Chapter IV
Study of the Process Goals

4.1 General Outline

During the first year of operation, the ANISA program was concerned with five of the processes that underlie learning competence. These processes are classification, seriation, verticality, attention and figure-ground perception. The first two processes belong to the cognitive category of psychological potentiality while the remaining processes belong to the psycho-motor, volitional and perceptual categories respectively. In order to assess the effectiveness of the program for aiding the development of these processes, it was necessary to construct or select a test to measure each process.

The following is an outline of the general paradigm we utilized during the test construction:

1) Reviewed the ANISA literature concerning the processes,
2) Reviewed the literature pertaining to measurement of the processes,
3) Collected and critically evaluated any available instruments that measured constructs similar to the processes,
4) Using the results of the prior steps, constructed or selected instruments that measured the processes as defined by the ANISA model,
5) Administered the instruments to the ANISA and Control group students during the year-end assessment.

In addition to developing measures of five processes listed above, it was necessary to construct an instrument to measure a higher order specification, cooperation, an aspect of moral competence, and to construct another instrument to measure a specific part of the language arts curriculum, the ability to use inflections. Again we utilized the paradigm related above to develop instruments for use in the year-end assessment of the students.

The remainder of this chapter presents the results of the year-end testing program. The caveats, presented in section 2.4, concerning interpretation of these results should be kept firmly in mind as the reader proceeds through the chapter.

4.2 Classification[1]

Test Development

The ANISA model which has been developed by Daniel Jordan and his colleagues in the School of Education at the University of Massachusetts, is based on the notion that development consists of the translation of potentiality into actuality. The model is comprehensive in that it purports to be a viable system for the education of the complete individual across disciplines and inclusive of all age groups. Part of the model draws on the theories and techniques of Jean Piaget. One of the important processes described by Piaget and which plays a prominent role in the ANISA theory of child development is classification. It

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[1]William Welsh was primarily responsible for developing this section of the report.

can be defined as "the process by which an individual identifies and abstracts a common property (or properties) from an array of actions, events, feelings, objectives or ideas and integrates these properties into a group or category which can be extended (generalized) to include all other experiences possessing those properties" (ANISA, 1973).

Typically, individuals classify their environment in three ways: perceptually, i.e., on the basis of obvious physical characteristics; conceptually, i.e., primarily on the basis of the function of the stimulus; and through the use of logical thought, on the basis of some abstract concept. Logical thought forms the basis of higher order classification.

The key to an individual's ability to classify is his ability to co-ordinate the intensive and extensive properties of a group of objects. Intensive properties are those characteristics common to members of one class and separating one class from another, i.e., qualitative aspects of classification. Extensive properties refer to the quantitative aspects of classification, i.e., concepts such as all, some, and none (ANISA, 1973).

That classification is a critical component of a child's cognitive skills is undeniable. It enables the individual to "deal economically with the environment" (Lavatelli, 1970). It enables us to make generalizations about the world around us, rather than dealing with everything that happens to us as a separate phenomenon. It is significant that Montessori equated classification ability with intelligence: "to be able to distinguish, classify and catalogue on the basis of a secure order established in the mind, this is at once intelligence and culture" (Kohlberg, 1968).

The developers of the ANISA program, have, through modification of a Kofsky (1966) study, arrived at a hierarchy of subskills that, taken together, constitute "classification ability." The hierarchy is reported in Figure 4.2.1.

Students whose classification skills are being monitored, then, should be tested on the following concepts (in order): resemblance sorting, consistent sorting, exhaustive sorting, conservation of classes, multiple class membership, some and all relations, relations between parts, hierarchical classification, conservation of hierarchy, and class inclusion. A few words about each of these is in order at this point [with definitions drawn largely from Kofsky (1966) and ANISA (1973)]:

Resemblance sorting involves grouping two items together because of some common physical characteristic.

Consistent sorting involves extending the ability to group two things together to the ability to group more than two together.

Exhaustive sorting, the next logical step, involves the ability to classify together all objects that are like each other in some way.

Conservation of classes is the idea that a class is preserved even when some members of that class are removed.

Multiple class membership is the notion that an object may belong to more than one class at the same time; it also includes the idea that many objects can be classified on the basis of more than one characteristic.

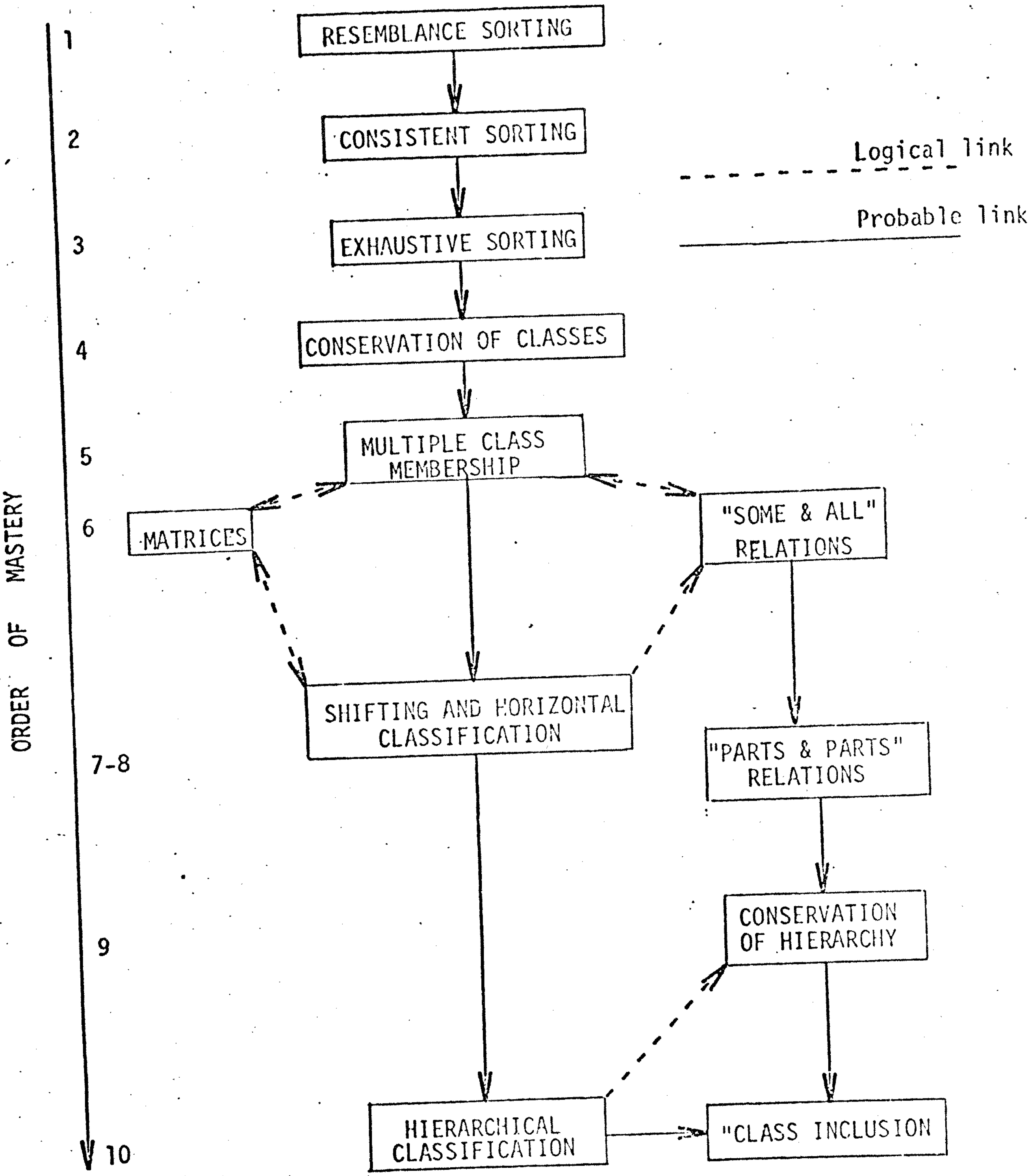

Figure 4.2.1 Predicted sequence of development of classificatory skills (Adapted with modifications from Kofsky, 1966.)

"Some" and "all" relations involves the notion of understanding the relationship between a whole class and the components of that class.

Relations between parts involves understanding of the relationships among the parts and the idea that the whole is equal to the sum of the parts.

Hierarchical classification is the idea that groups and subgroups can be formed within a larger unit.

Conservation of hierarchy is the idea that even when some subgroups in the hierarchy are removed, the hierarchy itself remains intact.

Class inclusion involves the ability to discern subclasses of objects and to perceive that they belong also to a larger class.

Of the ten subskills, during the first year of the program we developed tasks to test multiple class membership, "some" and "all" relations, and relations between parts. These were the subskills that were at the appropriate "difficulty level" for 5 and 6 year old children.

Results

The results of our testing of both the ANISA and control group school kindergarten and first grade students are summarized in Tables 4.2.1 and 4.2.2. While the differences were slight, the ANISA kindergarten children did tend to do better than their counterparts in the control school. The biggest differences were obtained on the some and all relations subskill. To a lesser extent, there were differences in the same direction on relation between parts. There were no differences between the two kindergarten groups on the multiple class membership tasks.

Table 4.2.1

Means and Standard Deviations for ANISA and Control School Kindergarten Students on the Classification Tasks

Variable		ANISA (N=26) $\bar{X}$	ANISA (N=26) SD	Control (N=28) $\bar{X}$	Control (N=28) SD
Task 1	B	.923	.272	.929	.262
	C	.962	.196	.964	.189
	E	.231	.430	.214	.418
Task 2	B	3.115	1.243	2.286	1.384
	C1	.962	.196	.964	.189
	C2	.962	.196	.893	.315
	C3	1.000	.000	1.000	.000
	C4	1.000	.000	.750	.441
Task 3	B	1.000	.000	.964	.189
	C	.885	.326	.857	.356
	D	.500	.510	.250	.441
Task 4	C	.462	.508	.500	.509
	F	.500	.510	.464	.508

Table 4.2.2

Means and Standard Deviations for ANISA and Control School Grade One Students on the Classification Tasks

Variable		ANISA (N=27)		Control (N=29)	
		$\overline{X}$	SD	$\overline{X}$	SD
Task 1	B	.963	.192	.966	.186
	C	1.000	.000	1.000	.000
	E	.111	.320	.103	.310
Task 2	B	3.630	.742	2.931	1.252
	C1	.889	.320	.897	.310
	C2	.778	.424	.897	.310
	C3	.889	.320	.862	.351
	C4	.889	.320	.862	.351
Task 3	B	.852	.362	.966	.186
	C	.963	.192	.897	.310
	D	.333	.480	.414	.501
Task 4	C	.556	.506	.621	.494
	F	.630	.492	.586	.501

With the first grade students, the differences were slight and overall, tended to show the two programs about even. ANISA students, as a group, were somewhat more proficient on one of the tasks (B) measuring the some and all relations subskill. Unlike their counterparts in the kindergarten class, they did not outperform the first graders in the control school on the remainder of the subskills tested. In fact, on the relationship between parts subskill, the control school students scored slightly higher. Again, there were no differences between the students in the two schools on the multiple class membership subskill.

While overall the results tended to show the ANISA students slightly ahead it was rather distressing to see such a small difference in performance between the kindergarten and first grade students in the ANISA and the control school. In fact, on several tasks, the kindergarten students outperformed the first graders. This finding would seem to be deserving of further study next year.

4.3 Seriation[1]

Test Development

Essentially our procedures for the development of tasks to test for seriation behavior followed along the lines of that already well-documented by Inhelder and Piaget (1964).

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[1] Dr. Hariharan Swaminathan and Larry Cadorette were primarily responsible for developing this section of the report.

Results

Table 4.3.1 presents the percentage of both ANISA and control kindergarten students achieving each possible score value on each of the three simple seriation tasks.

First, it appears that as a group, the ANISA students' performance was superior to that of the control group students. From Table 4.3.1 it is clear that only 28.7% of the ANISA group failed to seriate either by trial and error or operationally. This can be compared with the 41.2% of the control group who failed to seriate at either level. In addition, there was little difference in the percentage of either groups that seriated operationally (10.6% and 11.9%); however, there was approximately 14% more seriation by trial and error in the ANISA sample than was found in the control group.

Secondly, it can be seen from Table 4.3.1 that 57.5% of ANISA children were able to extend successfully (scores of 3 or 5) while only 46.6% of control children extended properly. This difference may point to a more mature approach towards cognitive competence on the part of the ANISA group. This ability to extend or generalize the process sc as to accept new members to the series is indeed a higher order process than the simple seriation of the objects alone.

Thirdly, if one uses the mean ratings for each task as an indication of the perceived difficulty level of each task for both ANISA and control groups, then quite similar patterns emerge for each group. For both groups, Task 1 (the seriation of a one-dimensional object)

Table 4.3.1

Percentage of ANISA and Control School Kindergarten Students Achieving Each Possible Score for Seriation Tasks I, II, and III

Score	Stage	ANISA (N=22) Task 1	2	3	$\overline{P}$*	Control (N=25) Task 1	2	3	$\overline{P}$*
0	No Seriation	0.0	13.6	9.1	7.5	32.0	12.0	0.0	14.6
1	Partial Seriation	36.4	18.2	9.1	21.2	16.0	24.0	4.0	26.6
2	Pre-Operational Seriation (Trial and Error)	9.1	9.1	22.7	13.6	16.0	12.0	0.0	9.3
3	Pre-Operational Seriation with Extension	54.5	54.5	31.8	46.9	32.0	44.0	36.0	37.3
4	Operational Seriation	6.0	0.0	0.0	0.0	0.0	8.0	0.0	2.6
5	Operational Seriation with Extension	0.0	4.5	27.3	10.6	4.0	0.0	24.0	9.3

*Mean percentage for all three tasks.

appears to be the most difficult task. This is what one's intuition might suggest since the child has only one dimension to compare--the length differences. Consequently, it is not surprising that Task 3 (seriation of three-dimensional objects), is the least difficult of the tasks for both groups. In general, the ANISA means were found to be larger than the equivalent control group means, suggesting that the ANISA children had less difficulty with the seriation tasks.

Table 4.3.2 presents the percentage of ANISA and control kindergarten students who achieved each score on the fourth seriation task, the anticipation of seriation. While the data are far from conclusive, they are suggestive in the sense that the ANISA children displayed more anticipatory behavior. Seventy-two percent of the ANISA group received a score of 2, indicating at least partial correspondence while only 48% of the control group did the same.

It should be noted that, expectedly, no ANISA or control children received scores of 4 or 5 on this task. Such scores would indicate a much higher level of functioning than should be expected at this age.

Table 4.3.3 presents the percentage of both ANISA and control school students achieving each possible score value on each of the three simple seriation tasks. As with the kindergarten sample, several observations, similar in thrust, can be presented from an examination of Table 4.3.3.

First, it can be seen from Table 4.3.3 that 66.6 percent of the ANISA group obtained scores indicative of operational seriation while only 34.5 percent of the control group did the same. This difference strongly suggests a superior level of functioning for the ANISA children

Table 4.3.2

Percentage of ANISA and Control School Kindergarten Students Achieving Each Possible Score for Seriation Task Four

Score	Stage	ANISA (N=22)	Control (N=25)
0	No Anticipation No Seriation	4.5	20.0
1	Semi-Anticipation Pre-Operational Seriation	18.2	24.0
2	Partial Corre-spondence Pre-Operational Seriation	72.7	48.0
3	Anticipation Pre-Operational Seriation	4.5	8.0
4	Anticipation Operational Seriation	4.0	0.0

Table 4.3.3

Percentage of ANISA and Control School
First Grade Students Achieving Each Possible
Score for Seriation Tasks I, II, and III

Score	Stage	ANISA (N=22) Task 1	2	3	$\overline{P}$*	Control (N=25) Task 1	2	3	$\overline{P}$*
0	No Seriation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Partial Seriation	4.5	4.5	4.5	4.5	3.6	0.0	0.0	1.2
2	Pre-Operational Seriation (Trial and Error)	0.0	0.0	0.0	0.0	10.7	14.3	7.1	10.7
3	Pre-Operational Seriation with Extension	50.0	18.2	18.2	28.8	60.7	50.0	50.0	53.6
4	Operational Seriation	4.5	13.6	9.1	9.0	14.3	17.9	7.1	13.1
5	Operational Seriation with Extension	40.9	63.6	60.2	57.5	10.7	17.9	35.7	21.4

*Mean percentage for all three tasks.

as a group.

Secondly, it can be seen from Table 4.3.3 that 86.4 percent of ANISA children were able to extend successfully (scores of 3 or 5), while only 75.0 percent of control children extended properly. As with the kindergarten sample this difference may point to a more mature approach towards cognitive competence on the part of the ANISA group.

Thirdly, using the mean ratings for each task as an indication of the perceived difficulty level of each task for both ANISA and control groups, task one appears to be the most difficult, task two and task three the least difficult. The ANISA group found less difficulty with the three tasks than did the control group.

Table 4.3.4 presents the percentage of ANISA first grade and control school students who achieved each score on the fourth seriation task. While the data in this case are far from indicative of any significant superiority of either the ANISA or control children, in general, there seems to be a very slight trend of superiority for the control group first grade students on task four. The superiority contrasts the strong trend of superiority for the ANISA students on tasks one, two, and three.

Table 4.3.4

Percentage of ANISA and Control School First Grade Students Achieving Each Possible Score for Seriation Task Four

Score	Stage	ANISA (N=22)	Control (N=28)
0	No Anticipation No Seriation	4.5	0.0
1	Semi-Anticipation Pre-Operational Seriation	13.6	3.6
2	Partial Corre- pondence Pre-Operational Seriation	36.4	39.3
3	Anticipation Pre-Operational Seriation	18.2	21.4
4	Anticipation Operational Seriation	32.2	35.7

4.4 Attention

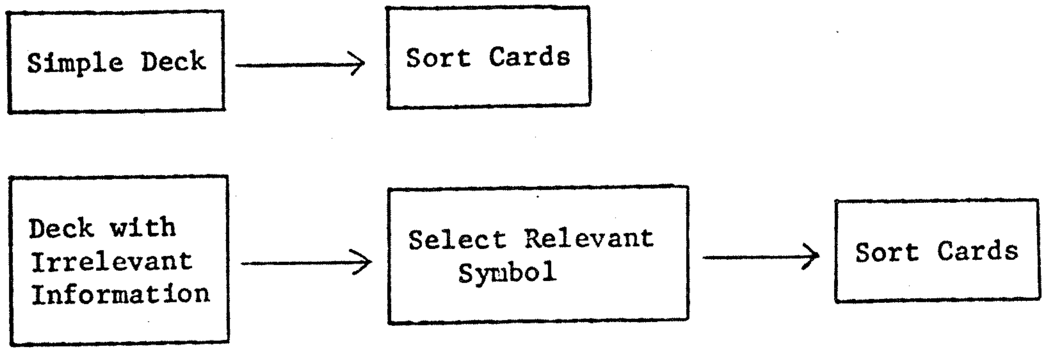
Test Development

Attention has been defined in a variety of ways in the psychological literature and it is not surprising to find that a large number of methods for measuring attention have been reported in the literature. The method chosen for the present study is based on a definition of attention as the act of selecting, for further processing, a subset of the total information available in the environment.

The method requires the child to sort various decks of cards on the basis of binary valued stimuli. For example, a deck of cards with either a circle or a square on each card is presented to the child. The examiner directs the child to separate the cards into two piles, one with all the cards defined by a circle and one with all the cards defined by a square. The examiner times the sorting process. A second deck of cards, having symbols in addition to the circles and squares, is then introduced. Again the examiner directs the child to separate the cards on the basis of the circles and squares. However, as these contain additional irrelevant information, the child must select the relevant symbol from the total array present on each card in order to sort the cards correctly. The examiner also times this card sort.

The act of selection or attention theoretically takes appreciable amounts of time. The difference between the amount of time taken to sort the deck containing the irrelevant information and the time taken to sort the simple deck is taken as a measure of attention. A schematic representation of the card sorting process is presented in Figure 4.4.1.

Figure 4.4.1. Schematic Drawing of the Card Sorting Process.



In choosing the time difference as the measure of attention, the assumption is made that the card sorting takes the same amount of time for both decks. Any time difference is assumed to be caused by the symbol selection process.

The present test utilized three paired decks of cards. The results for these three pairs are reported in Table 4.4.1. In addition, a total score consisting of the difference between the total sorting time for all decks containing irrelevant information and the total sorting time for all simple decks is reported.

Results

The results presented in Table 4.4.1 strongly suggest that the ANISA kindergarten students' performance on the attention test was superior to the performance of the control group. The mean score for the ANISA group is smaller in every case and the difference between the mean scores for the two groups is large relative to the standard deviations.

These results may be interpreted in the following manner: When informed of the relevant information for completing the card sorting task, the ANISA kindergarten students, on the average, can select this information more efficiently from the display of relevant and irrelevant information.

At present the evaluators are unaware of any research on the educational implications of such an ability. However, it seems plausable that the presence of this ability would permit the student to perform well in educational situations in which the relevant information is first learned by the student and subsequently is important in some academic performance. It also seems plausable that a lack of this ability may be one cause of the fairly common occurence that a child can perform a task on some occasions but not on others. These two hypotheses certainly seem to merit consideration.

The results presented in Table 4.4.1 are equivocal with regard to the existence of real differences between the ANISA and control first grade students. The ANISA group mean score is superior for the first and third pair, while the control group mean score is superior for the

Table 4.4.1

Means and Standard Deviations for ANISA and Control School Students on the Attention Measures

Variable	Grade	ANISA (K=13, 1=16)		Control (K=13, 1=20)	
		$\overline{X}$	SD	$\overline{X}$	SD
Pair I	K	.96	5.20	5.92	8.30
	1	- 1.91	10.31	.46	4.86
Pair II	K	2.31	9.76	11.35	9.54
	1	4.64	9.64	2.70	19.37
Pair III	K	9.91	7.68	14.97	15.15
	1	.73	9.12	9.23	10.94
Total	K	13.64	17.83	32.23	28.72
	1	3.46	16.45	12.39	21.51

second pair. The size of the differences between the mean scores on the first two pairs is relatively small and so these observed differences may not represent important differences in attention ability. Although the difference between the mean scores, for the third pair, is relatively large, its importance is decreased by the pattern of results observed for the first two pairs. It is possible that this difference occurred by chance. As it is based on all three pairs, the difference between the mean scores for the total score is the best indicator of differences in attention ability. This difference favors the ANISA group, but the difference seems relatively small when the size of the standard deviations is considered. The results indicate a trend of superior attention ability for the ANISA first grade students, but a strong conclusion is not warranted.

It should be noted that the results for both the kindergarten and the first grade students are specific to attention as it has been defined and measured in this study. It is possible that a study, based on a different test or a different definition, would produce different results. This consideration seems particularly important in view of the wide variety of definitions of attention that have been reported in the literature.

4.5 Figure-Ground Perception

Test Development

For assessment in the area of figure-ground perception there were several tests available which seemed to be consistent with the ANISA definition of that skill. After reviewing those figure-ground tests appropriate for the age level of interest, the Children's Embedded

Figures Test[1] was selected for our evaluative study. This test seemed to make the least demand, in the areas of eye-hand co-ordination and visual-motor integration, of any of the tests. Since the requirement of this additional skill would have had a confounding effect on assessing the acquisition of skill in figure-ground perception, tests with this characteristic were considered less appropriate instruments. The Children's Embedded Figures Test has an added feature of teaching the task before requiring the child to respond to the test items. This procedure helps to ensure the child's understanding of the task, thereby providing the potential for a more reliable and valid measure.

The Children's Embedded Figures Test is recommended for use with children from age 5 to 10 and takes from 10 to 20 minutes to administer. The test materials consist of a series of cards containing complex figures, 11 cards having a simple tent figure embedded in them and 14 cards having a house figure embedded in them. The child's task is to locate a previously seen simple figure (i.e., the tent or house) embedded within a larger complex figure which has been organized to obscure the simple figure. The child points to the embedded figure on the card and then places the model of the previously seen tent (or house) on the card in the required position, in order to verify that he has indeed pointed to the embedded figure.

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[1]The test was constructed by Witkin, H. A., Oltman, P. K., Raskin, E., and Karp, S. A. and published by Consulting Psychologists Press, Inc., Palo Alto, California, in 1971.

Results

The results presented in Table 4.5.1 indicated that the ANISA kindergarten students' performance on the Figure-Ground Perception Test was superior to the control group performance. On the average, ANISA students received credit for approximately two and one-half items more than the control group. This is a fairly large difference and may be of some educational importance. A decision about the educational importance of this difference will only be possible when the relation between figure-ground perceptual ability and other relevant educational outcomes becomes known.

Table 4.5.1 indicates that the first grade students' figure-ground perceptual ability appears somewhat superior to that of the control group students. However, the difference between mean scores is only 1.8 and therefore a strong conclusion that the ANISA group is superior to the control group is unwarranted.

It is perhaps interesting to note that both the ANISA and Control group students in kindergarten and first grade scored substantially higher than the average student of the same age as reported in the norms table for the test. The ANISA school results were particularly impressive.

Table 4.5.1

Means and Standard Deviations for ANISA and Control School Students on the Figure-Ground Perception Test

Grade	ANISA (K=17, 1=20) $\bar{X}$	SD	Control (K=20, 1=20) $\bar{X}$	SD
K	11.88	4.24	9.45	4.21
1	15.85	5.22	14.05	5.20

4.6 Co-operation[1]

Test Development

Co-operation, in terms of the ANISA definition, is a human value which underlies the ability to establish and maintain ordered relationships wherein human behavior is mutually beneficial. The quality of this value is determined by the extent to which acts of assistance and contribution are observable during the performance of some group enterprise. It is theoretically suggested that differences in general co-operativeness are the same differences found while observing a group of individuals participating in a task that requires group effort. In evaluating the effectiveness of the ANISA program, for developing this value, our purpose was to compare the co-operative behavior of the ANISA group with that of the control group by using specific tasks to provide a common situation in which such a comparison could be made. The common situation was established by requiring the completion of an assigned task through a group effort. A pilot test of six different tasks showed that three of them provided a useful situation for testing co-operation and that one of them (the use of building blocks) was best. The three tasks were: 1) coloring a mural or any large picture; 2) cleaning book shelves; and 3) building some structure with building blocks, which was the most useful. It was also learned that the optimum number of children in each group was 3.

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[1]Wally Carter was primarily responsible for developing this section of the report.

Having chosen tasks with a potential for eliciting co-operative (and unco-operative) behavior it was necessary to define categories of co-operative behavior and to establish a method to record instances of these behaviors. After reviewing a few scales used by past and present researchers, we deemed it necessary to develop our instrument using the Parten scale and the Theroux modification of that scale as a basis. The Theroux scale lacked an adequate breakdown of the category "co-operative behavior" which was necessary for our evaluation. Therefore, our categories labelled "Assisting," "Taking Turns," "Contributing Verbally to the Task" and "Contributing Independently to the Task" constitute what was generally termed "co-operative behavior" in her scale.

Review of the literature indicates that the short sample technique has been an effective approach for recording social behavior. Briefly, this technique involves the following:

1) Develop a score or tally sheet in grid form. Rows are labelled by the categories of behavior to be observed and columns indicate time intervals.

2) Set a time interval during which separate observations are to be made (e.g., 5 seconds, 15 seconds, 1 minute). This set time is constant for all observations.

3) Observe behavior during the first time interval, and check off the appropriate category of behavior in column one. Do the same during the second time interval and check off in column two. Continue this method until all columns are completed.

When categories of behavior are clearly outlined and observers understand (preferably memorize) them, this approach is potentially quite reliable.

Results

The testing program at the ANISA and Hampden control schools utilized the building block task only. During each administration of the task, three children were tested and there were 10 observations on each child constituting a total of 30 observations per administration.

Table 4.6.1 discloses no appreciable differences between schools in the "Taking Turns," "Responding Positively," and "Onlooking" categories. Differences in relative frequencies in the other categories are as follows:

1) ANISA first graders demonstrated assisting behavior over 3 times as often as did the control group of first graders.
2) ANISA first graders contributed verbally to the task slightly more than did the control group first graders.
3) Control group kindergarteners were observed to be non-participating 30% more often than were the ANISA kindergartners.
4) Control group first graders responded negatively over 2 times more often than the ANISA first graders.
5) Control group kindergarteners were distracting or disrupting the group 4 times more often than the ANISA kindergartners were, while the control group first graders demonstrated this behavior 3 times more often than did the ANISA first graders.

Table 4.6.1

Relative Frequency of Observed Cooperative Behavior for ANISA and Control School Students

Behavior	ANISA K (N=30)	ANISA 1 (N=15)	Control K (N=15)	Control 1 (N=15)
Strong Cooperation	.33	.51	.16	.25
Assisting	.12	.20	.04	.06
Taking Turns	.02	.01	.00	.00
Contributing Verbally	.14	.23	.10	.17
Responding Positively	.05	.07	.02	.02
Incidental Cooperation	.29	.27	.21	.33
Contributing Independently	.29	.27	.21	.33
Non-Cooperation	.38	.22	.64	.42
Onlooking	.09	.10	.08	.10
Non-Participation	.21	.04	.35	.09
Responding Negatively	.05	.05	.09	.13
Distracting/Disrupting	.03	.03	.12	.09

6) ANISA kindergarteners and first graders performed "strong co-operation" over twice as many times as did the control group kindergarteners and first graders respectively.

Overall, then, the ANISA children demonstrated more cooperation than did children in the control school.

4.7 Inflection

Test Development

Inflection refers to the transformation of words as a function of their role in the sentence, such as person, number, tense, possession, comparison, etc. The two major approaches for determining linguistic development in the area of inflections have been to study children's natural conversation or to attempt to elicit their control of inflections by presenting nonsense words in contexts requiring inflections. To assess the internalization of morphological rules, by children in the ANISA program, for applying inflectional endings, the second approach was deemed most appropriate. Nonsense words are used to determine if the child is able to generalize to new cases. If real words are used, one cannot be certain whether the child has acquired the rule or has merely learned the word which contains an application of the rule. Since no published test utilizing this approach is available, a test had to be developed.

Development of the inflection test was based primarily on the work of Berko (1958) who examined the 1000 most frequent words in the first-grader's vocabulary from Rinsland's list (Rinsland, 1945) to determine what features of English morphology are most prevalent in the vocabulary of the first grade child. She found that all of the English inflectional morphemes were present. However, one would expect children to have a generalized rule for appending inflectional endings only when the inflection occurs with some regularity in their own vocabulary. Hence, the following areas seemed most appropriate for inclusion in the test: plural and possessive of nouns, comparative and superlative of adjectives, progressive, past tense, and third person singular of verbs, and the noun derived form with the agentive er. Although pronouns occur frequently in children's language, they were not included on the test because they are so irregular that it would be difficult to make up suitable nonsense pronouns. In order to test for the child's use of morphological rules for these inflections under varying phonological conditions, nonsense words were generated following the rules for possible sound combinations in English.

The morphemic endings that indicate the plural and the possessive of nouns and the third person singular of the verb are determined by the final phoneme in the following way:

1) -ez after stems that end in s, z, j (e.g., glasses, watches, garages);
2) -s after stems that end in p, t, k, f, o (e.g., maps, paths, hits);
3) -z after all other phomemes (e.g., dogs, beds, goes).

The morphemic endings for the past tense are also phonologically conditioned. These alternatives are available:

1) -ed after stems that end in t or d (e.g., melted);
2) -t after stems that end in p, k, c, f, o, s (e.g., stopped);

3) -d after stems ending in voiced sounds except d (e.g., climbed, played.

Therefore, the items used to test for the plural and possessive of nouns and the third person singular of verbs were generated to include all three appropriate phonemic endings. Similarly the items used in testing the past tense inflections included the appropriate morphemic endings.

As in Berko's test (Berko, 1958), pictures representing the nonsense words were drawn on cards and presented to the child. The child's task was to respond verbally with the inflected form of the nonsense word. Although the materials and testing procedures were similar to Berko's, an attempt was made to incorporate changes that overcome some of the limitations in her test.

As pointed out by Anisfeld and Tucker (1973), one cannot infer that a child lacks knowledge of certain rules if he is not asked to use them in particular situations. Therefore, it is important to test the child in both productive tasks, requiring the child to produce responses on demand, and in recognition kinds of tasks, requiring the child to recognize instances of correct usage. Berko's test (Berko, 1958) used only productive tasks. Also, her test always called for the child to provide the plural form given the singular. Further revisions of the Berko procedure include the use of more interesting and detailed drawings, as well as three-dimensional figures actually capable of action for testing for verb inflections, and variation of the dialogue to include a variety of language structures.

The total test includes 26 items covering eight inflections distributed as follows:

1) 6 items for production of noun plurals (Tasks 1 to 6),
2) 2 items for recognition of noun plurals (Tasks 7 and 8),
3) 3 items for possessive of nouns (Tasks 9, 10, and 11),
4) 3 items for comparative of adjectives (Tasks 12a, 13a, and 14a),
5) 3 items for superlative of adjectives (Tasks 12b, 13b, and 14b),
6) 1 item for progressive of verbs (Task 15a),
7) 3 items for past tense of regular verbs (Tasks 15c, 16b, and 17b),
8) 1 item for past tense of irregular verbs (Task 18a),
9) 3 items for third person singular of verbs (Tasks 15b, 16a, and 17a),
10) 1 item for noun derived form (Task 18b).

Results

The majority of the inflections showed essentially no difference between the ANISA and the control school kindergarten students (Table 4.7.1). However, on one inflection, the comparative adjectival form, the ANISA group did almost twice as well as the control group. Also, there were slight differences favoring the ANISA group on noun possessives and adjective superlatives. The control group did somewhat better in noun plural forms on recognition tasks but not on production tasks.

There was a tendency for the ANISA group to do better on -s and -z phonemes and for the control group to do better on the -ez phoneme.

Results reported in Table 4.7.1 show that the ANISA first grade students did consistently better than the control school first grade students. In two instances, the production of noun plurals and the

Table 4.7.1

Summary of Means for ANISA and Control School Students on the Inflection Tasks

Variable	ANISA K (N=23)	ANISA 1 (N=27)	Control K (N=18)	Control 1 (N=22)
Inflection				
Noun Plural-Production	3.7	5.0	3.8	3.9
Noun Plural-Recognition	1.3	1.6	1.6	1.8
Noun Possessive	1.7	2.5	1.4	1.5
Adjective Comparative	1.2	1.4	.1	1.4
Adjective Superlative	1.9	1.6	1.4	1.5
Verb Progressive	.7	.9	.6	.8
Verb Past Tense-Regular	.6	1.7	.7	1.1
Verb Past Tense-Irregular	.2	.7	.3	.6
Verb Third Person Singular	2.2	2.6	2.2	2.0
Noun Derived Form	.2	.4	.3	.3
Phonemic Ending				
S	2.7	2.9	2.3	2.6
Z	2.8	2.9	2.3	2.6
EZ	1.3	2.8	1.6	1.4

noun possessive case, the ANISA children scored substantially higher than the control children. Differences in the past tense of regular verbs and in the third person singular verb form also favored the ANISA group.

The ANISA students did better on all three phonemic endings, scoring on the average twice as high as the control students on the -ez.

4.8 Verticality (Static Balance)

Test Development

The measurement of static balance has been approached by at least two different methods in the literature. The simplest and most straightforward way to assess static balance is to measure the time of maintaining a certain posture without moving the feet or taking resort to support. Researchers have criticized this approach on the grounds that the results indicate incidence of failure rather than assessing patterns of performance. He suggests the use of relatively sophisticated machines, known as ataxiameters or statometers, in the assessment of static balance. These machines, although differing in method, all attempt to record body sway during the maintenance of certain postures. A continuous record of the pattern of weight displacement is used as a measure of static balance ability. In the present study we attempted to incorporate an assessment of the pattern of performance into the first approach for measuring static balance ability. This was accomplished by requiring the examiner to rate the child's performance on a rating scale in addition to timing the maintenance of balance.

Four different postures were utilized: standing normally, modified romberg, romberg, and standing on one foot. The rating scale was used with the first three postures, while time of maintainence was recorded for all postures. Two trials were completed for each posture. For all four postures the child was required to balance with eyes closed. This requirement presumably removes the effect of visual cues on static balance and the child must depend on proprioceptive cues to maintain balance. Thus we are measuring a psychomotor function that seems to consist of interpreting internally generated cues concerning the position of the body relative to the center of gravity and making the appropriate muscular adjustments to maintain balance.

Results

The results of the static balance testing for kindergarten students are presented in Tables 4.8.1 and 4.8.2. Table 4.8.1 presents means and standard deviations for both the time and rating scores. The entries are based on two trials. Table 4.8.2 reports data concerning the rating scores for the normal standing, the modified romberg and the romberg postures respectively. The reported results are the number and proportion of students, within each group, achieving each possible rating score where ratings are summed over both trials. Also tabulated in Table 4.8.2 are data concerning the ratings for single trials. The possible patterns of single trial scores for each summated rating are presented. Trial order is not considered in defining these patterns. The results are the number and proportion of students, within each group, exhibiting each pattern.

Table 4.8.1

Means and Standard Deviations for ANISA and Control
Group Kindergarten and First Grade Students on Static Balance

Posture	Variable	ANISA Grade K(N=27) $\overline{X}$	ANISA Grade K(N=27) SD	ANISA Grade 1(N=28) $\overline{X}$	ANISA Grade 1(N=28) SD	Control Grade K(N=24) $\overline{X}$	Control Grade K(N=24) SD	Control Grade 1(N=20) $\overline{X}$	Control Grade 1(N=20) SD
Normal	Time	60.0	.0	59.6	1.9	59.8	1.2	59.2	3.6
	Rating	9.5	.9	9.9	.3	9.4	1.3	9.9	.5
Modified Romberg	Time	59.3	3.5	60.0	.0	57.4	8.9	57.7	6.0
	Rating	8.6	1.3	9.6	.9	8.6	1.9	9.0	1.6
Romberg	Time	25.6	19.3	47.9	12.2	25.7	17.0	42.0	14.0
	Rating	3.7	1.8	4.8	1.6	3.3	1.9	3.4	1.4
One Foot	Time	8.4	4.3	15.2	9.6	13.2	9.1	19.6	10.8

Table 4.8.2

Summary of Percentage of Ratings/Patterns on the Static Balance Measures for ANISA and Control Group Kindergarten and First Grade Students

Posture	Rating	Pattern	ANISA % K	ANISA % 1	Control % K	Control % 1
Normal Standing	6	3,3	0.0	0.0	4.2	0.0
		5,1	0.0	0.0	4.2	0.0
	8	4,4	25.9	0.0	12.6	0.0
		5,3	0.0	0.0	0.0	5.0
	9	5,4	0.0	7.1	4.2	5.0
	10	5,5	74.1	92.9	75.0	90.0
Modified Romberg	2	1,1	0.0	0.0	4.2	0.0
	5	4,1	3.7	0.0	0.0	5.0
	6	3,3	0.0	3.6	0.0	0.0
		4,2	3.7	0.0	8.3	0.0
		5,1	0.0	0.0	0.0	5.0
	7	4,3	3.7	0.0	0.0	0.0
	8	4,4	41.7	0.0	29.2	5.0
		5,3	3.7	3.6	0.0	5.0
	9	5,4	7.4	17.9	12.5	5.0
	10	5,5	37.0	75.0	45.8	65.0
Romberg Posture	2	1,1	37.0	3.6	41.7	45.0
	3	1,2	3.7	0.0	20.8	0.0
		2,1	0.0	14.3	0.0	5.0
	4	2,2	33.3	14.3	16.6	5.0
		3,1	3.7	21.4	4.2	15.0
	5	3,2	7.4	14.3	0.0	10.0
		4,1	3.7	7.1	4.2	15.0
	6	3,3	0.0	0.0	4.2	0.0
		4,2	0.0	0.0	4.2	0.0
		5,1	0.0	7.1	0.0	5.0
	7	4,3	3.7	3.6	0.0	0.0
		5,2	0.0	7.1	0.0	0.0
	8	4,4	3.7	3.6	4.2	0.0
		5,3	0.0	3.6	0.0	0.0

The results presented in Table 4.8.1 reveal that, for the first three postures, the mean scores for the two groups are essentially equivalent. This is true for both the time of maintenance of the posture and the qualitative rating of the balance performance.

Maintenance of the first two postures was extremely easy for both the ANISA and control students. For the normal standing posture, all students, with the exception of a single control student, achieved perfect scores. Similarly, for the modified romberg posture only one ANISA student and one control student failed to achieve perfect scores. The rating scores for these postures exhibit a similar pattern. Table 4.8.2 indicates that for the normal standing posture 74.1% of the ANISA group and 75.0% of the control group achieved perfect ratings. One hundred percent of the ANISA students had ratings of four or greater for both trials, while 91.7% of the control group had ratings of four or greater for both trials. The results for the modified romberg posture, reported in Table 4.8.2 demonstrate that 92.1% of the ANISA students achieved ratings of four or five for both trials, while 87.5% of the control students achieved these ratings.

The romberg pósture was the first posture that was difficult for the students. It is clear from Table 4.8.1 that for both groups the mean time and rating scores are substantially smaller for this posture than for the previous two. However, as indicated above, the mean time and rating scores for the romberg posture were essentially equivalent for both groups. The results presented in Table 4.8.2 indicate that

74.0% of the ANISA students and 75.1% of the control students received ratings of two or less on both trials. Again, this indicates a substantially poorer performance for both groups on this posture than on the previous two postures. However, the performances by the two groups were equivalent.

The data concerning the one foot posture, reported in Table 4.8.1, indicate that the control students were able to maintain this posture for a substantially longer period of time than the ANISA students.

In the comparative sense, the results are fairly inconclusive about the effect of the ANISA curriculum on static balance ability when vision is occulded. The extremely positive performance by all students in both groups on the first two postures indicates that the measures based on these postures do not discriminate between individuals and therefore cannot discriminate between programs. The time measure based on the romberg postures did discriminate among individuals. However, the group performances were essentially the same. The only important difference occured in the time measure for the one-foot posture. The difference favored the control group, but it is difficult to justify a judgment about the effectiveness of a portion of the curriculum on the basis of this single difference.

The first grade data for the measurements based on the normal standing and modified romberg postures are similar to the kindergarten data. The mean time and mean rating scores are essentially equivalent for both the first grade ANISA students and control group students. The majority of students in each group achieved perfect scores on the time measure for each posture. One student in each group failed to attain a perfect score for the standing normal posture. One student from the ANISA group and three students from the control group failed to attain perfect scores for the modified romberg posture. Perfect rating scores were earned by 92.9% of the ANISA students and by 90% of the control group students for the normal standing posture. Ratings of four or above on both trials were achieved by 92.9% of the ANISA students on the modified romberg posture while 80% of the control group students achieved ratings of four and above on this posture.

The results for the romberg posture, however, diverged from the pattern of kindergarten results. The ANISA students mean time score and mean rating score were larger than the corresponding scores for the control group. The differences between the mean scores are large relative to the respective standard deviations and thus seem to be important differences. The difference in mean rating scores is reflected by the results reported in Table 4.8.2. The table shows that 45% of the control group received a rating of one on both trials, whereas only 3.6% of the ANISA students received a rating of one on both trials.

The data for the one foot posture for the first grade students again are similar to those observed for the kindergarten students. The control group mean score is larger than the ANISA mean score.

The results for the first grade students are fairly inconclusive. The ANISA group did score substantially better on both measures for the romberg posture. However, the control group excelled on the one foot posture. These results are particularly difficult to interpret.

On one hand, the romberg posture and the one foot posture might elicit different aspects of static balance ability. The results would indicate that the ANISA students excelled on one aspect of static balance ability, while the control group excelled on another aspect. However, we lack a systematic theory to tell us how static balance ability relates to other desirable educational outcomes and therefore, even if this were the case, we could not come to a conclusion about which aspect of static balance ability is most important. On the other hand, the two postures might elicit similar aspects of static balance ability and the results, averaged over both postures, would indicate that the two groups do not differ in static balance ability. It would seem that, given the current lack of knowledge about the aspects of static balance ability being measured for each posture, the most reasonable interpretation is the second one.