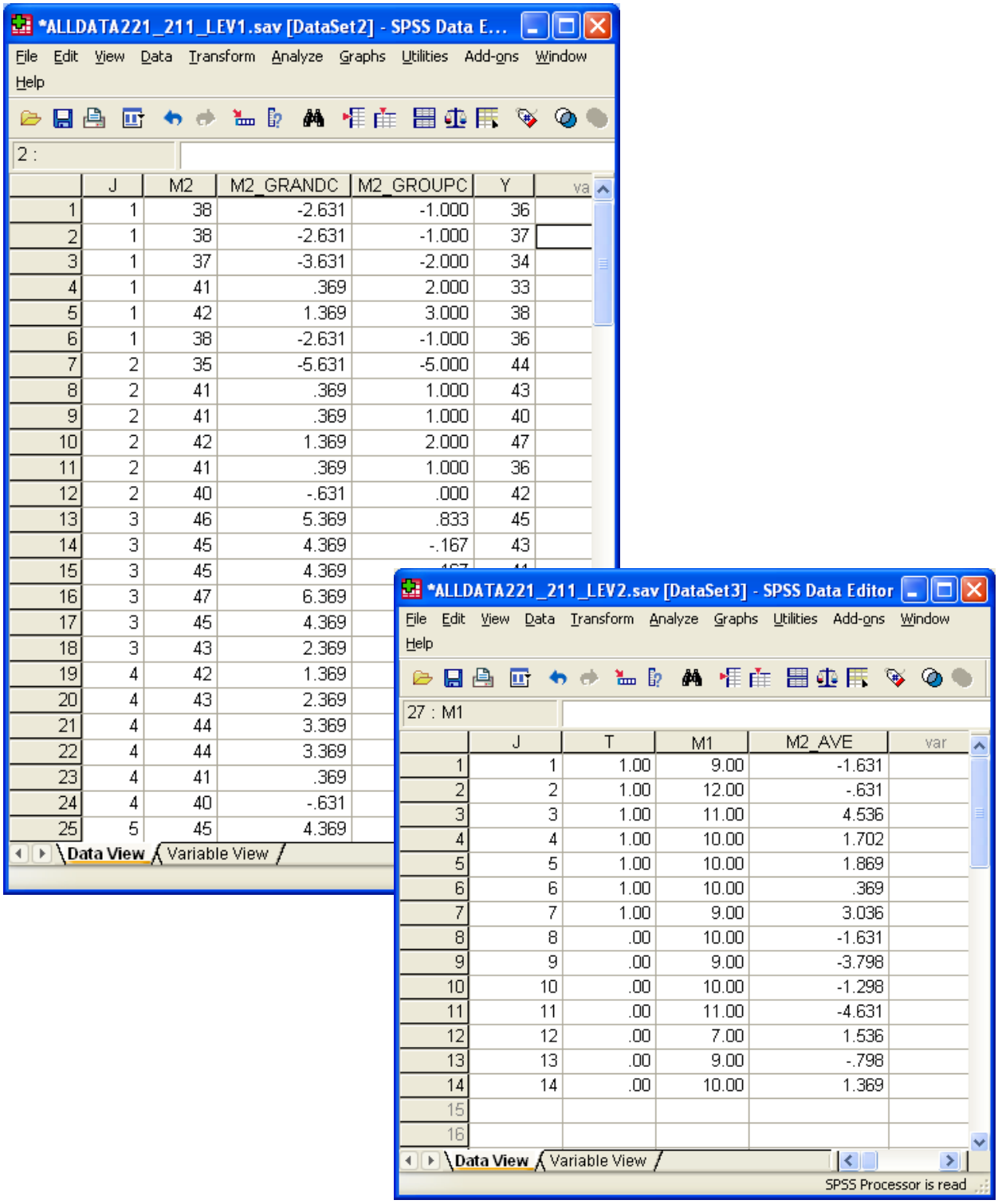
Example data set for cluster randomized experiment

School	*Indiv*	*Treat*	*Tchr_imp*	*Child knowledge of socio-emotional*				*Behavior*
J	ID	T	M1	M2	M2_GrandC	M2_GroupC	M2_ave	Y
1	1	1	9	38	-2.631	-1.000	-1.631	36
1	2	1	9	38	-2.631	-1.000	-1.631	37
1	3	1	9	37	-3.631	-2.000	-1.631	34
1	4	1	9	41	0.369	2.000	-1.631	33
1	5	1	9	42	1.369	3.000	-1.631	38
1	6	1	9	38	-2.631	-1.000	-1.631	36
2	7	1	12	35	-5.631	-5.000	-0.631	44
2	8	1	12	41	0.369	1.000	-0.631	43
2	9	1	12	41	0.369	1.000	-0.631	40
2	10	1	12	42	1.369	2.000	-0.631	47
2	11	1	12	41	0.369	1.000	-0.631	36
2	12	1	12	40	-0.631	0.000	-0.631	42
3	13	1	11	46	5.369	0.833	4.536	45
3	14	1	11	45	4.369	-0.167	4.536	43
3	15	1	11	45	4.369	-0.167	4.536	41
3	16	1	11	47	6.369	1.833	4.536	44
3	17	1	11	45	4.369	-0.167	4.536	40
3	18	1	11	43	2.369	-2.167	4.536	39
4	19	1	10	42	1.369	-0.333	1.702	39
4	20	1	10	43	2.369	0.667	1.702	41
4	21	1	10	44	3.369	1.667	1.702	42
4	22	1	10	44	3.369	1.667	1.702	41
4	23	1	10	41	0.369	-1.333	1.702	39
4	24	1	10	40	-0.631	-2.333	1.702	36
5	25	1	10	45	4.369	2.500	1.869	41
5	26	1	10	46	5.369	3.500	1.869	42
5	27	1	10	42	1.369	-0.500	1.869	37
5	28	1	10	40	-0.631	-2.500	1.869	36
5	29	1	10	39	-1.631	-3.500	1.869	34
5	30	1	10	43	2.369	0.500	1.869	40
6	31	1	10	43	2.369	2.000	0.369	37
6	32	1	10	41	0.369	0.000	0.369	38
6	33	1	10	40	-0.631	-1.000	0.369	35
6	34	1	10	41	0.369	0.000	0.369	36
6	35	1	10	42	1.369	1.000	0.369	36
6	36	1	10	39	-1.631	-2.000	0.369	35
7	37	1	9	46	5.369	2.333	3.036	38
7	38	1	9	43	2.369	-0.667	3.036	35
7	39	1	9	45	4.369	1.333	3.036	32
7	40	1	9	44	3.369	0.333	3.036	39
7	41	1	9	44	3.369	0.333	3.036	38
7	42	1	9	40	-0.631	-3.667	3.036	36

Example data set for cluster randomized experiment (continued)

School	*Indiv*	*Treat*	*Tchr_imp*	*Child knowledge of socio-emotional*				*Behavior*
J	ID	T	M1	M2	M2_GrandC	M2_GroupC	M2_ave	Y
8	43	0	10	37	-3.631	-2.000	-1.631	36
8	44	0	10	38	-2.631	-1.000	-1.631	37
8	45	0	10	40	-0.631	1.000	-1.631	37
8	46	0	10	41	0.369	2.000	-1.631	40
8	47	0	10	38	-2.631	-1.000	-1.631	33
8	48	0	10	40	-0.631	1.000	-1.631	38
9	49	0	9	40	-0.631	3.167	-3.798	35
9	50	0	9	33	-7.631	-3.833	-3.798	28
9	51	0	9	36	-4.631	-0.833	-3.798	32
9	52	0	9	40	-0.631	3.167	-3.798	32
9	53	0	9	36	-4.631	-0.833	-3.798	27
9	54	0	9	36	-4.631	-0.833	-3.798	30
10	55	0	10	38	-2.631	-1.333	-1.298	39
10	56	0	10	38	-2.631	-1.333	-1.298	40
10	57	0	10	41	0.369	1.667	-1.298	38
10	58	0	10	42	1.369	2.667	-1.298	38
10	59	0	10	39	-1.631	-0.333	-1.298	34
10	60	0	10	38	-2.631	-1.333	-1.298	39
11	61	0	11	31	-9.631	-5.000	-4.631	26
11	62	0	11	41	0.369	5.000	-4.631	33
11	63	0	11	37	-3.631	1.000	-4.631	33
11	64	0	11	36	-4.631	0.000	-4.631	37
11	65	0	11	33	-7.631	-3.000	-4.631	25
11	66	0	11	38	-2.631	2.000	-4.631	32
12	67	0	7	42	1.369	-0.167	1.536	31
12	68	0	7	43	2.369	0.833	1.536	39
12	69	0	7	41	0.369	-1.167	1.536	34
12	70	0	7	43	2.369	0.833	1.536	30
12	71	0	7	41	0.369	-1.167	1.536	36
12	72	0	7	43	2.369	0.833	1.536	41
13	73	0	9	42	1.369	2.167	-0.798	30
13	74	0	9	40	-0.631	0.167	-0.798	39
13	75	0	9	37	-3.631	-2.833	-0.798	31
13	76	0	9	37	-3.631	-2.833	-0.798	33
13	77	0	9	42	1.369	2.167	-0.798	34
13	78	0	9	41	0.369	1.167	-0.798	40
14	79	0	10	42	1.369	0.000	1.369	29
14	80	0	10	45	4.369	3.000	1.369	35
14	81	0	10	43	2.369	1.000	1.369	38
14	82	0	10	41	0.369	-1.000	1.369	39
14	83	0	10	40	-0.631	-2.000	1.369	34
14	84	0	10	41	0.369	-1.000	1.369	31

SPSS screen shots of two separate datasets used to build MDM file for HLM



*ALLDATA221_211_LEV1.sav [DataSet2] - SPSS Data E...

File Edit View Data Transform Analyze Graphs Utilities Add-ons Window Help

2 :

	J	M2	M2_GRANDC	M2_GROUPC	Y	va
1	1	38	-2.631	-1.000	36	
2	1	38	-2.631	-1.000	37	
3	1	37	-3.631	-2.000	34	
4	1	41	.369	2.000	33	
5	1	42	1.369	3.000	38	
6	1	38	-2.631	-1.000	36	
7	2	35	-5.631	-5.000	44	
8	2	41	.369	1.000	43	
9	2	41	.369	1.000	40	
10	2	42	1.369	2.000	47	
11	2	41	.369	1.000	36	
12	2	40	-.631	.000	42	
13	3	46	5.369	.833	45	
14	3	45	4.369	-.167	43	
15	3	45	4.369			
16	3	47	6.369			
17	3	45	4.369			
18	3	43	2.369			
19	4	42	1.369			
20	4	43	2.369			
21	4	44	3.369			
22	4	44	3.369			
23	4	41	.369			
24	4	40	-.631			
25	5	45	4.369			

Data View Variable View

*ALLDATA221_211_LEV2.sav [DataSet3] - SPSS Data Editor

File Edit View Data Transform Analyze Graphs Utilities Add-ons Window Help

27 : M1

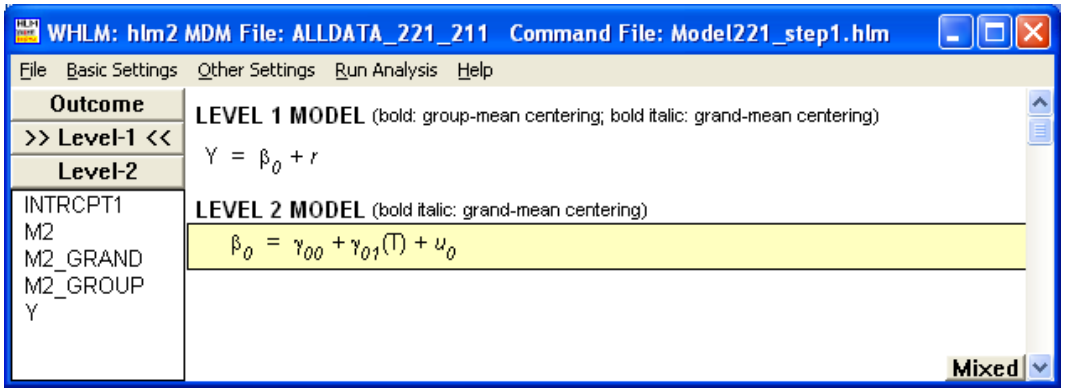
	J	T	M1	M2_AVE	var
1	1	1.00	9.00	-1.631	
2	2	1.00	12.00	-.631	
3	3	1.00	11.00	4.536	
4	4	1.00	10.00	1.702	
5	5	1.00	10.00	1.869	
6	6	1.00	10.00	.369	
7	7	1.00	9.00	3.036	
8	8	.00	10.00	-1.631	
9	9	.00	9.00	-3.798	
10	10	.00	10.00	-1.298	
11	11	.00	11.00	-4.631	
12	12	.00	7.00	1.536	
13	13	.00	9.00	-.798	
14	14	.00	10.00	1.369	
15					
16					

Data View Variable View

SPSS Processor is read

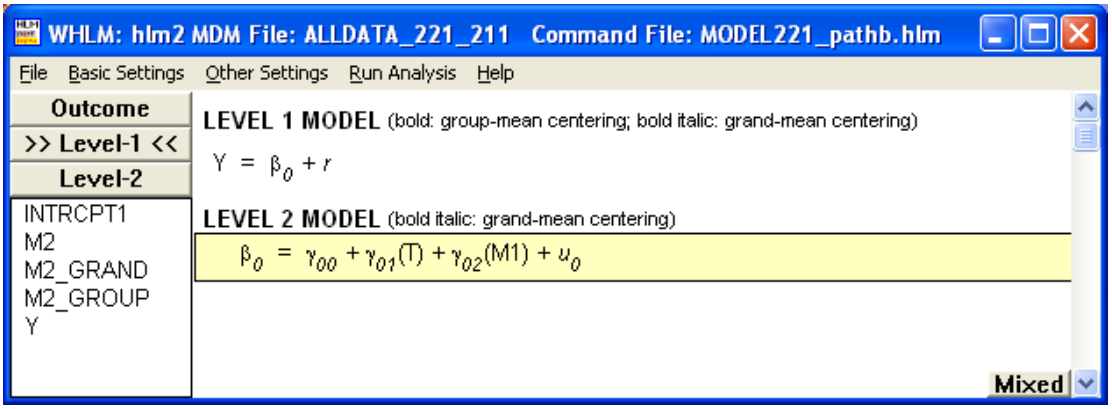
HLM screen shots to run each of the mediation models

```
**TOTAL EFFECT***;
```



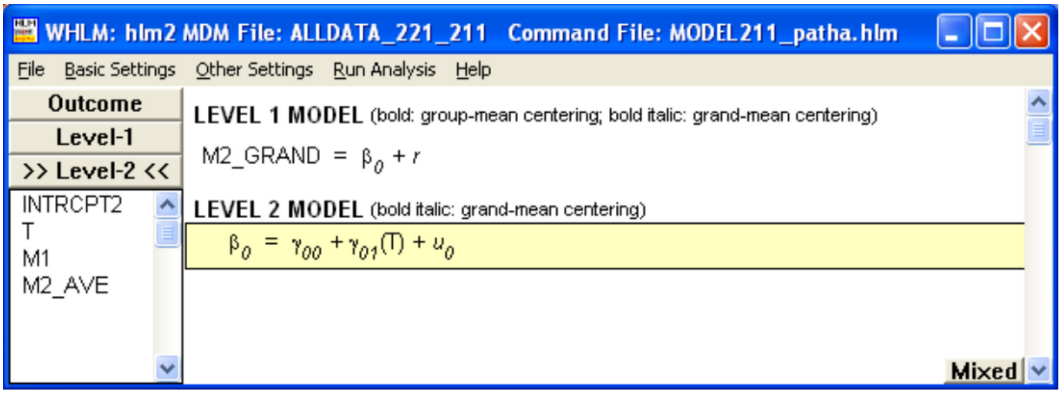

```
***ANALYSES FOR 2-2-1 DESIGN***;
```

```
  ***path b***;
```

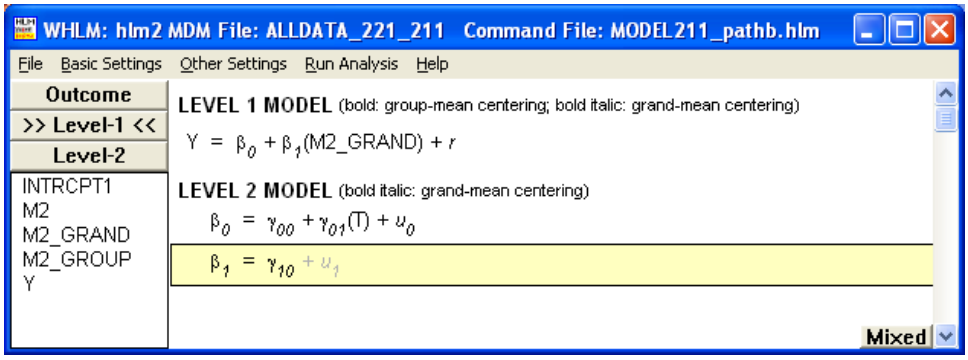



```
***ANALYSES FOR 2-1-1 DESIGN ***;
```

```
  ***path a****;
```



```
  ***path b***;
```

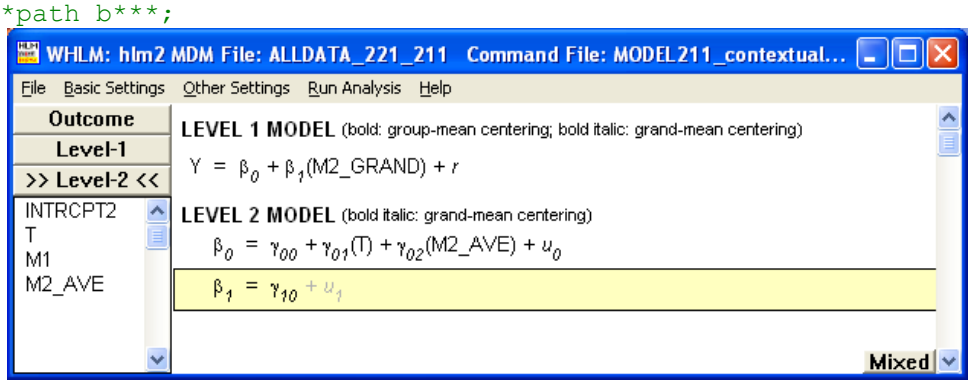



```
***ANALYSES FOR 2-1/2-1 DESIGN --  M2 IS GRANDMEAN CENTERED AND GROUP MEAN IS
IN MODEL -- discrepancy model***;

  ***path a****;

     <<Same model as for 2-1-1>>

  ***path b***;
```

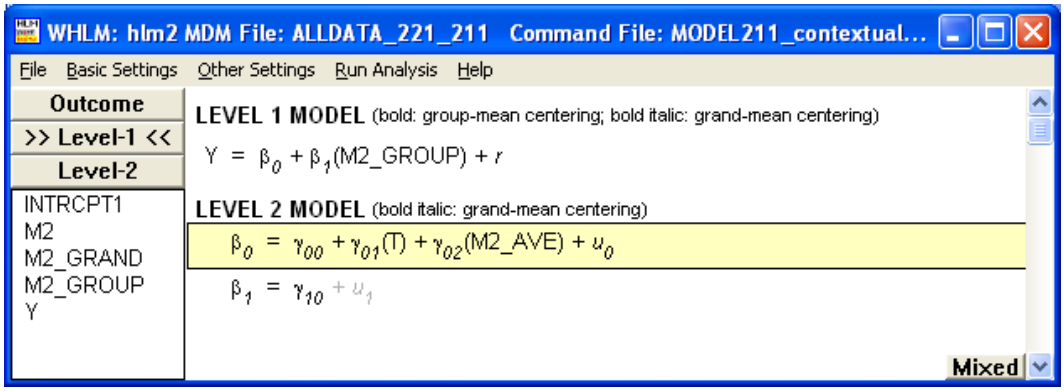



```
***ANALYSES FOR 2-1/2-1 DESIGN --  M2 IS GROUPMEAN CENTERED AND GROUP MEAN IS
IN MODEL -- overall model***;

  ***path a****;

     <<Same model as for 2-1-1>>

  ***path b***;
```



SAS syntax to run each of the mediation models

```
**TOTAL EFFECT***;
  PROC MIXED NOCLPRINT COVTEST;   CLASS J;
    MODEL Y = T     /SOLUTION ddfm=bw ;
    RANDOM INTERCEPT /SUB=J ;      RUN; QUIT;

***ANALYSES FOR 2-2-1 DESIGN***;
  ***path a****;
  PROC REG DATA=schls;  MODEL M1 = T; RUN;

  ***path b***;
  PROC MIXED NOCLPRINT COVTEST;   CLASS J;
    MODEL Y = M1 T     /SOLUTION ddfm=bw ;
    RANDOM INTERCEPT /SUB=J ;      RUN; QUIT;


***ANALYSES FOR 2-1-1 DESIGN ***;
  ***path a****;
  PROC MIXED NOCLPRINT COVTEST;   CLASS J;
    MODEL  M2 GrandC = T     /SOLUTION ddfm=bw ;
    RANDOM INTERCEPT /SUB=J ;      RUN; QUIT;

  ***path b***;
  PROC MIXED NOCLPRINT COVTEST;   CLASS J;
    MODEL Y = M2 GrandC T     /SOLUTION ddfm=bw ;
    RANDOM INTERCEPT /SUB=J ;      RUN; QUIT;


***ANALYSES FOR 2-1/2-1 DESIGN --  M2 IS GRANDMEAN CENTERED AND GROUP MEAN IS
IN MODEL -- discrepancy model***;

  ***path a****;
  PROC MIXED NOCLPRINT COVTEST;   CLASS J;
    MODEL  M2 GrandC = T     /SOLUTION ddfm=bw ;
    RANDOM INTERCEPT /SUB=J ;      RUN; QUIT;

  ***path b***;
  PROC MIXED NOCLPRINT COVTEST;   CLASS J;
    MODEL Y = M2 GrandC M2 ave T     /SOLUTION ddfm=bw ;
    RANDOM INTERCEPT /SUB=J ;      RUN; QUIT;

***ANALYSES FOR 2-1/2-1 DESIGN --  M2 IS GROUPMEAN CENTERED AND GROUP MEAN IS
IN MODEL -- overall model***;

  ***path a****;
  PROC MIXED NOCLPRINT COVTEST;   CLASS J;
    MODEL  M2_GrandC = T     /SOLUTION ddfm=bw ;
    RANDOM INTERCEPT /SUB=J ;      RUN; QUIT;

  ***path b***;
  PROC MIXED NOCLPRINT COVTEST;   CLASS J;
    MODEL Y = M2_GroupC M2_ave T     /SOLUTION ddfm=bw ;
    RANDOM INTERCEPT /SUB=J ;      RUN; QUIT;
```

Reference List for Further Reading on Tests of Mediation in Multisite and Cluster Randomized Trials *(readings may be repeated if relevant to more than one topic)*

Basic issues in mediation (including issues in causal assumptions)

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1-1-1 modeling with multisite trials

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Testing mediation using 3-level models

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Pituch, K.A., Tate, R.L., & Murphy, D.L. (forthcoming). Three-Level Models for Indirect Effects in School- and Class-Randomized Experiments in Education, *Journal of Experimental Education.*

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Distribution of the product approaches to estimate standard errors and/or build confidence intervals

MacKinnon, D.P., Fritz, M.S., Williams, J., & Lockwood, C.M. (2007). Distribution of the product confidence limits for the indirect effect: Program PRODCLIN. *Behavior Research Methods, 39*, 384-89.

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