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. Complete descriptions of the testing procedures are presented in Appendix B. Unfortunately, because of confusion over the testing of verticality, the results were of very limited value, and for this reason they are not reported.

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

---

[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.

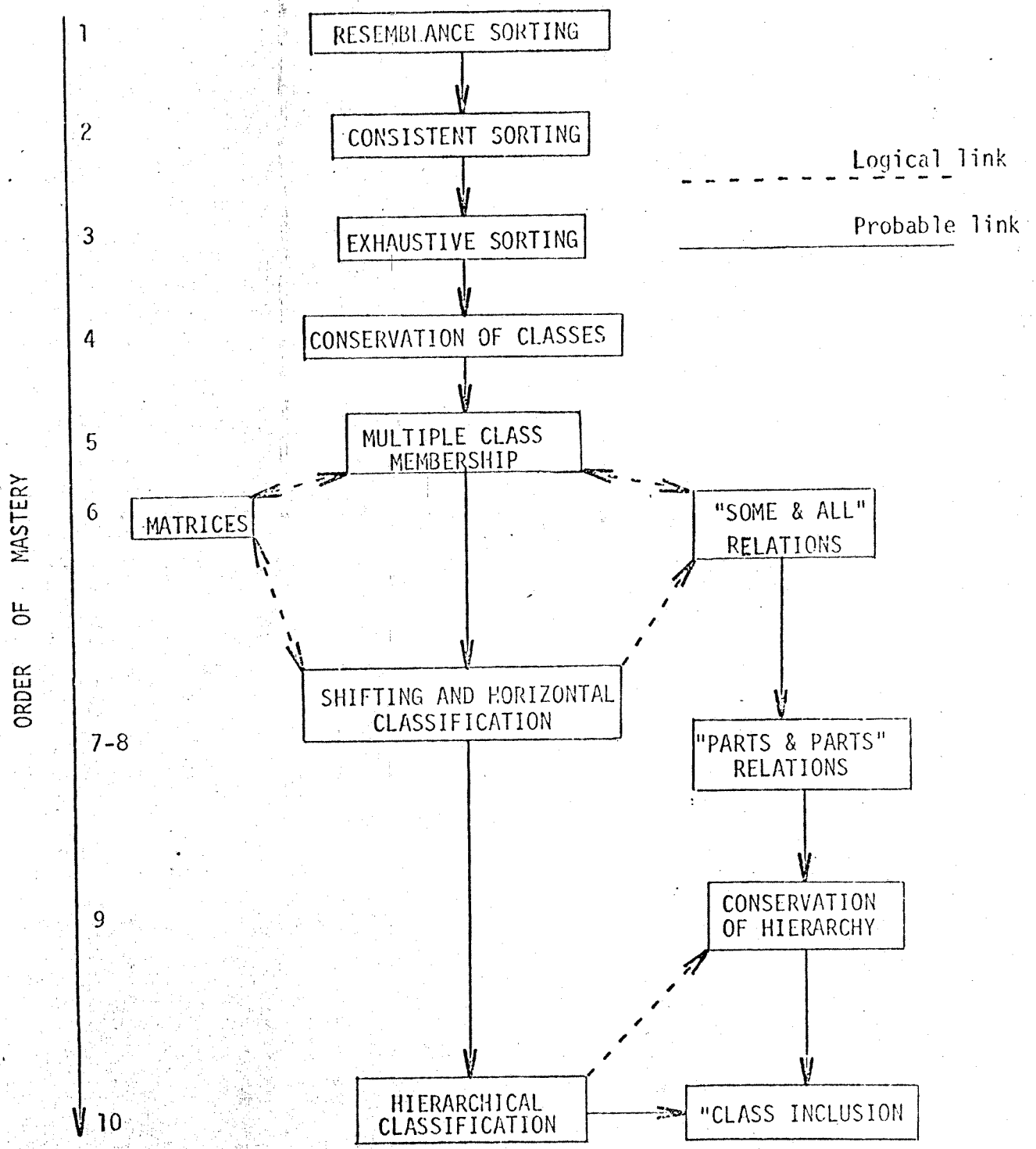


Figure 4.2.1 Predicted sequence of development of classificatory skills (Adapted with modifications from Kofsky, 1966.)

"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 26 students in both the ANISA and control group school are summarized in Table 4.2.1. While some differences were observed between the two groups, the differences tended to be quite small. The ANISA students tended to do a little better on Tasks 1 and 2 and a little worse on Tasks 3 and 4. (It should be noted that Task 2-B, was scored 0-1 by the administrators rather than on the scale 0-4 as recommended in the manual.) Tasks 1 and 2 were designed to test the multiple class membership and the some and all relations subskills. Tasks 3 and 4 tested the relation between parts

Table 4.2.1

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

Variable		ANISA (N=26)		Control (N=26)	
		$\bar{X}$	SD	$\bar{X}$	SD
Task 1	B	.962	.196	.962	.196
	C	1.000	.000	1.000	.000
	E	.269	.456	.154	.368
Task 2	B	.538	.508	.500	.510
	C1	1.000	.000	.923	.272
	C2	.962	.196	.962	.196
	C3	.962	.196	1.000	.000
	C4	.923	.272	.846	.368
Task 3	B	.769	.430	.808	.402
	C	.846	.368	.962	.196
	D	.192	.402	.154	.368
Task 4	C	.500	.510	.538	.508
	F	.615	.496	.654	.485

and the multiple class membership subskills.

In summary, it is rather clear from our data that there are essentially no differences between the ANISA and Control school students on the classificatory behaviors tested in our study. Our data also suggests that roughly 50% of the students have mastered the multiple class membership subskill, about 90%, some and all relations; and about 20%, relation between parts.

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).

Results

Table 4.3.1 presents the percentage of both ANISA and Suffield control students achieving each possible score value on each of the three simple seriation tasks. It appears that the ANISA students' performance was superior to that of the control students. It can be seen from Table 4.3.1 that, when the data were averaged over the three simple seriation tasks ($\overline{P}$), only 33.3% of the ANISA sample failed to seriate while 46.1% of the control group failed to seriate. In

---

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

Table 4.3.1

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

Score	Stage	ANISA (N=25) Task				Control (N=26) Task			
		1	2	3	$\bar{P}$*	1	2	3	$\bar{P}$*
0	No Seriation	28.0	8.0	4.0	13.3	3.8	11.5	0.0	5.1
1	Partial Seriation	8.0	36.0	16.0	20.0	57.7	38.5	26.9	41.0
2	Pre-Operational Seriation (Trial and Error)	20.0	12.0	12.0	14.6	15.4	3.8	23.1	14.1
3	Pre-Operational Seriation with Extension	12.0	4.0	16.0	10.6	0.0	3.8	11.5	5.1
4	Operational Seriation	4.0	20.0	12.0	12.0	3.8	30.8	15.4	15.6
5	Operational Seriation with Extension	28.0	20.0	40.0	29.3	19.2	11.5	23.1	17.9

*Mean percentage for all three tasks.

addition, 41.3% of the ANISA group seriated operationally, while only 33.5% of the control sample seriated at this level. In all, 66.6% of the ANISA group seriated either operationally or by trial and error while 53.9% of the control group achieved seriation. Table 4.3.1 also reveals that 39.9% of ANISA children were able to extend successfully (scores of 3 or 5) while only 23.0% of control children were able to. This difference indicates a more mature approach towards cognitive competence on the part of the ANISA group.

For the first and third tasks, the ANISA students, on the average, received higher scores, while for the second task, the ANISA and control students received essentially similar scores. It should be noted that the clearest difference existed for task three and this difference is the major determinant of the overall differences. A result that may be important occurred for task one in which 28% of the ANISA students failed to seriate at all. This is the only result which substantially favored the control group and so it may be due to chance.

Table 4.3.2 presents the percentage of ANISA and control school 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 control group displayed, slightly more anticipation of seriation. It should be noted that only one of the ANISA students and none of the control students received scores of four on the task. This is an expected result since anticipation of seriation is generally not observed in kindergarten children.

Table 4.3.2

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

Score	Stage	ANISA (N=25)	Control (N=26)
0	No Anticipation No Seriation	48.0	46.2
1	Semi-anticipation Pre-Operational Seriation	28.0	23.4
2	Partial Correspondence Pre-Operational Seriation	20.0	30.8
3	Anticipation Pre-Operational Seriation	0.0	0.0
4	Anticipation Operational Seriation	4.0	0.0

4.4 Attention

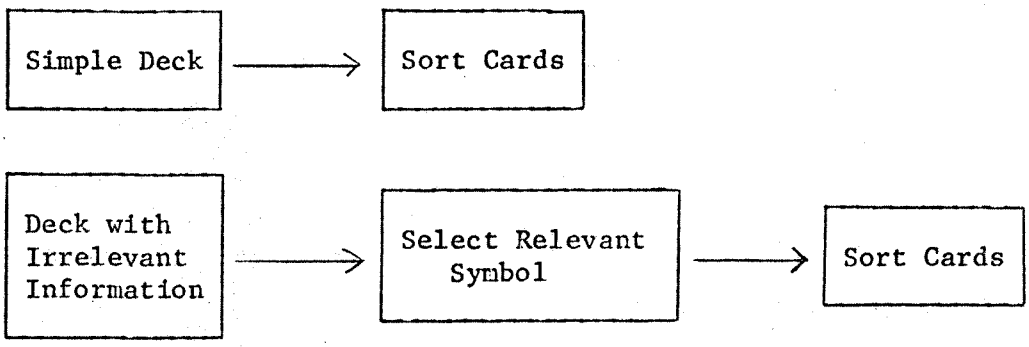
Test Development

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 suggest that there are no differences between the ANISA school and the control school with regard to the aspect of attention measured in this study. The fluctuations of the size and of the direction of the differences between the group mean scores for the three pairs are consistent with the hypothesis that the true difference is zero. That is, the observed differences seem to be simply random fluctuations about a true difference of zero.

Further support for this hypothesis is derived from the total score. The ANISA students' mean attention score was just 0.8 seconds better than the control students' mean attention score. This value is the best estimate of the true difference, since it is based on all three pairs.

It should be noted that these results are specific to attention as defined and measured in this study. It is possible that a study based on either a different test or a different definition would produce different results. This consideration seems particularly important in view of the number of definitions of attention 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

Table 4.4.1

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

Variable	ANISA (N=20)		Control (N=18)	
	$\bar{X}$	SD	$\bar{X}$	SD
Pair I	2.60	6.73	.48	11.60
Pair II	11.13	52.06	15.91	48.99
Pair III	12.93	11.31	10.96	11.25
Total	26.65	55.34	27.34	57.55

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.

---

[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 of the figure-ground perception test are as follows: The mean and standard deviation of scores on the test were 10.39 and 4.09 for the ANISA group, and 9.71 and 3.68 for the control group school. The ANISA students did slightly better, but the difference between mean scores is so small that attaching any importance to the difference is unwarranted. Effectively then, the results indicate that the ANISA and control students were equivalent in terms of figure-ground perception ability. It is interesting to note however, that both groups scored significantly higher than the average student of the same age in the norms table for the test.

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

---

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

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.

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

All three tasks were utilized in the testing program at the ANISA and Suffield control school. During the administration of each task, 3 children were tested and there were 10 observations on each child constituting a total of 30 observations per administration.

As revealed by Table 4.6.1, no appreciable differences were found between the ANISA and Control groups. There is a mild tendency indicated toward better cooperation by the control group, but the difference certainly is not significant. The ANISA group faired better in only 2 of the 9 categories of behavior whereas the Control group faired better in 5 of the 9 categories.

Table 4.6.1

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

Behavior	ANISA (N=30)	Control (N=27)
Strong Cooperation	.24	.26
Assisting	.05	.05
Taking Turns	.01	.04
Contributing Verbally	.12	.14
Responding Positively	.07	.03
Incidental Cooperation	.50	.53
Contributing Independently	.50	.53
Non-Cooperation	.25	.20
Onlooking	.09	.05
Non-Participation	.10	.11
Responding Negatively	.02	.02
Distracting/Disrupting	.04	.02

The data presented in this table also indicates that for both groups the majority of the observed behavior was considered to be incidental cooperation. The remaining behavior was classified as non-cooperation as often as it was classified as strong cooperation.

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 nouns 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, š, ž, č, ǰ (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 phonemes (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, g, 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

Results on the inflection test are reported under ten inflection categories in Table 4.7.1. The mean number of correct responses per inflection are given for both the ANISA and control groups.

Additionally, data are reported by phonemic ending since previous research on inflections has shown a developmental trend for the ez, s, and z endings. The phoneme -ez is more difficult for young children and is generally learned later than the phonemes -s or -z.

As shown in Table 4.7.1, in eight of the ten inflections there were basically no differences between the ANISA and the control groups. The two inflections showing a slight superiority for the control group were the superlative adjectival form and the third person singular verb form.

Table 4.7.1

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

Variable	ANISA (N=28)	Control (N=27)
Inflection		
Noun Plural-Production	3.20	3.22
Noun Plural-Recognition	1.58	1.59
Noun Possessive	1.89	1.92
Adjective Comparative	1.29	1.30
Adjective Superlative	2.11	2.44
Verb Progressive	.57	.67
Verb Past Tense-Regular	1.00	.82
Verb Past Tense-Irregular	.57	.67
Verb Third Person-Singular	1.68	2.11
Noun Derived Form	.25	.26
Phonemic Ending		
S	2.21	2.52
Z	1.93	2.37
EZ	1.61	1.48

Of the phonemic endings the most difficult, or -ez phoneme, showed no difference, while the differences between the remaining two phonemes favored the control group.

The mean differences on the inflectional endings which favored the control group were of a magnitude of approximately 1/3 to 1/2 an item. The mean differences are based on three items in each case except for the -s phoneme. That mean difference is based on four items. These differences may indicate inflectional endings to which the ANISA teachers should pay more attention. However the mean difference for the entire test is only .77 and therefore we must conclude that there are essentially no differences between the ANISA and control group students in terms of a global measure of inflections.