

# Appendix A: Preschool COR Development and Validation

## Final Instrument Development

To examine the psychometric characteristics of the Preschool COR, Head Start teaching staff of the Equal Opportunity Commission of St. Clair County Children’s Services in Port Huron, Michigan, collected data from 160 children in spring 2002 and 233 children in fall 2002. After the spring study, COR project staff revised four items and made minor wording changes in seven other items to address the concerns raised, then used the new version in the fall study.<sup>1</sup> Findings from these studies of the revised COR are posted at the High/Scope Web site (<http://www.highscope.org>).

On the basis of findings from the first study in the spring, we decided to combine the four shorter categories that had only three to five items into two longer categories that have eight items each. We combined *Initiative* and *Social Relations*; we also combined *Creative Representation* and *Movement and Music*. As a result, for data aggregation and statistical purposes, the preschool COR has four categories of eight items each:

- *Initiative, Social Relations*
- *Creative Representation, Movement and Music*
- *Language and Literacy*
- *Mathematics and Science*

## Item Statistics

Table 1 (on this page) presents the age distribution for the spring study and the fall study. For both studies, the age range was 3 years 0 months to 5 years 5 months, but, as expected, the children were older in the spring than in the fall, with an average age of 4 years 2 months in the fall study and 4 years 9 months in the spring study.

**Table 1. Percentages of Children of Various Ages in the Two COR Studies**

Age in Years and Months	First Study: Spring 2002	Second Study: Fall 2002
3-0–3-5	1.2	14.2
3-6–3-11	9.2	17.7
4-0–4-5	10.4	35.3
4-6–4-11	33.7	29.3
5-0–5-5	39.9	2.6

*Note.* Spring 2002  $N = 154$ ; fall 2002  $N = 230$

Tables 2 and 3 (on pages 27 and 28) present findings from the two studies for each COR category and item: the number of cases, mean score, standard deviation, and percentage scoring 1, 2, 3, 4, and 5. Table 2 presents statistics for the first study in spring 2002. Table 3 presents statistics for the second study in fall 2002. The tables are arranged in the order of actual occurrence, even though the order for the typical program year would be fall followed by spring. These children were not selected to be statistically representative of all children or even of all Head Start children. Nor are the children the same in both studies, so differences between the two sets of scores do not represent gains. With these caveats in mind, these scores do nonetheless provide some basis for comparison with the COR scores of other groups of children.

In the spring study, COR data were collected on 160 children, with data on all the items collected on 66 of them, 41% of the total sample. No one item had data for fewer than 71% of the children. By category, data on all the items were available on 87% of the children for *Initiative, Social Relations*; 84% for

**Table 2. Spring COR Item Statistics**

Item	Number of Cases	Mean	Standard Deviation	1	2	3	4	5
<b>COR Total</b>	66	3.47	0.57	5.5	13.7	27.0	37.8	15.9
<b>Initiative, Social Relations</b>	139	3.23	0.67	8.2	14.2	34.3	33.0	10.3
Making choices and plans	160	3.44	0.77	1.3	7.5	43.8	41.3	6.3
Solving problems with materials	152	2.92	1.10	10.5	23.7	38.2	18.4	9.2
Initiating play*	152	3.83	0.71	0.0	5.9	17.1	65.1	11.8
Taking care of personal needs	153	3.46	0.87	0.7	10.5	43.1	33.3	12.4
Relating to adults	152	3.38	1.04	7.9	3.3	46.7	27.0	15.1
Relating to other children	153	3.35	1.02	5.2	12.4	37.3	32.7	12.4
Resolving interpersonal conflict	147	2.79	1.27	18.4	23.8	32.7	10.9	14.3
Understanding and expressing feelings	155	2.66	1.37	27.1	27.1	6.5	31.6	7.7
<b>Creative Representation, Movement and Music</b>	134	3.37	0.63	4.9	17.1	32.3	27.6	18.1
Making and building models	153	3.01	0.96	6.5	22.2	38.6	29.4	3.3
Drawing and painting pictures	160	3.40	1.24	11.9	8.1	29.4	29.4	21.3
Pretending	150	3.33	0.97	5.3	10.0	40.7	34.7	9.3
Moving in various ways	152	3.83	1.14	1.3	12.5	28.9	16.4	40.8
Moving with objects*	160	4.38	0.76	0.0	3.8	5.6	40.0	50.6
Feeling and expressing steady beat*	150	2.59	0.80	2.7	48.0	40.7	4.7	4.0
Moving to music*	148	3.07	1.17	12.8	23.6	9.5	51.4	2.7
Singing	146	3.39	1.07	2.7	11.6	54.8	5.5	25.3
<b>Language and Literacy</b>	146	3.09	0.89	15.5	18.6	18.0	36.2	11.7
Listening to and understanding speech	154	2.90	1.33	26.6	7.1	22.1	37.7	6.5
Using vocabulary	152	2.85	1.20	14.5	31.6	13.2	36.2	4.6
Using complex patterns of speech	155	3.47	1.19	1.3	24.5	29.0	16.1	29.0
Showing awareness of sounds in words	145	2.77	1.35	24.1	24.8	8.3	35.2	7.6
Demonstrating knowledge about books	155	3.52	0.92	0.6	20.0	14.2	57.4	7.7
Using letter names and sounds	154	3.32	1.58	21.4	11.0	20.1	9.1	38.3
Reading	149	3.29	1.02	4.0	26.2	10.1	56.4	3.4
Writing	149	2.87	1.28	27.5	3.4	27.5	38.3	3.4
<b>Mathematics and Science</b>	81	3.15	0.83	10.0	20.4	26.1	31.3	12.2
Sorting objects	147	2.93	0.85	4.8	25.2	43.5	25.9	0.6
Identifying patterns	138	2.86	1.18	17.4	17.4	34.1	23.9	7.2
Comparing properties	149	3.07	1.40	18.8	19.5	16.8	26.2	18.8
Counting	153	3.73	1.01	2.0	15.0	11.1	51.6	20.3
Identifying position and direction	146	2.79	1.03	8.9	36.3	24.7	27.4	2.7
Identifying sequence, change, and causality	140	2.52	1.03	31.4	18.6	26.4	13.6	10.0
Identifying materials and properties	118	2.48	1.37	33.1	22.0	19.5	14.4	11.0
Identifying natural and living things	113	2.75	1.19	15.0	31.0	27.4	16.8	9.7

Note. Findings come from the first COR study of 160 children in spring 2002. Percentage scoring at each level (1, 2, 3, 4, 5) is indicated in columns 4–8.

\*The wording of this item was revised following this data collection, so these statistics do not apply to the published version.

Table 3. Fall COR Item Statistics

Item	Number of Cases					Mean	Standard Deviation	1	2	3	4	5
	60	171	233	215	231							
<b>COR Total</b>	60	171	233	215	231	2.49	.47	40.3	32.0	21.3	5.2	1.2
<b>Initiative, Social Relations</b>												
Making choices and plans	171	171	233	215	231	2.63	.51	13.0	24.6	50.7	8.4	3.4
Solving problems with materials	233	171	233	215	231	2.90	.90	7.7	21.0	45.9	24.0	1.3
Initiating play	215	171	233	215	231	2.51	.79	9.3	39.5	42.3	8.8	0.0
Taking care of personal needs	231	171	233	215	231	2.77	.77	7.4	19.5	64.1	6.9	2.2
Relating to adults	232	171	233	215	231	2.92	.68	1.3	21.1	64.2	11.2	2.2
Relating to other children	230	171	233	215	231	2.94	.74	7.8	4.8	74.3	11.3	1.7
Resolving interpersonal conflict	229	171	233	215	231	2.64	.86	9.2	33.2	43.2	13.5	0.9
Understanding and expressing feelings	204	171	233	215	231	2.39	1.06	20.1	38.2	30.4	4.9	6.4
<b>Creative Representation, Movement and Music</b>												
Making and building models	211	171	233	215	231	2.28	1.29	38.4	18.0	31.8	0.9	10.9
Drawing and painting pictures	174	171	233	215	231	2.41	.59	25.1	27.3	35.9	8.1	3.5
Pretending	224	171	233	215	231	2.17	1.04	36.2	20.1	35.3	7.6	0.9
Moving in various ways	225	171	233	215	231	2.31	1.29	42.7	7.6	30.7	14.2	4.9
Moving with objects	223	171	233	215	231	2.40	.96	24.2	20.6	46.2	8.5	0.4
Feeling and expressing steady beat	228	171	233	215	231	2.66	1.12	8.2	49.4	21.5	10.3	10.7
Moving to music	228	171	233	215	231	2.60	.76	11.4	22.4	61.0	5.3	0.0
Singing	225	171	233	215	231	2.29	.82	15.4	46.1	34.6	2.2	1.8
<b>Language and Literacy</b>												
Listening to and understanding speech	203	171	233	215	231	1.74	.95	52.9	26.7	16.9	0.9	2.7
Using vocabulary	207	171	233	215	231	2.87	1.03	9.4	24.6	42.4	16.7	6.9
Using complex patterns of speech	224	171	233	215	231	2.12	.56	34.4	33.3	21.1	9.7	1.5
Showing awareness of sounds in words	224	171	233	215	231	1.88	1.04	51.8	16.5	24.1	7.1	0.4
Demonstrating knowledge about books	225	171	233	215	231	2.16	.92	24.9	44.0	22.7	7.6	0.9
Using letter names and sounds	232	171	233	215	231	2.74	.98	6.0	39.2	35.8	12.5	6.5
Reading	183	171	233	215	231	1.46	.72	63.4	30.1	3.8	2.2	0.5
Writing	231	171	233	215	231	2.74	.96	10.0	32.0	33.3	23.8	0.9
<b>Mathematics and Science</b>												
Sorting objects	205	171	233	215	231	1.49	.86	66.3	25.4	2.4	4.4	1.5
Identifying patterns	214	171	233	215	231	2.32	.69	3.3	71.0	16.8	8.4	0.5
Comparing properties	210	171	233	215	231	1.85	1.11	59.5	6.7	23.8	9.5	0.5
Counting	99	171	233	215	231	2.05	.55	40.3	32.0	21.3	5.2	1.2
Identifying position and direction	207	171	233	215	231	2.13	.83	26.1	37.7	34.3	1.4	0.5
Identifying sequence, change, and causality	206	171	233	215	231	1.45	.73	68.0	20.9	9.7	1.5	0.0
Identifying materials and properties	198	171	233	215	231	1.91	1.15	52.0	22.7	9.1	14.6	1.5
Identifying natural and living things	221	171	233	215	231	2.64	.94	15.4	20.8	49.3	13.1	1.4
	224	171	233	215	231	2.13	.73	18.3	52.2	27.2	2.2	0.0
	181	171	233	215	231	1.75	.95	53.0	24.3	19.3	1.1	2.2
	193	171	233	215	231	1.55	.82	61.7	24.9	11.9	0.0	1.6
	190	171	233	215	231	1.93	.97	34.7	51.1	4.2	6.8	3.2

Note. Findings are based on the corrected scores of the second COR study of 233 children in fall 2002. Percentage scoring at each level (1, 2, 3, 4, 5) is indicated in columns 4–8.

*Creative Representation, Movement and Music*; 91% for *Language and Literacy*; and 51% for *Mathematics and Science*. In the fall study, 32 teachers collected COR data on 233 children, with data on all the items collected on 60 of them, 26% of the total sample. However, no one item had data for fewer than 78% of the children. By category, data on all the items were available on 73% of the children for *Initiative, Social Relations*; 75% for *Creative Representation, Movement and Music*; 89% for *Language and Literacy*; and 42% for *Mathematics and Science*.

Under standard procedures for completing the COR, a COR item is not scored until the teacher has written an anecdote about the child's behavior that supports the score given. Strictly speaking, this means that if a teacher has not completed even one item in a category, none of the data for that child in that category, or indeed on that entire COR, can be used in a rigorous data analysis. To achieve this standard in the COR validation studies we would have had to require that anyone completing a COR had to complete all the items, without exception. However, that requirement was not met in these two studies.

The average COR Total scores were 2.49 in the fall study and 3.47 in the spring study. The spring average was higher than the fall average, as one would expect. However, as explained earlier, this difference does not constitute a gain score because the averages come from different sets of children in different program years. Ten items had average scores below 2.00 in the fall, but no items had scores this low in the spring. No items had average scores above 3.00 in the fall, but 18 items had scores this high in the spring. With the full range of the items from 1.00 to 5.00, the item averages ranged from 1.45 to 2.94 in the fall and 2.52 to 4.38 in the spring, indicating good use of the items' full ranges.

One would expect that while some children would score at each available level of a 5-point item, most children would score low at the beginning of the program in the fall, and most would score high at the end of the program in the spring. These expectations were borne out by the findings. In fact, for the COR Total score, 72% of the children scored 1 or 2 in the fall. Of the items in the fall, most children scored low on 18 items, and most scored in the middle on 14 items. In the spring, 65% of the children scored 3 or 4, with similar distributions for most of the items.

## Reliability

Reliability is defined as how well various measurements of the same thing (such as a group of similar items or two observers completing the same items) agree with one another. In examining the COR's reliability, we examined the internal consistency of its items, using the Cronbach alpha coefficient. We also examined inter-observer agreement, using Pearson product-moment correlations between two sets of observers, the teachers and assistant teachers in 10 classrooms (20 observers in all). For both alpha coefficients and correlation coefficients, 1.00 represents perfect reliability, and .70 represents a degree of reliability that is acceptable for everyday, low-stakes judgments about groups of children.

### Internal consistency

As shown in Table 4 (on this page), the alpha coefficient of internal consistency for all 32 COR items was very sound: .94 in the first study and .91 in the second study. The alpha coefficients for the four categories were also acceptable, ranging from .79 to .88 in the spring study and .75 to .80 in the fall study.

### Inter-observer agreement

In the fall study, 10 pairs of teachers and assistant teachers both rated the same 41 children. The correlations between teachers and assistant teachers were as follows:

- .73 for COR Total
- .69 for *Initiative, Social Relations*
- .70 for *Creative Representation, Movement and Music*

**Table 4. Alpha Coefficients of Internal Consistency Reliability for the COR**

Category	First Study	Second Study
COR Total	.94	.91
Initiative, Social Relations	.82	.75
Creative Representation, Movement and Music	.79	.80
Language and Literacy	.85	.80
Mathematics and Science	.88	.75

*Note.* Findings come from the first COR study in spring 2002 and the second COR study in fall 2002.

**Table 5. COR Factor Analysis**

Item	Correlation With Factor				
	1	2	3	4	5
Percentage of variance explained	15.8%	12.7%	11.9%	10.1%	8.6%
<b>Initiative, Social Relations (n = 139)</b>					
Making choices and plans	–	–	–	.46	–
Solving problems with materials	–	–	.61	–	–
Initiating play	–	–	–	–	.72
Taking care of personal needs	.52	–	.48	–	–
Relating to adults	–	–	.44	–	–
Relating to other children	–	–	.59	–	–
Resolving interpersonal conflict	–	–	.74	–	–
Understanding and expressing feelings	–	–	.53	–	–
<b>Creative Representation, Movement and Music (n = 134)</b>					
Making and building models	–	–	–	.70	–
Drawing and painting pictures	.41	–	–	–	–
Pretending	–	–	–	.58	–
Moving in various ways	–	–	–	–	.65
Moving with objects	–	–	–	.63	–
Feeling and expressing steady beat	–	–	.54	–	–
Moving to music	–	–	–	–	.58
Singing	–	–	–	.45	–
<b>Language and Literacy (n = 133)</b>					
Listening to and understanding speech	–	.41	–	.45	–
Using vocabulary	.53	–	.41	–	–
Using complex patterns of speech	.46	–	–	–	.42
Showing awareness of word sounds	–	.58	–	–	–
Demonstrating knowledge about books	–	–	–	–	–
Using letter names and sounds	–	.80	–	–	–
Reading	–	.76	–	–	–
Writing	–	.71	–	–	–
<b>Mathematics and Science (n = 81)</b>					
Sorting objects	–	.44	–	–	–
Identifying patterns	.58	.44	–	–	–
Comparing properties	.66	–	–	–	–
Counting	–	.61	–	–	–
Identifying position and direction	.74	–	–	–	–
Identifying sequence, change, and causality	.68	–	.43	–	–
Identifying materials and properties	.69	–	–	–	–
Identifying natural and living things	.60	–	–	–	.46

*Note.* Correlations greater than .40 are reported. The factor analysis's extraction method was principal component analysis; its rotation method was Varimax with Kaiser normalization. These findings come from the first COR study in spring 2002.

- .79 for *Language and Literacy*
- .73 for *Mathematics and Science*

These correlations are less than 1.00 for two reasons—differences between teachers and assistant teachers in which child behaviors they observed and differences in how they scored what they observed. While such differences diminish reliability, they can also be seen as a strength of a teaching team, a way in which team members complement each other by seeing different aspects of children’s behavior.

## Validity

Validity is defined as how well an instrument measures what it claims to measure. Our assessment of the validity of the COR encompasses both internal validity, using confirmatory factor analysis to examine its internal structure, and external validity, examining correlations between the COR and important related measures, specifically those in the Cognitive Skills Assessment Battery (CSAB; Boehm & Slater, 1981) and children’s age and gender.

Table 5 (on page 30) presents the findings of a confirmatory factor analysis conducted with the data from the spring study. These findings provided the rationale for our changing from six to four COR categories. The factor analysis found four factors that clearly represented these four categories.

- Factor 1 had six of the eight *Mathematics and Science* items.
- Factor 2 had five of the eight *Language and Literacy* items.
- Factor 3 had six of the eight *Initiative, Social Relations* items.
- Factor 4 had four of the eight *Creative Representation, Music and Movement* items.

Factor 5 had items from each of the four categories, as did the first four factors. The first four factors accounted for 50.5% of the variance in the COR.

To assess the validity of the revised COR, in the fall study we administered the CSAB to 28 Head Start children on whom we also had COR data. The CSAB produces three scores—Basic Information (correctly identifying name, address, birthdate, and telephone number); Cognitive Skills (such as identifying body parts, colors, and shapes; recalling words and sentences; muscle coordination; vocabulary; and discriminating symbols, sounds, and words); and Response During Assessment (such as task persistence, attention span, and confidence). We selected

the CSAB because its items resemble COR items, but the two instruments are also different in both process and content, so that in general, moderate positive correlations between .40 and .70 were expected.

Table 6 (below) shows the correlations between CSAB and COR scores. The COR Total was moderately correlated with CSAB scores: .46 with Basic Information, .57 with Cognitive Skills, and .62 with Response During Assessment. COR *Language and Literacy* had the strongest correlations with CSAB categories, while *Creative Representation, Movement and Music* had the weakest. COR *Mathematics and Science* had weaker-than-expected correlations with CSAB categories. Of the three CSAB categories, Response During Assessment had the strongest correlations with COR categories.

Because COR categories are intended to represent the child’s learning based on various developmental opportunities, they should be moderately correlated with age, but not strongly correlated, which would suggest a dominant role of maturation. The fall study examined this question. Children’s ages were weakly but significantly (probability of less than 1 in 20) correlated with various COR scores: .31 with COR Total, .25 with *Initiative and Social Relations*, .16

**Table 6. Correlations Between COR and Cognitive Skills Assessment Battery**

COR Category	n	CSAB		
		Basic Information	Cognitive Skills	Response During Assessment
COR Total	10	.46	.57	.62
Initiative, Social Relations	23	.44*	.49*	.47*
Creative Representation, Movement and Music	22	.23	.31	.47*
Language and Literacy	26	.63**	.52**	.67**
Mathematics and Science	12	.22	.39	.40

Note. These findings come from the second COR study in fall 2002.

\* $p < .05$ ; \*\* $p < .01$

with *Creative Representation, Movement and Music*, .33 with *Language and Literacy*, and .28 with *Mathematics and Science*; numbers of children in the analyses varied from 99 to 208.

It is desirable for an instrument such as the COR to be gender-neutral, that is, for scores to be no higher for boys or for girls. In fact, in the fall study none of the differences between girls' and boys' scores were statistically significant. As Table 7 (below) shows, girls' COR scores were a little higher than boys'. The largest difference was in the COR Total, for which girls' average score was .17 of a point higher than boys'.

### Summary

To examine the statistical characteristics of the Preschool COR, Head Start teaching staff in one grantee collected data from 160 children in spring

2002 and 233 children in fall 2002. Children ranged in age from 3 years 0 months to 5 years 5 months. Some data were missing on most of the children. The average COR Total scores were 2.49 in the fall study and 3.47 in the spring study. The alpha coefficients of internal consistency for all 32 COR items were a healthy .94 in the first study and .91 in the second study, with alpha coefficients for the four COR categories ranging from .75 to .88. The COR scores of 10 pairs of teachers and assistant teachers were correlated at .73 for COR Total and .69 to .79 for the categories. The COR's internal validity was affirmed by a confirmatory factor analysis on data from the spring study, which identified four factors that fit the four COR categories rather well. The COR's external validity was supported by expected correlations between COR Total and the CSAB (.46 to .62) and between COR Total and children's ages (.31), and no significant association with gender.

**Table 7. COR Scores by Child Gender**

Category		Males	Females
COR Total	<i>Number of Cases</i>	30	30
	<i>Mean</i>	2.41	2.58
	<i>Standard Deviation</i>	(.47)	(.47)
Initiative, Social Relations	<i>Number of Cases</i>	88	82
	<i>Mean</i>	2.60	2.67
	<i>Standard Deviation</i>	(.53)	(.50)
Creative Representation, Movement and Music	<i>Number of Cases</i>	86	87
	<i>Mean</i>	2.33	2.47
	<i>Standard Deviation</i>	(.55)	(.62)
Language and Literacy	<i>Number of Cases</i>	105	101
	<i>Mean</i>	2.06	2.18
	<i>Standard Deviation</i>	(.55)	(.57)
Mathematics and Science	<i>Number of Cases</i>	50	49
	<i>Mean</i>	2.01	2.08
	<i>Standard Deviation</i>	(.61)	(.49)

*Note.* None of these differences were statistically significant with a probability of less than .05. These findings come from the second COR study in fall 2002.