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ABSTRACT

This is a report on the North Carolina Advancement School's research and program for the Fall, 1968, and Spring, 1969. The School was designed to implement research on the problem of underachievement. The students, sixth- and seventh-grade boys, usually reside at the School. The instructional program includes humanities, reading, mathematics, and art. Individual instruction, team teaching, and other experimental methods were employed. The results show that the students evidenced significant growth on measures of achievement; the sixth-graders did better than those older in this area. This suggests that age is related to ability to respond to the program. Changes in personality variables were also more pronounced for sixth-graders. However, all students tended to change on psychological characteristics in a positive direction. Further research is urged. For related reports, see UD 011 076-079 and CG 011 081. (Author/JW)

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A RESEARCH REPORT OF

THE NORTH CAROLINA ADVANCEMENT SCHOOL:

FALL TERM, 1968

SPRING TERM, 1969

Submitted to the Board of Governors
and the North Carolina State Board of Education

UD011080

Winston-Salem, North Carolina

October, 1969

John N. Bridgman, Jr., Director
James Lee Howard, Assistant Director
Richard F. Allen, Coordinator of Counseling

FOREWORD

This report is the third in a series of research reports describing results derived from working with underachieving boys from all parts of the state of North Carolina. It represents our continuing efforts to further define and identify possible causes and remedies of underachievement.

The results as reported in this volume can best be understood with prior knowledge of the contents of the first volume, The North Carolina Advancement School Research Report, Spring, 1968, and the second volume, The North Carolina Advancement School Research Report, Summer, 1968. In addition, it should be understood that one major purpose of this report is to compare results obtained as reported in prior research reports to those reported in this volume. The results as reported herein are most gratifying in that we are able to understand more clearly the phenomenon of underachievement and how it develops over a period of years and are therefore better prepared to design programs for their remedial value.

ACKNOWLEDGEMENTS

Gratitude is expressed to the Board of Governors and to the State Board of Education for their continuing support and encouragement and for their meaningful advice and directions in carrying to fruition the purposes of the School as set forth by the North Carolina Legislature. The assistance of Mr. A. C. Davis and Mr. J. E. Miller, who served as special consultants to the Board, has been of particular significance in planning and implementing the program.

Grateful appreciation is extended to Dr. W. Scott Gehman, consultant psychologist from Duke University, and to Dr. Kinnard White, consultant in educational research from the University of North Carolina, for their help in designing this study and for their invaluable assistance in carrying out the objectives of the School.

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CHAPTER I

INTRODUCTION

The 1968 fall term and the 1969 spring term of the North Carolina Advancement School were designed to implement research related to describing and remedying the problem of underachievement with sixth- and seventh-grade boys. Results obtained from the 1968 summer session indicated that the program at the Advancement School could be effective in helping sixth- and seventh-grade boys overcome their problems. Based on this information, the decision was made to accept seventh-grade boys for the 1968 fall term and sixth-grade boys for the 1969 spring term. Specifically, the 1968-69 academic year program was designed to answer the following questions:

1. What are the academic, physical, psychological, and behavioral characteristics of sixth- and seventh-grade boys who are not achieving in school?
2. How do sixth- and seventh-grade underachievers compare with one another on these characteristics and with eighth-graders?
3. What treatments seem to be effective with sixth- and seventh-graders and how do they differ from treatment prescribed for eighth-grade underachieving boys by the Advancement School?

As with previous research, the underachiever was defined as any student with average or above-average ability who was not achieving at his expected level as assessed by standardized scores, academic record, and teacher observation. Selection criteria for the fall and spring terms were essentially the same as for previous terms at the North Carolina Advancement School. This was deemed necessary in order to have some constant factor on which to base comparisons in characteristics of sixth-, seventh-, and eighth-graders.

The Instructional Program.[1] The instructional program implemented during the 1968-69 academic year was basically the same as the spring and summer programs of 1968. It consisted of three areas:

1. A Humanities Block emphasizing the role of counseling, with learning experiences designed around problems of concern to students.
2. A Learning Center emphasizing skill development in reading and mathematics.
3. An Exploratory Curriculum for study of special interest areas including science, art, music, industrial arts, and physical education.

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[1] For a more detailed description of the philosophy of the school and its overall program, see The North Carolina Advancement School Research Report, Spring, 1968, Winston-Salem, North Carolina, August, 1968.

These three areas comprised the basic structure for the program and were refined internally using the recommendations from The North Carolina Advancement School Research Report, Summer, 1968, as guidelines.[2] The following individual research projects were implemented in addition to the overall research:

1. Individualized science instruction
2. Comparisons between traditional and discovery remedial mathematics
3. Team-teaching versus departmentalization
4. Behavioral characteristics of underachievers

The overall research design and its analysis have been described in Chapter II of this volume, and the analyses of the individual research projects have been described in Chapter III. Chapter IV was devoted to summarizing, conclusions, and recommendations.

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[2] See The North Carolina Advancement School Research Report, Summer, 1968, Winston-Salem, North Carolina: North Carolina Advancement School, pp. 43-47.

CHAPTER II

A STATISTICAL ANALYSIS OF DATA: FALL, 1968, AND SPRING, 1969

Research conducted at the North Carolina Advancement School during the 1968-1969 academic year attempted to describe sixth- and seventh-grade underachieving boys in terms of achievement levels, psychological characteristics, and motor abilities. An effort was made to discern changes in these characteristics and to determine if these changes were statistically significant at accepted confidence levels. In addition, an attempt was made to describe these students behaviorally and to develop a behavior rating scale. The variables tested and the instruments used are summarized in Table 1.

I. COLLECTION OF THE DATA

Design of this study utilized pre-test and post-test situations. For the 96 seventh-grade boys in attendance during the fall, pre-test data were collected in September, 1968, and post-test data were collected in January, 1969. For sixth-graders attending the spring term, pre-tests were administered in February, 1969, with post-tests being administered in May, 1969. Complete pre-test, post-test data were available for 67 seventh-graders and for 71 sixth-graders.

TABLE 1

VARIABLES MEASURED AND INSTRUMENTS USED IN ASSESSING GROWTH OF SEVENTH- AND SIXTH-GRADE STUDENTS ATTENDING ADVANCEMENT SCHOOL DURING FALL, 1968, AND SPRING, 1969

Variable	Instruments Used for 7th-Graders	Instruments Used for 6th-Graders
Achievement	Wide Range Achievement Test (WRAT) Gates Vocabulary Test Gates Comprehension Test Gilmore Oral Reading Test	Gates Vocabulary Test Gates Comprehension Test Diagnostic Tests and Self-Helps in Arithmetic (Brueckner)
Critical Thinking	Macy-Wood Test of Critical Thinking	Macy-Wood Test of Critical Thinking
Personality	Tennessee Self Concept Scale Semantic Differential California Test of Personality Intellectual Achievement Responsibility Scale (IAR)	Tennessee Self Concept Scale Semantic Differential Intellectual Achievement Responsibility Scale (IAR)
Motor Ability	Barrow Motor Ability Test (BMA)	Johnson Test of Motor Ability

II. RESULTS OF THE STUDY

Pre- and post-test data for seventh- and sixth-graders are recorded in Tables 2 and 3 respectively. An analysis of these data yielded the following results in the areas indicated:

Achievement. Examination of Tables 2 and 3 clearly indicated that both seventh- and sixth-graders grew in certain reading achievement areas. Seventh-graders grew significantly in general reading achievement (as measured by the Wide Range Achievement Test[3]), in comprehension, and in oral reading skills. Sixth-graders evidenced significant change in vocabulary only. It should be noted that the WRAT was not administered to the sixth-grade group.

An increase in mathematics achievement is shown for the sixth-grade study group, whereas seventh-graders did not evidence significant growth in this area.

These results are somewhat consistent with results obtained from the 1968 summer program.[4] Changes in reading achievement were noted during the summer for both sixth- and seventh-graders on selected criteria. Although mathematics achievement was not assessed during the summer session, the

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[3] J. F. Jastak, et. al., Wide Range Achievement Test, Wilmington, Delaware: Guidance Associates, 1965.

[4] Op. cit., pp. 15-20.

TABLE 2

COMPARISON OF PRE-TEST AND POST-TEST MEANS
FOR 7th-GRADE BOYS ATTENDING NCAS DURING FALL, 1968

Variable	N	Pre $\bar{X}$	S. D.	Post $\bar{X}$	S. D.	Correlated t-tests
WRAT-Reading	67	86.25	11.78	89.60	12.00	5.051**
WRAT-Spelling	76	81.61	9.99	82.41	8.61	1.208
WRAT-Arithmetic	74	82.50	7.18	81.51	8.44	1.610
Gates-Vocabulary	74	25.92	7.53	26.22	7.05	0.520
Gates-Comprehension	72	18.06	8.03	21.72	6.81	4.343**
Gilmore-Oral	73	52.93	16.43	67.99	19.53	10.434**
Tennessee Self Concept Scale						
Self-Criticism	77	47.03	9.08	51.56	10.06	3.631**
Total Positive	77	41.17	8.95	39.17	9.60	-2.064*
Identity	77	40.83	12.17	41.02	12.91	0.131
Self-Satisfaction	77	44.57	9.10	42.02	9.94	-2.478*
Behavior	77	40.36	10.63	36.30	10.17	-3.649**
Physical Self	77	46.06	11.59	43.94	13.99	1.481
Moral-Ethical Self	77	43.52	10.63	35.40	11.21	-5.176**
Personal Self	77	39.04	9.64	42.34	10.86	2.561*
Family Self	77	41.56	9.62	40.70	11.74	0.759
Social Self	77	42.38	9.45	39.87	9.56	-2.422*

* $p < .05$
** $p < .01$

TABLE 2 (continued)

Variable	N	Pre X	S. D.	Post X	S. D.	Correlated t-tests
Tennessee Self Concept Scale (continued)						
Variability	77	54.12	12.34	56.65	10.06	1.708
Distribution	77	49.91	14.44	50.05	14.12	0.112
California Test of Personality						
Total	78	40.73	6.58	39.69	7.41	1.448
Personal	78	43.10	6.99	41.37	8.26	-2.146*
Social	78	38.05	7.54	37.59	7.64	0.530
Semantic Differential						
Me At School	78	40.86	7.22	43.22	7.97	2.894**
Teachers	78	44.08	7.40	42.67	11.05	1.108
Me At Home	78	42.91	8.14	47.49	6.98	4.084**
Ideal Self	78	48.11	8.44	51.95	5.60	3.336**
NCAS	76	48.09	8.02	47.71	10.29	0.289
IAR-Positive	76	12.47	2.68	12.82	2.54	1.178
IAR-Negative	76	11.49	2.63	11.66	2.58	0.505
IAR-Total	76	24.09	4.61	24.47	4.14	0.749
BMA	68	44.41	7.05	47.81	7.03	4.966**

TABLE 3

COMPARISON OF PRE-TEST AND POST-TEST MEANS FOR SIXTH-GRADE BOYS ATTENDING NCAS DURING SPRING, 1969

Variable	N	Pre $\bar{X}$	S. D.	Post $\bar{X}$	S. D.	Correlated t-tests
Gates Vocabulary	88	22.78	7.94	23.82	7.13	1.6577*
Gates Comprehension	88	17.32	8.81	18.36	8.04	1.2480
Math	91	37.65	16.23	42.77	15.46	4.3728***
Macy-Wood Test of Critical Thinking						
Relationships	87	25.19	5.46	26.32	5.19	1.8879*
Openmindedness	87	25.28	5.21	28.00	5.83	4.7826***
Generalizations	87	26.44	9.88	30.80	8.42	3.6713***
Accuracy	87	12.40	7.76	18.29	11.92	4.8899***
Total	87	88.26	16.15	103.24	19.93	8.9113***
Tennessee Self Concept Scale						
Self-Criticism	88	50.18	8.80	52.34	9.74	2.2710**
Total Positive	88	39.60	8.60	40.51	10.17	1.0976
Identity	88	39.29	10.31	42.02	12.20	2.3916**
Self-Satisfaction	88	43.18	9.50	42.48	10.46	.8410
Behavior	87	39.53	10.65	38.70	9.67	.9344
Physical Self	87	43.91	10.70	45.74	11.09	1.9088*

* $p < .10$
** $p < .05$
*** $p < .01$

TABLE 3 (continued)

Variable	N	Pre $\bar{X}$	S. D.	Post $\bar{X}$	S. D.	Correlated t-tests
Tennessee Self Concept Scale (continued)						
Moral-Ethical Self	87	35.17	10.17	34.43	10.11	.7762
Personal Self	87	42.99	10.64	43.87	11.06	.8085
Family Self	87	43.07	9.52	43.53	10.54	.4737
Social Self	87	41.48	9.31	39.70	9.37	1.8481*
Variability	87	55.40	9.19	54.57	10.37	.7174
Distribution	86	48.46	10.79	45.09	11.84	3.1056***
IAR Positive	71	12.91	2.83	13.70	2.66	2.2051**
IAR Negative	71	12.32	2.75	13.01	2.37	1.9214*
IAR Total	71	25.20	4.50	26.72	4.20	3.1142***
Semantic Differential						
Me At School	73	38.94	7.72	39.63	8.37	.7859
Teachers	73	42.01	9.36	42.59	8.98	.5254
Me At Home	73	43.59	7.12	46.27	6.51	3.1611***
Ideal Self	72	51.01	6.45	51.42	5.97	.3997
NCAS	72	48.82	5.77	48.76	7.14	.1504
Johnson Test (Motor Ability)	79	49.82	5.77	54.47	8.11	5.0328***

fall and spring results on mathematics achievement tend to substantiate the findings that sixth-graders respond better to the North Carolina Advancement School program than do seventh-graders as evidenced by growth in achievement in general.

In addition to achievement measures, a test of critical thinking was administered to all sixth-graders attending the Advancement School during the spring term and to seventh-graders attending in the fall who were involved in an experimental science program. (The results of the science study are explained in detail in Chapter III of this report.) In general, both sixth- and seventh-graders grew in their abilities to think critically. The seventh-grade group improved significantly in the area of accuracy as it relates to critical thinking, whereas the sixth-grade group improved significantly in all areas. Although both groups improved significantly in their abilities to think critically, sixth-graders evidenced more positive change than did seventh graders.

Personality. Pre-post measures on personality variables presented a less clear picture of discernible differences between sixth- and seventh-graders. On the Tennessee Self Concept Scale,[5] significant changes did occur for the two

[5] William H. Fitts, Tennessee Self Concept Scale, Nashville: Counselor Recordings and Tests, 1965.

groups. Both showed positive change on the Self-Criticism sub-scale. This may be interpreted that both sixth- and seventh-grade students became more open to their faults and less defensive about themselves. Seventh-graders viewed themselves more positively as measured by the Personal Self sub-scale. On other sub-scales, seventh-graders showed significant regression. They became less satisfied with themselves as individuals, less satisfied with their behavior, and less satisfied with themselves as moral beings. They also came to feel less adequate in social interactions with other people.

Sixth-graders, on the other hand, grew positively in their feelings about themselves as individuals, in their feelings about their physical appearance and physical self in general, and in their feelings of adequacy in social interactions. Generally, sixth-graders evidenced more positive growth in self-concept than did seventh-graders as measured by the Tennessee Self Concept Scale.

On the Intellectual Achievement Responsibility (IAR) Scale,[6] the seventh-grade group did not change significantly in accepting responsibility for their school achievement. Sixth-graders, however, did show significant change in this

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[6] Virginia J. Crandall, W. Kathovsky, and S. Preston, "Motivational and Ability Determinants of Young Children's Intellectual Achievement Behaviors," Child Development, 33: 643-661, 1962.

area. In comparing seventh-grade scores on the IAR, it should be noted that the Advancement School seventh-grade students compared favorably to national norms. Advancement School sixth-graders compared favorably on the pre-test to national norms, and on the post-test they scored significantly above these norms.

As measured by a semantic differential,[7] the seventh-grade study group grew in the positive direction in their attitudes toward school, home, and ideal self. Sixth-graders grew in the positive direction in their view of themselves in the home situation.

Other Analyses. To gain further insight into the problem of underachievement concerning self-concept and attitudes, correlation coefficients were computed relating self-concept to attitudes, using data collected on seventh-graders. Only pre-test data were analyzed in an effort to describe the phenomenon of underachievement. These data are presented in Table 4 and Table 5.

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[7] Based on the original work by C. E. Osgood, G. Soci, and P. Tannenbaum, The Measurement of Meaning, Urbana, Ill.: University of Illinois Press, 1957. The actual items came from a study conducted with elementary school children using this technique. See Daniel C. Neale and J. M. Proshek, "School Related Attitudes of Culturally Disadvantaged Elementary School Children," Journal of Educational Psychology, 58: 238-244, 1967.

An inspection of Table 4 revealed that self-concept is highly related to the attitude of an individual toward school, home, and teachers. Of particular importance was the individual's view of himself as it affected his perception of himself in school, in the home, and his attitudes toward teachers. The more adequate an individual's view of himself, the more favorable were his attitudes toward teachers. Self at school was highly correlated with identity, the way the individual perceives himself morally, the feelings of worthwhileness as a family member, and attitudes toward teachers. Attitude toward teachers was highly related to how the individual saw himself as a person.

Table 5 revealed similar results. Intelligence was related negatively to an individual's ability to accept responsibility for his own achievement. This may be interpreted to mean that the higher an individual's intelligence, the less he is able to accept responsibility for his own successes and failures.

Of particular significance were the relationships between total positive self, moral-ethical self, self at school, and self at home with achievement responsibility. The more an individual viewed himself positively and was acceptant of himself as a moral-ethical being, the more he was able to accept responsibility for his own achievement. The better his attitude toward himself in home and school,

TABLE 4

CORRELATIONS OF PERSONALITY VARIABLES
WITH SELF AT SCHOOL, SELF AT HOME, AND ATTITUDE TOWARD
TEACHERS UPON ENTRY AT NCAS - FALL, 1968 (7th GRADERS)

	Self At School	Self At Home	Attitude Toward Teachers
Self-Criticism	-.20	-.23*	-.24*
Total Positive	.52**	.62**	.54**
Identity	.57**	.64**	.56**
Self-Satisfaction	.22*	.35**	.30**
Behavior	.36**	.35**	.32**
Physical Self	.44**	.45**	.50**
Moral-Ethical Self	.41**	.53**	.43**
Personal Self	.32**	.33**	.35**
Family Self	.37**	.56**	.41**
Social Self	.38**	.36**	.40**
Attitude Toward Teachers	.64**	.69**	____
Self At Home	.77**	____	____
Self At School	____	____	____

N = 81

* $p < .05$
** $p < .01$

TABLE 5

CORRELATIONS OF PERSONALITY VARIABLES WITH ACHIEVEMENT RESPONSIBILITY UPON ENTRY AT NCAS - FALL, 1968 (7th GRADERS)

	IAR-Positive	IAR-Negative	IAR-Total
IQ	-.22*	-.23*	-.26*
Self-Criticism	-.27*	-.22*	-.28**
Total Positive	.24*	.36**	.35**
Identity	.19	.20	.22*
Self-Satisfaction	.08	.18	.15
Behavior	.25*	.31**	.32**
Physical Self	.29**	.22*	.29**
Moral-Ethical Self	.34**	.42**	.43**
Personal Self	.06	.05	.06
Family Self	.13	.34**	.28**
Social Self	.03	.14	.11
Self At School	.41**	.31**	.41**
Self At Home	.41**	.36**	.43**
Teachers	.35**	.27*	.35**

N = 81

* $p < .05$
** $p < .01$

the more capable he was of accepting responsibility for his own behavior with respect to achievement.

These data tend to support the hypothesis that if a person feels good about himself as an individual and views himself with esteem, he is more likely to possess favorable attitudes toward teachers, is more capable of relating to the home and school environments, and is more capable of accepting responsibility for his own behavior.

Using data collected on the sixth-grade study group, further analyses were attempted to relate demographic data to how well a child responded to the Advancement School. Education of father, size of home city, number of parents in the home, and family income were used to stratify the sixth-grade group. An analysis of covariance was applied to assess differences among groups on post-test measures of vocabulary, comprehension, mathematics achievement, critical thinking, self-concept, and achievement responsibility. Using this system of classification, no significant differences were observed. These data, along with data collected on other age groups, are being analyzed further and will be presented in a later report.

CHAPTER III

OTHER RESEARCH CONDUCTED DURING FALL, 1968, AND SPRING, 1969

In addition to the overall research program as described in Chapter II, individual departments conducted research projects during the fall of 1968 and spring of 1969. The projects selected for inclusion were the following:

1. Individualized science instruction
2. Comparisons between traditional and discovery mathematics
3. Team teaching versus departmentalization
4. Behavioral characteristics of underachievers

The first three of these projects represented the Advancement School's initial attempts at planning and evaluating instructional approaches which might prove to be beneficial in working toward the remediation of underachievement. The fourth project represented an effort to obtain behavioral data on underachievers with a view toward eventually relating these data to academic and psychological data.

I. COMPARISONS OF TWO APPROACHES TO INDIVIDUALIZING SCIENCE INSTRUCTION FOR UNDERACHIEVERS - FALL, 1968

Purposes. The major purpose of this study revolved around the design of two different approaches to individualizing

science instruction. One approach emphasized developing the role of the student as a scientist in the classroom. The second approach incorporated some pre-packaged experiences in science with these students eventually assuming more self-direction. For both groups, emphasis was given to helping students identify research projects. This study was conducted over a four-and-one-half-month period.

More specifically, this study attempted to answer the following questions:

1. Does the student evidence a greater degree of achievement from a role-assumption approach or from a semi-structured approach?
2. Does the student develop critical thinking skills and attitudes to a greater degree in the role-assumption approach or the semi-structured approach?
3. Which of the two approaches is more likely to alleviate science misconceptions?
4. Is the student's self-concept enhanced more through a role-assumption approach or through a semi-structured approach?
5. Are more positive attitudes toward science better developed through one approach than the other?

The Study Groups. Seventh-grade students who elected to take science were divided randomly into two groups. Students

of one group were to assume the role of a science researcher (T_1). Students in the second group received a more structured approach to science learning (T_2). A control group was selected randomly from those students who did not elect to take science (T_3).

Each student in Group I was asked to select an interest area and was guided in any research he wanted to attempt in this area. Examples of research attempted by students in the role-assumption group are as follows:

1. Conditioning animals - maze and skinner box
2. Plant growth in different environments
3. Uptake of P_{32} by plants
4. Photography
5. Chemistry (general)
6. Electronics - specifically radio - build AM radio
7. Reproduction and photoperiodism (mice)
8. Music and plant growth
9. Weather prediction

After the student in this group selected a research project, direct supervision and guidance were withdrawn by the two instructors in attendance. Instructors did not give direct answers to questions asked by members of this group. Students were not required to look for answers to questions but were offered possible sources. The students in this group were not forced to work on their research each day but

were expected to work when they were in class. Students were encouraged by the instructors complimenting the work they had done, but they were not chastised for not doing their work.

The student in this group did not receive lectures, view audio-visual materials, or participate in any activity in science which did not pertain to his research area. In some instances, students in this group worked on more than one research project, depending upon the length of time necessary for results to be derived. This group was composed of thirty students.

The students in Group II were also encouraged to select a research project in an interest area; but, unlike students in Group I, they received lectures, audio-visual presentations, regular laboratory sessions, field trips, and resource speakers as would be found in many science programs. The research projects selected by students in this group were as follows:

1. Photoperiodism and plants
2. Animal behavior as affected by different colors
3. Nutrition and mice
4. Plants and the spectrum
5. Chemistry
6. Photography

Students in the semi-structured group were closely supervised and constantly encouraged. They were urged to work on their projects when they were found idle. When they appeared bored, they were taken away from their projects and exposed to a structured science program for remotivation purposes, after which they were encouraged to return to their projects. Direct answers were supplied by instructors to questions, or students were told exactly where to find an answer and were sent immediately to get it. An attempt was made to keep these students working every minute while in the class situation. Twenty-three students comprised this group.

A third group of twenty-five students was randomly selected from those students who did not elect to take science. These students received all pre- and post-tests that students in the other two groups received.

Variables Measured. Pre-tests were administered to students in all three groups in September, 1968, and post-tests were administered during January, 1969. Variables included for study and the test instruments used to assess these variables are the following:

1. Science achievement as measured by the Sequential Test of Educational Progress: Science, forms 3A and 3B. This test emphasizes the understanding of concepts rather than factual information.

2. Critical thinking as measured by the Macy-Wood Test of Critical Thinking; four sub-scales (Relationships, Openmindedness, Generalizations, Accuracy) comprise the test.
3. Science misconceptions as measured by the Relationships sub-scale on the Macy-Wood Test of Critical Thinking.
4. Self-concept as measured by the Tennessee Self Concept Scale.
5. Attitude toward science as measured by a semantic differential.

In addition, an Intellectual Achievement Responsibility Scale was administered to students in all three groups to assess the degree of school alienation possessed by these students and to measure the degree to which individual students accepted responsibility for their own successes or failures in achievement.

Statistical Treatment of Data. For each of the variables measured on each of the three groups, means and standard deviations were computed. In addition, the data were subjected to the following statistical treatments:

1. A multi-variate analysis of covariance. Each post-test criterion for the three groups was compared using the pre-test score for the criterion and

pre-test I.Q. to adjust for initial differences between the three groups. In each analysis, the effects of the pre-test on the variable to be tested were analyzed by use of a regression formula. In this way, it was possible to assess the extent to which the covariates were related to the criterion and to assess which treatment seemed to account for most of the variance.

2. 3 X 2 analysis of variance. This technique was utilized to further stratify the sample within treatment groups. Each of the treatments were further stratified using a median split on I.Q., CRT pre-test, STEP pre-test, SD pre-test, and IAR pre-test. Using this design, each post-test variable was analyzed. In this way it was possible to analyze the effect of each treatment on the variable, the effect of scoring high or low on pre-test variables, and the interaction between the two.

3. Sheffé technique. This is a simple technique to compare the post-test means for each of the treatment groups simultaneously. (T_1 vs T_2 , T_1 vs T_3 , T_2 vs T_3, $\frac{T_1 + T_2}{2}$ vs T_3).

In each statistical test, the accepted level of confidence was the .05 level or beyond.

Results. In general, both experimental groups performed significantly better on all post-variables than did the control group. Specifically, the results of this study are as follows:

1. As one would expect, students in both experimental groups did significantly better in science achievement than did those in the control group. Furthermore, those students with above-average I.Q.'s and high initial scores on the critical thinking test did significantly better than did those with below average I.Q.'s and low initial critical thinking. All of these differences were statistically significant at the .05 level of confidence. Although not statistically significant, a trend in favor of the role-assumption group over the semi-structured group on STEP achievement was established.
2. Comparisons with national norms on the STEP science test revealed that on pre-test measures, the three groups were equivalent and ranked in the 12-34 percentile band. Pre-test scores for all three groups were at the lower quartile. On post-tests, the role-assumption and semi-structured groups ranked in the 16-39 percentile band. The post-test mean for the role-assumption group was at the national median, whereas the post-test mean for the semi-structured group was slightly below the national median, and

the post-test mean for the control group was at the lower quartile. It is interesting to note that 20 per cent of those students in the role-assumption group scored at or above the upper quartile of national norms on the post-test, whereas only 10 per cent from the semi-structured and control groups scored at the upper quartile.

3. In general, there were no differences in growth in critical thinking ability between the role-assumption group and the semi-structured group. Both the role-assumption group and the semi-structured group grew significantly in critical thinking ability when compared to the control group. However, some differences did exist between the role-assumption group and the semi-structured group on certain sub-scales of the critical thinking test.

The semi-structured group tended to grow more than the role-assumption group in analyzing statements representing science misconceptions. Furthermore, students in the role-assumption group who possessed high initial attitudes toward science did significantly better on the critical thinking accuracy scale than did those students in the role-assumption group possessing low attitudes. Students with low attitudes responded better to the semi-structured approach on growth in accuracy.

4. On attitudes toward science, there were no significant differences between the role-assumption and the semi-structured groups. A slight trend was evidenced to indicate that students in the semi-structured group grew more in their attitudes toward science than did those in the role-assumption group. Students in the role-assumption and semi-structured groups grew significantly more in their attitudes toward science than did the control group.
5. No significant differences existed on school alienation as measured by the IAR among the three groups. However, a relationship existed between low initial attitude toward science and final IAR positive indicating that those students with low initial attitudes toward science who were exposed to the semi-structured approach were less alienated toward school.
6. In general, there were no differences among the three groups on measures of self-concept. However, the Self-Criticism sub-scale on the Tennessee Self Concept Scale did differentiate among the three groups. On this scale the role-assumption group grew significantly more than the semi-structured group, and the control group grew significantly more than the semi-structured group. An examination of the pre- and post-test means for this sub-scale revealed that the semi-structured

group regressed on this variable. This indicates that those students in the role-assumption group became more critical of themselves, whereas those students in the semi-structured group became less critical of themselves.

Summary and Conclusions. Several questions have been raised and possible answers identified by this study:

1. Is it more desirable to group students on the basis of initial attitudes than on the basis of achievement or aptitude? The results of this study tend to indicate that attitudes toward science have a direct effect on a student's achievement. Furthermore, for those students with positive attitudes toward science, a non-directive role-assumption approach to learning seems to advance science achievement, whereas those students with poor attitudes benefit from a more directive, semi-structured approach. It is recommended that further research be conducted on the use of attitude for grouping purposes.
2. Does an individualized approach to science learning result in growth in general science achievement? Even though the students in the two experimental groups spent most of their time working on one project, they grew significantly on an achievement test

which measures knowledge in all scientific areas. Furthermore, the students in the less structured, role-assumption group grew more in science achievement than did those in the semi-structured group. This suggests that freedom to work through frustrations results in both increased critical thinking and achievement.

3. Do students with specific characteristics benefit more from one type of individualized instruction than they do from another? The results of this study indicate that students with low attitudes toward science benefit more from a semi-structured approach, whereas students with higher attitudes toward science benefit from a non-directive or role-assumption approach. It is recommended that this study be replicated in a public school setting.
4. Is this approach to individualized science learning applicable to age groups other than seventh grade? Research is now in progress with sixth-graders. Preliminary results and observations indicate that this type of instruction may be even more successful with younger children.

II. COMPARISONS OF TWO APPROACHES TO TEACHING MATHEMATICS - FALL, 1968

The major purposes of this study were to assess the effectiveness of two approaches to individualizing mathematics instruction and to compare a discovery approach with a direct-presentation approach. Specifically, this study attempted to answer the following questions:

1. Which of the two methods has the greater effect on a student's attitude toward mathematics, self-concept in mathematics, achievement in mathematics, and ability to think critically?
2. Is intelligence a significant factor in determining which method is best suited for the group?

Sixty students were chosen to participate in the study. Each student scored above 86 on the Slosson Intelligence Test and scored below the sixth-grade level in mathematics on the Wide Range Achievement Test.

Students were randomly assigned to one of two treatment groups. Treatment 1 (T_1) emphasized the learning of mathematics through discovery, whereas Treatment 2 (T_2) emphasized a more direct approach to the teaching of mathematics. The I.Q. range was 86-124, with a median of 100 for each group.

Treatment 1 consisted of providing a series of mathematical experiences designed to enhance self-discovery on the part of students. The principle of self-selection was utilized in that

students were encouraged to begin their study of mathematics in a skill area of their selection. The role of the teacher was one of encouraging and guiding rather than presenting explanations of mathematical processes and directly answering students' questions. Students were allowed to progress at their own rates and guided to form generalizations intuitively which might be applied to new mathematical situations.

Treatment 2 provided the student with appropriate mathematical definitions, rules, explanations, and derivations based on diagnostic information available on each student. The role of the teacher was one of presenting mathematical concepts and processes directly to the student. The teacher determined where the student should start and how fast he should progress.

Pre-tests were administered to students in September, 1968, and post-tests during January, 1969. The test instruments used were:

1. A semantic differential which measured students' self-concepts in mathematics and their attitudes toward mathematics.
2. A questionnaire designed by the mathematics faculty which attempted to measure the students' attitudes toward mathematics.
3. Diagnostic Tests and Self-Helps in Arithmetic which measured performance in adding, subtracting, multiplying, and dividing whole numbers, fractions, and decimals.

4. A teacher-made supplement to the achievement test designed to measure understanding of fractional numbers, decimals, percentages, ratio, basic number theory, basic set theory, and problem solving.
5. The Macy-Wood Test of Critical Thinking which measured the ability of students to think critically.

Data derived from this study have been recorded in Table 6. For analysis purposes, each treatment group was sub-divided according to ability. Students with I.Q.'s above 100 were assigned to high ability groups, whereas students with I.Q.'s lower than 100 were assigned to low ability groups. Inspection of Table 6 revealed that students in the direct-approach treatment evidenced a higher net gain in attitude toward math, self-concept in math, and critical thinking than did those students enrolled in discovery classes, regardless of ability measurement. In total achievement, the direct method tended to favor high ability students, whereas the discovery method tended to favor low ability students. In general, the direct-presentation approach to the teaching of mathematics benefited students in the development of skills more than the discovery method.

Additional analysis of these data are currently under way to determine if one approach is more effective than the other in promoting development of mathematical concepts.

TABLE 6

PRE- AND POST-TEST MEANS FOR STUDENTS
IN DISCOVERY (T_1) AND DIRECT (T_2) MATHEMATICS GROUPS,
STRATIFIED ACCORDING TO HIGH OR LOW ABILITY

Treatment Groups		High Ability T_1 (N = 14)	High Ability T_2 (N = 11)	Low Ability T_1 (N = 11)	Low Ability T_2 (N = 14)
Math Achievement	Pre	33.43	39.91	27.18	46.00
	Post	39.00	57.18	31.27	48.46
	Gain	5.57	17.27	4.09	2.46
Critical Thinking	Pre	82.73	89.20	67.43	67.00
	Post	96.82	112.50	79.57	89.73
	Gain	14.09	23.30	12.14	22.73
Attitude Toward Math	Pre	56.93	53.91	55.09	58.79
	Post	55.07	56.82	53.19	66.28
	Gain	-1.86	2.91	-1.90	7.49
Self-Concept in Math	Pre	46.43	44.82	48.36	47.93
	Post	48.79	48.28	51.01	52.57
	Gain	2.36	3.46	2.63	4.64

III. A COMPARISON OF TEAM-TEACHING WITH DEPARTMENTALIZATION - SPRING, 1969

A pilot study comparing the effects of team-teaching with departmentalization was conducted during the spring of 1969 in an attempt to refine organizational patterns for working with underachieving students. Two of the six houses of the Advancement School were organized to work together developing a common theme. All subject matter and skill-development areas were related directly to this central theme. The skill areas of reading and mathematics were taught only as needs developed and as those needs related to the overall solutions of problems stemming directly from the central theme. Two counselors and one teacher from mathematics, reading, art, science, and physical education were assigned to this team. The team worked together the full day, incorporating all phases of learning into the development of the central thematic idea. In addition, the industrial arts teacher and the music teacher served as resource personnel to the team.

The other four houses were assigned to departmentalized classes. Each student was required to take reading, mathematics, and physical education. Each student was also allowed to elect two of the following courses: science, industrial arts, music, and art.

The basic purpose of this study was to compare levels of performance by students assigned to the team-teaching program

with the performance of those students assigned to the departmentalized one. A pre-test, post-test design was employed, using the net gain as the criteria for comparison.

Measuring instruments used in this study were:

1. The Gates Vocabulary Test
2. The Gates Comprehension Test
3. "The North Carolina Advancement School Math Test"
4. The Macy-Wood Test of Critical Thinking
5. The Tennessee Self Concept Scale

The data derived from these tests have been presented in Table 7. From this table it can be seen that students in the departmentalized program realized higher net gains than students assigned to the team-teaching group in all categories except for the Tennessee Self Concept Scale.

A further analysis of these data involved sub-dividing the two groups into low ability and high ability, based on I.Q. scores. An analysis of variance was utilized to analyze these data. Using this 2 X 2 design, interaction in the area of self-concept was established. An inspection of Table 8 revealed that low ability students benefited more from the team-teaching program, whereas high ability students benefited more from the departmentalized program when self-concept was analyzed.

Additional analyses of these data are currently under way. Further data is being collected with students attending

TABLE 7

PRE- AND POST-TEST MEANS FOR STUDENTS
IN TEAM-TEACHING AND DEPARTMENTALIZED TREATMENTS

		Gates Vocab.	Compre-hension	Math	Critical Thinking	Self-Concept
Team-Teaching (N = 29)	Pre	24.310	20.310	38.724	89.448	38.931
	S.D.	6.118	8.264	17.596	18.641	7.741
	Post	22.276	19.724	40.345	101.379	39.966
	S.D.	6.193	7.959	13.903	20.017	9.962
	Gain	-2.034	-0.586	1.621	11.931	1.035
Departmen-talization (N = 51)	Pre	22.196	15.549	36.981	87.647	39.098
	S.D.	8.405	8.573	14.837	14.899	8.900
	Post	24.980	17.686	44.000	105.020	39.882
	S.D.	6.736	8.157	14.396	18.158	10.244
	Gain	2.784	2.137	7.019	17.373	0.784

TABLE 8

ANALYSIS OF POST-TEST SELF-CONCEPT OF STUDENTS IN TEAM-TEACHING AND DEPARTMENTAL TREATMENTS STRATIFIED BY HIGH AND LOW ABILITY

	Team-Teaching	N	Departmentalized	N	Total
High	39.27	22	42.70	27	41.16
Low	43.72	11	37.85	28	39.51
Totals	40.72	33	40.23	55	40.43

the fall, 1969, term to further analyze the effects of team-teaching on the development of academic skills and self-concept. These analyses will be presented in a later report.

IV. DEVELOPMENT OF A BEHAVIORAL RATING SCALE - SPRING, 1969

The North Carolina Advancement School Student Behavior Inventory is being developed as a means of measuring the behavior characteristics most commonly found among under-achievers. Behavior characteristics measured by the inventory were selected for inclusion on the basis of the following information:

1. Results of the Devereux Behavior Rating Scale[8], which was completed by home school teachers for each boy

[8] Marshall Swift and George Spivack, "The Assessment of Achievement-Related Classroom Behavior," The Journal of Special Education, 2:137-153, Winter, 1968.

who applied for the 1969 spring term. This scale measures the degree to which a student possesses thirteen behavior characteristics. The results of these ratings were studied for both qualified and unqualified (not underachievers) applicants to determine which characteristics were most descriptive of underachievers. The following categories were identified: general anxiety, quiet-withdrawn, poor work habits, lacks intellectual independence, verbal negativism, disturbance-restlessness, and expressed inability.

2. Results of records kept by Advancement School counselors on student behavior during the summer and fall terms of 1968. A scale[9] had been devised through which counselors could mark particular behaviors frequently exhibited by their students. Several types of behavior appeared to be recurrent and were considered for inclusion in the behavior inventory: dependency, submissiveness, withdrawal, uncooperativeness, hostility, tenseness, and depression. Particular instances in which these behaviors were exhibited were also indicated by counselors and were considered in devising items for the inventory.

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[9] Op. cit., The North Carolina Advancement School Research Report, Summer, 1968, p. 55.

3. Research literature was reviewed to determine what behaviors had been observed in other underachievers. Reports by researchers further substantiated the findings of the Advancement School.

From these sources, the following six categories were selected as incorporating the types of behavior most frequently exhibited by underachievers at the Advancement School: dependency, aggressiveness, passivity, anxiety, poor work habits, and hyperactivity.

Items descriptive of these behaviors were then written and placed randomly in the inventory. In order to keep the inventory brief, only four items were used for each category. All items were written to apply to any grade level. A scale was then devised which would allow a teacher to mark the exact degree to which the item applied to a student.

This behavior inventory is currently being completed for several age groups of underachievers as well as normal school populations. When the development of the inventory is completed, some valuable information about the relationship of behavior to academic achievement may be obtained. The inventory may also offer a new mechanism for the early identification and prevention of potentially serious underachievement.

CHAPTER IV

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The 1968 fall term and 1969 spring term of the North Carolina Advancement School were designed to implement research related to describing and remedying the phenomenon of underachievement with sixth- and seventh-grade boys from all parts of the state of North Carolina. For the purposes of this study, an underachiever was defined as any student with average or above average intelligence who was not realizing his capabilities in the public schools. Priority for admission was given to students who were achieving one or more years below expectancy as measured by standardized tests, grades, and teacher observation.

The 1968-69 academic year program was designed to answer the following questions:

1. What are the academic, physical, psychological, and behavioral characteristics of sixth- and seventh-grade boys who are not achieving in school?
2. How do sixth- and seventh-grade underachievers compare with one another on these characteristics and with eighth-graders?
3. What treatments seem to be effective with sixth- and seventh-graders and how do they differ from

treatment prescribed for eighth-grade underachieving boys by the Advancement School?

I. SUMMARY

Ninety-six seventh-graders were admitted during the fall of 1968, and ninety-six sixth-graders in the spring of 1969. The instructional program was basically the same as that of the spring of 1968. It consisted of a humanities block emphasizing the role of counseling, a learning center devoted to skill development in reading and mathematics, and an exploratory curriculum for the study of special interests.

Design of the Study. The research design was characterized by two major emphases:

1. Overall research describing the underachiever academically, psychologically, and physically.
2. Individual research in instructional areas intended to answer basic questions regarding remediation of underachievement. These included research in the individualization of science instruction, in the individualization of mathematics instruction, and in comparing team-teaching with departmentalization.

In addition, continued efforts to develop a behavior rating scale have been reported. Emphasis was given to the individualization of instruction at all levels.

The statistical treatments used to analyze the data were:

1. Analyses of variance and covariance.
2. Correlated t-tests.
3. Correlation coefficients.
4. Descriptive comparisons when applicable.

Differences existing between pre- and post-test data and between treatment groups have been reported as significant at .01, .05, and .10 levels of confidence.

II. CONCLUSIONS

The following conclusions were derived from this study:

1. Both sixth- and seventh-grade study groups evidenced significant growth on measures of achievement. In comparing these results with results obtained during the summer of 1968, it may be concluded that sixth-graders evidenced more growth in achievement than did seventh-graders. Both sixth- and seventh-graders grew more in achievement than did eighth-graders. This tends to suggest that the age and grade of a student is definitely related to his ability to respond to the Advancement School program.
2. Changes on personality variables were more pronounced for sixth-graders than for seventh-graders. In general, sixth-graders grew positively on measures of self-concept, whereas seventh-graders evidenced

some growth and some regression. Sixth-graders grew significantly in their ability to accept responsibility for their own achievement, whereas seventh-graders did not show significant change. Both study groups evidenced attitude changes, with sixth-graders having more positive attitudes toward their home situation, and seventh-graders having more positive attitudes toward school, home, and ideal self. While these data tend to be somewhat contradictory, they do suggest that both study groups tended to change on psychological characteristics in the positive direction. In addition, a comparison of sixth- and seventh-graders with eighth-graders indicated that sixth- and seventh-graders evidenced more positive change on psychological measures than did eighth-graders.

3. Further analysis of seventh-grade data indicated that self-concept variables were highly related to positive attitudes toward home, school, and teachers. In addition, self-concept variables were positively related to an individual's acceptance of responsibility for his own achievement.
4. Results of this study indicated that an individualized approach to the teaching of science enhanced student growth in the areas of science achievement, critical thinking ability, and attitudes toward science.

Furthermore, initial attitude toward science was directly related to the treatment. Students with high initial attitudes benefited more from a non-structured approach, whereas students with low initial attitudes benefited from a more directive approach to the teaching of science.

5. In comparing a discovery approach of teaching mathematics to a direct-presentation approach, student growth in skill development was enhanced more by the direct approach than by the discovery approach.

6. In comparing team-teaching with departmentalization, the team-teaching situation enhanced growth in self-concept of students, whereas the departmental program enhanced student growth in achievement.

7. A behavior rating scale is in the process of further development. Research to date indicates that underachievers may be differentiated from normal achievers by certain behavior patterns. These behavior patterns are aggressiveness, dependency, passivity, anxiety, hyperactivity, and poor work habits. Underachievers tend to evidence more extreme behavior within these categories than do achievers.

III. RECOMMENDATIONS

The following recommendations are made with respect to this study:

1. Further research should be attempted with sixth-graders during the fall and spring terms of 1969-1970. Emphasis should be given to the development of remedial programs applicable to this age group.
2. Further analysis of data collected from previous terms should be attempted, with a view toward the development of a taxonomy of underachievement. This system would incorporate academic, psychological, social, and behavioral data and would increase educators' capabilities of identifying the potential underachiever at an early age.
3. Further analysis of data collected from previous terms should be undertaken to distinguish between those underachievers who have responded well to the Advancement School programs and those who have not. Based on this information, program refinement and sophistication may be undertaken to meet more nearly the needs of those students who have not responded well to the program.
4. Efforts should be continued to collect data concerning the behavioral characteristics of underachievers.

5. Further research should be implemented to relate more clearly the phenomenon of intellectual achievement responsibility to counseling and instructional programs and to types of underachievers.
6. Further research and continued analysis of existing data should be attempted to validate the data derived from the pilot studies in individualizing mathematics and science instruction and in team approaches to learning.
7. Further efforts should be made to identify physical characteristics which may be related to underachievement.
8. Initial observations indicate that knowledge about styles of learning may hold a key to the teaching-learning process for underachievers. Investigations should be attempted to differentiate among styles of learning exhibited by underachievers, and teaching techniques developed to accommodate and enhance these styles.
9. Selected programs developed at the Advancement School should be implemented in typical public schools to determine their applicability in those settings.
10. Follow-up studies on sixth- and seventh-graders who have attended the Advancement School should be initiated. Follow-up studies with eighth-graders should be continued.

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APPENDIX

TABLE 9

TESTS USED DURING FALL, 1968, AND SPRING, 1969

Wide Range Achievement Test (WRAT)

Gates Vocabulary Test

Gates Comprehension Test

Gilmore Oral Reading Test

Diagnostic Tests and Self-Helps in Arithmetic (Brueckner)

Macy-Wood Test of Critical Thinking

Tennessee Self Concept Scale

Semantic Differentials

California Test of Personality

Intellectual Achievement Responsibility Scale (IAR)

Barrow Motor Ability Test

Johnson Test of Motor Ability

Sequential Test of Educational Progress: Science

Slosson Intelligence Test

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