

TABLE 5

Correlation Coefficient Matrix

	Author's Judgment	PND Score	PEM Score
Author's Judgment	_	.472*** (N=937)	.586*** (N=937)
PND Score	.442*** (N=98)	_	.628*** (N=952)
PEM Score	.610*** (N=98)	.729*** (N=98)	_

Note. The correlation coefficient between the PEM and PND scores are Pearson r because both the PEM and PND scores are of interval scaling. Others are *Spearman correlation coefficient* because ratings of the original authors' judgments are of ordinal scaling.

*** p<.001

The Influence of Orthogonal Slope Changes and Outliers

A total of 158 sets of data comprised two pairs of effect sizes in a reversal design (ABAB). To detect orthogonal slope changes, all the second pairs of baseline-treatment phases were examined. There were only 4 figures that displayed orthogonal slope changes in the second pair of baseline-treatment phases, i.e., in Figure 1 of the study conducted by Hasazi and Hasazi (1972); Figure 2 of the study by Howell, Sidorenko, and Jurica (1987); Figure 1 of the study by Lahey, McNees, and Brown (1973); and in a graph for subject 2 in Figure 1 of the study by Olympia, Sheridan, Jenson, and Andrews (1994). This finding indicates that the appearance of orthogonal slope changes is not an acute problem.

67 of 952 effect sizes were underestimated by the PND method owing to the influence of outliers that appeared in the baseline. After eliminating the influence of outliers from the raw data, a test of the Spearman rank order correlation was repeated. As shown in Table 6, the correlation coefficient between the PND and the conclusions reached by original authors is 0.674. Compared with the previous result ($r = .472$, $p < .001$), the validity of the PND increased. In addition, the correlation coefficient between the PEM and the conclusions reached by original authors is still higher than that between the PND and the authors' judgments. These results indicate that the PEM approach is appropriate for the task required of it.

TABLE 6

Correlation Coefficient Matrix for No Influence of Outliers

	Author's Judgment	PND Score	PEM Score
Author's Judgment	_		
PND Score	.674*** (N=870)	_	
PEM Score	.779*** (N=870)	.717*** (N=885)	_

Note. The correlation coefficient between the PEM and PND scores are Pearson r because both the PEM and PND scores are of interval scaling. Others are *Spearman correlation coefficient* because ratings of the original authors' judgments are of ordinal scaling.

*** p<.001

Judgment Criteria of Effectiveness

To set up the interpretative criteria of the PEM scores, the judgments of primary authors were classified into three subcategories: ineffective, partially effective, and effective outcomes. Then, the PEM and PND scores within each subcategories were averaged. Results show that the mean of PEM scores corresponding to ineffective outcomes is 0.3495 (n=101); the mean of PEM scores corresponding to partially effective outcomes is 0.7947 (n=26); and the mean of PEM scores corresponding to effective outcomes is 0.9404 (n=810). According to the criteria of the PND scores

proposed by Scruggs & Mastropieri (1994), an intervention is partially effective while the PND score is between 0.5 and .90. However, in Table 7, the mean of PND scores corresponding to partially effective outcomes is 0.4901 and the mean of PND scores corresponding to marked effect is 0.753. It was found that the fit of the PEM with the criteria was better than that of the PND.

TABLE 7

Interpretative Criteria

Author's Judgment	N	Mean of PEM	Mean of PND	Scruggs & Mastropieri (1994)
Ineffective	101	0.3495	0.1213	Below .50
Partially Effective	26	0.7947	0.4901	.50-.90
Effective	810	0.9404	0.753	Above .90

The 98 studies yielded 952 effect sizes that were calculated from each pair of baseline-treatment phases. The mean of 952 PEM scores is 86.71% with a standard deviation of 25.16%, which demonstrates moderate effectiveness of treatments.

More detailed information on effect sizes of all relevant coded variables is reported in Table 8 and findings are described as follows.

TABLE 8

Effect Sizes by Study Characteristics

	PEM			PND		Author' s Judgment		
	N	M	SD	M	SD	N	M	SD
Overall Effect								
With Article as Unit	98	0.881	0.131	0.673	0.239	98	1.792	0.402
With Pair of Baseline-treatments as Unit	952	0.867	0.252	0.669	0.376	937	1.757	0.633
Academic Behavior (Dependent Variable)								
Engagement	237	0.894	0.241	0.694	0.378	237	1.734	0.665
Achievement	715	0.858	0.254	0.660	0.375	700	1.764	0.622
Intervention (Independent Variable)								
Computer Assisted Instruction	11	0.756	0.195	0.438	0.295	11	2.000	0.000
Cooperative Learning	137	0.844	0.258	0.592	0.408	124	1.758	0.655
Mastery Learning	37	0.917	0.204	0.862	0.246	37	2.000	0.000
Reinforcement	162	0.915	0.191	0.699	0.361	162	1.827	0.530
Both	27	0.804	0.331	0.698	0.382	27	1.333	0.920
Material	59	0.940	0.139	0.611	0.393	59	1.949	0.222
Social	76	0.936	0.142	0.768	0.315	76	1.908	0.406

(Table continues)

TABLE 8

Effect Sizes by Study Characteristics (Continued)

	PEM			PND		Author' s Judgment		
	N	M	SD	M	SD	N	M	SD
Self-control Training	278	0.897	0.242	0.692	0.377	278	1.817	0.556
Package	41	0.927	0.190	0.728	0.342	41	1.951	0.218
Self-instruction	62	0.847	0.292	0.693	0.400	62	1.694	0.692
Self-monitoring	157	0.897	0.242	0.654	0.384	157	1.809	0.579
Self-Reinforcement	18	1.000	0.000	0.933	0.168	18	2.000	0.000
Situated Learning	12	0.800	0.220	0.383	0.412	12	1.000	1.044
Social Learning	40	0.855	0.251	0.636	0.361	40	1.700	0.723
Strategy Instruction	251	0.820	0.290	0.660	0.369	249	1.651	0.731
Meta-cognitive Strategy	25	0.958	0.096	0.822	0.270	25	1.960	0.200
Problem-solving	96	0.838	0.289	0.750	0.350	96	1.677	0.688
Question-asking	18	0.954	0.125	0.702	0.327	18	2.000	0.000
Reading Comprehension	70	0.756	0.254	0.498	0.317	68	1.485	0.855
Word Recognition	42	0.744	0.406	0.608	0.457	42	1.524	0.862
Others	24	0.851	0.270	0.733	0.367	24	1.667	0.702

(Table continues)

TABLE 8

Effect Sizes by Study Characteristics (Continued)

	PEM			PND		Author' s Judgment		
	N	M	SD	M	SD	N	M	SD
Sex								
Female	109	0.894	0.195	0.697	0.346	108	1.833	0.538
Male	472	0.873	0.243	0.660	0.380	469	1.759	0.630
Educational Level								
Preschool	9	0.798	0.213	0.628	0.334	9	1.556	0.882
Elementary School	609	0.880	0.232	0.702	0.361	605	1.770	0.613
Middle School	210	0.862	0.279	0.650	0.385	210	1.729	0.676
High School	80	0.894	0.185	0.603	0.386	80	1.900	0.377
College	16	0.688	0.375	0.229	0.398	5	2.000	0.000
Subject Classification								
Attention Deficit	31	0.786	0.304	0.672	0.361	29	1.552	0.736
Hyperactivity Disorder								
Autism	16	0.832	0.255	0.524	0.400	16	1.875	0.500
Behavioral Disorder	145	0.878	0.252	0.671	0.391	145	1.745	0.664
Emotional Disturbance	48	0.811	0.321	0.569	0.435	48	1.479	0.875
Learning Difficulties	570	0.869	0.248	0.686	0.364	568	1.762	0.627
Normal	120	0.878	0.239	0.636	0.396	109	1.853	0.487

(Table continues)

TABLE 8

Effect Sizes by Study Characteristics (Continued)

	PEM			PND		Author' s Judgment		
	N	M	SD	M	SD	N	M	SD
Academic Subject								
Psychology	16	0.688	0.375	0.229	0.398	5	2.000	0.000
Language	383	0.847	0.260	0.627	0.376	379	1.723	0.670
Math	430	0.873	0.256	0.712	0.367	430	1.740	0.649
Science	12	1.000	0.000	0.879	0.249	12	2.000	0.000
Social Science	20	0.883	0.192	0.683	0.385	20	1.900	0.447
Setting								
Home	60	0.968	0.146	0.843	0.249	60	1.983	0.129
Institution	110	0.816	0.294	0.657	0.382	110	1.618	0.766
School	782	0.867	0.250	0.657	0.380	767	1.759	0.630
Intervenor								
Parent	23	0.979	0.073	0.777	0.270	23	1.957	0.209
Peer	131	0.837	0.262	0.573	0.407	118	1.746	0.669
Researcher	282	0.850	0.257	0.664	0.369	282	1.702	0.667
Teacher	516	0.879	0.250	0.691	0.372	514	1.780	0.615

Note. The number of PND scores are the same as the number of PEM scores.

Academic Behaviors

The studies inquired into various academic behaviors, which in this study were aggregated into two groups (i.e., academic engagement and academic achievement). As indicated in Table 8, both target behaviors were improved by interventions (mean PEM of academic engagement is 0.894 and mean PEM of academic achievement is 0.858).

Interventions

A variety of interventions employed for enhancing academic behaviors were classified into one of the following categories: (a) computer assisted instruction; (b) cooperative learning including reciprocal peer tutoring; (c) mastery learning such as repeated reading and drill; (d) reinforcement, involving the use of social reinforcers such as giving praise and attention, the use of material reinforcers such as candy, mechanical pencils, yo-yos, and stickers, and the use of both social and material reinforcers; (e) self-control training, which comprised self-control packages, self-instruction, self-monitoring, and self-reinforcement; (f) situated learning (e.g., student-operated business curriculum and functional writing); (g) social learning; (h) strategy instruction, which comprised meta-cognitive strategies (including self-questioning strategies, underlining strategies, and visual imagery strategies),

reading comprehension (including story mapping), problem-solving, question-asking, and word recognition (e.g., phonological awareness and word identification); and (i) others (e.g., extinction, public posting, and self-selected seatwork assignments).

More detailed descriptions about operational procedures of the independent variable are summarized as Table 9.

TABLE 9

Operational Procedures of the Independent Variable

Independent Variable	Operational Procedures
Computer Assisted Instruction	The procedures consisted student training in the operation of the computer and a instructional period that students worked with the hypertext study guide or involved a drill-and-practice mathematics program (students race against time to answer randomly generated problems) and a tutorial-based software package with teacher intervention (students were taught an algorithmic approach to problem solution)

(Table continues)

TABLE 9

Operational Procedures of the Independent Variable (Continued)

Independent Variable	Operational Procedures
Cooperative Learning	Peer tutoring or cooperative learning procedures (each student was assigned to a team role: coach, scorekeeper, referee, and manager; group activities consisted of distribution of materials tubs, peer tutoring, team activity utilizing either a worksheet or a research activity and a whole-class activity)
Mastery Learning	Repeated practice, error-correction procedures (students listened to an audiotaped model of passage and were instructed to reread the passage until they met the specified criterion)
Reinforcement	Contingent reward
Self-control Training	Students were taught the tasks of the self-control components such as self-monitoring, self-evaluation, self-instruction, and self-reinforcement and the appropriate sequencing of these components

(Table continues)

TABLE 9

Operational Procedures of the Independent Variable (Continued)

Independent Variable	Operational Procedures
Situated Learning	Students were exposed to authentic learning activities such as a math curriculum centered around a student-operated business that was used as the context for presenting the math problems or a functional writing (students actually wrote a minimum of five sentences as a letter and mailed it to soldiers)
Social Learning	By watching the actions of others and observing the consequences, students learned some behavior patterns
Strategy Instruction	Treatment consisted of strategy acquisition training, which included demonstration and guided practice, testing and corrective feedback

Analysis of PEM scores revealed that all interventions have positive effects on academic behaviors. Of all interventions, mastery learning, reinforcement, and self-control training yield more obvious effectiveness (see Table 8). Moreover, two subcategories of self-control training, i.e., self-control packages and self-reinforcement and two subcategories of strategy instruction, i.e., meta-cognitive strategies and question-asking have extremely high effects on target behaviors, their mean PEM scores being all above 0.9.

Other Study Characteristics

Table 8 also provides descriptive information on mean effect sizes by participants characteristics (i.e., sex, educational level, and classification) and context characteristics (i.e., academic subjects, intervenors, and settings). Overall, outcomes appeared to be relatively consistent across different levels of these variables. Only the mean of PEM scores associated with participants in colleges and a psychology course were lower ($\overline{X}_{PEM} = 0.688$), and nothing that their data source came from the same investigation of Coyne (1978). Furthermore, the mean of PEM scores associated with home settings and parents as intervenors was above .90.

Interaction Effects between the Academic Behaviors and Interventions

For academic engagement, some subcategories of interventions (i.e., computer assisted instruction, cooperative learning, mastery learning, reinforcement, and self-control training) have notable effects. The average effect sizes of computer assisted instruction, cooperative learning, reinforcement, and self-control training were higher for academic engagement than for academic achievement (see Table 10). But the average effect size of social learning on academic engagement was only .65. That is, social learning has a weaker relationship with participants' academic engagement. The effectiveness of mastery learning, strategy instruction, and other

interventions on academic engagement are similar to that on academic achievement.

For academic achievement, mastery learning and social learning were extreme effective interventions. The mean of PEM scores were .91 and .942 respectively. In addition, computer assisted instruction, cooperative learning, reinforcement, self-control training, and strategy instruction have moderate influence on academic achievement (see Table 10).

TABLE 10

Interaction Effect Sizes of the Academic Behaviors and Interventions

	PEM			PND		Author' s Judgment		
	N	M	SD	M	SD	N	M	SD
Academic Engagement								
Computer Assisted Instruction	2	1.000	0.000	0.334	0.472	2	2.000	0.000
Cooperative Learning	8	1.000	0.000	0.844	0.352	8	2.000	0.000
Mastery Learning	3	1.000	0.000	1.000	0.000	3	2.000	0.000
Reinforcement	46	0.980	0.063	0.837	0.285	46	1.935	0.327
Self-control Training	116	0.903	0.227	0.688	0.375	116	1.819	0.569
Situated Learning	12	0.800	0.220	0.383	0.412	12	1.000	1.044
Social Learning	12	0.650	0.353	0.450	0.436	12	1.000	1.044
Strategy Instruction	31	0.818	0.348	0.600	0.396	31	1.419	0.886
Others	10	0.823	0.321	0.788	0.342	10	1.700	0.675

(Table continues)

TABLE 10

Interaction Effect Sizes of the Academic Behaviors and Interventions (Continued)

	PEM			PND		Author' s Judgment		
	N	M	SD	M	SD	N	M	SD
Academic Achievement								
Computer Assisted Instruction	9	0.701	0.171	0.461	0.278	9	2.000	0.000
Cooperative Learning	129	0.835	0.263	0.577	0.407	116	1.741	0.674
Mastery Learning	34	0.910	0.211	0.849	0.253	34	2.000	0.000
Reinforcement	116	0.889	0.217	0.645	0.374	116	1.785	0.587
Self-control Training	162	0.893	0.253	0.694	0.379	162	1.815	0.549
Situated Learning	_	_	_	_	_	_	_	_
Social Learning	28	0.942	0.116	0.715	0.298	28	2.000	0.000
Strategy Instruction	220	0.820	0.281	0.668	0.366	218	1.684	0.703
Others	14	0.870	0.238	0.693	0.392	14	1.643	0.745

Note. The number of PND scores are the same as the number of PEM scores.