Summer Achievement Score Change And Grade, Sex, and Socio-Economic Status

Gilbert R. Austin
Lois Williams
University of Maryland

Mohammad A. Shami
Maryland State Department of Education

Craig Scott
Frederick County, Maryland, Board of Education

Summer school compensatory education programs are one of the most common types of Title I efforts intended to halt the progressive achievement level decline relative to national norms evident with increasing age for children who come from lower socio-economic home backgrounds. In an extensive review on the effectiveness of the Summer Compensatory Education Program component of Title I of the Elementary and Secondary Education Act of 1965, Austin, Rogers and Walbesser (1972) noted little evidence of documented achievement gains or change or losses resulting from Title I support of summer programs.

The largest and most recent study of summer compensatory reading programs was carried out for USOE by Educational Testing Services and Resource Management Corporation (Al-Salem, et al., 1976; Trisman, et al., 1976).

The study is based on students in 731 public elementary schools with compensatory reading programs, with the evaluation of summer programs limited to 27 of these schools. These schools were chosen because of their willingness to participate and their having a sufficient number of students to make such a study feasible.

Trisman et al. (1976) concluded, "From the data of this study, it is impossible to decide whether the summer programs investigated produced negligible effects on student achievement, or were successful in counteracting achievement losses possibly typical of the summer recess."

One of the facts that clearly emerged as a result of these studies was that there was little if any baseline data available on what happens to average children's achievement over the course of the summer from which to make judgments about other groups of children. The test publishers suggest that the average (50th percentile) child achieves at the rate of one GE month for each of the nine months in the school year (usually September through May) and one month over the three-month summer vacation period (usually June through August). But they offer little evidence to support their statements about summer growth. Whether the same gain or even a proportional gain can be expected for the child at the 20th or 80th percentile is not discussed; Thomas and Pelavin (1976) suggest it can not. Some test publishers (Iowa, Gates-MacGinitie) acknowledge that there are no gains and even losses for the average student over the summer but that a smooth growth curve requires a forced fit of a one-month gain over the summer. This statement suggests that little real evidence exists on what happens to average children over the summer. Therefore, it seemed important to establish some baseline data on the average child's performance before making comments about the disadvantaged child's performance.

Summary of Summer Change Literature Findings

While the reviewed literature has included studies finding a summer achivement loss, studies finding no change over the summer, and studies finding an achievement gain, some patterns emerge from a review of the whole body of literature.

One study reported that change was consistent over grade level (Florence, 1972) and two studies noted no relationship between change and grade (Parsley

and Power, 1962; L. Scott, 1970). However, a number of studies that noted a relationsihp between summer change and grade found that older children were more likely to gain over the summer than were younger children (Redmond, n.d.; Austin et al., 1976) or that there was a greater summer gain for older children than for younger children (Botwin, 1966; Beck, 1975).

Most recent studies found no significant difference in change related to student ability level (Rude, 1974; Dorrell, 1974; Austin et al., 1976) although two historical studies and a recent statistically questionable study had noted a greater loss for low ability students (Bruecker and Distad, 1924; Ross, 1974). Virtually no studies found a differential summer change according to the sex of the student although one study found a signficant difference favoring girls in the lowest grades, reversing to a non-signficant difference favoring boys in the upper grades (Parsley and Power, 1962).

A number of studies document a relationship between summer change and socio-economic status (Turner, 1972; Hayes and King, 1974; Heyns, 1975). Other evidence linking summer gain with high socio-economic status is indirect. Studies carried out with a low socio-economic population found predominate summer loss, particularly for younger children (C. Scott, 1972; Redmond, n.d.) or no change for middle grade children (Soar and Soar, 1972). Studies carried out with middle socio-economic group populatoins found strong gains, particularly for older children (Soar and Soar, 1968; Austin et al., 1976).

Studies relating change to initial achievement level have found a summer gain for low spring achievement level students compared with high initial achievement level students (Fitzsimmons, 1964; Florence, 1972). These findings are contradictory to the Beck (1975) extrapolated pattern of no change or loss over the summer for the lowest students compared with substantial gain for the high initial achievement level students. These are also contrary to the Thomas

and Pelavin (1976) conclusions derived from inspection of the test publishers' norms patterns for the twentieth percentile student.

Studies that found a differential change over subject matter areas noted a growth in verbal and general knowledge-based areas coupled with losses in skill and specific information-based subjects (Breune, 1928; Schrepel and Laslett, 1936; Keys and Lawson, 1937; Beggs and Hieronymus, 1965). No conclusive findings have resulted from studies comparing curricular approaches. The few significant relationships between classroom variables and summer achievement change delineated by the two Soar and Soar studies (1986; 1972) suggest the complexity of this issue. No significant difference in achievement score change over the summer has been attributed to summer school attendance (Austin et al., 1972; Thomas, 1974; Heyns, 1975).

Research Questions

This study is one aspect of the senior author's on-going interest in the topic of summer change in achievement scores. Three research questions were investigated:

1. What is the direction and magnitude of summer achievement score change in reading and in mathematics at the primary, intermediate and junior high level?
2. Is the achievement score change the same for boys as for girls?
3. Are there differences in summer achievement score change when subjects are grouped by Hollingshead socio-economic status levels?

Methodology

The Metropolitan Achievement Test Battery (1971) was adminstered to all first, fourth, and seventh graders as part of the county's accountability program in May 1974. Alternate forms of the same level were administered to a representative sample of these same children in second, fifth, and eighth grades in September, 1974, with September classroom assignments determining the

sample of children to be included in the study. A statement of father's occupation and education was obtained from school records. Raw scores were converted to standard scores; for the Metropolitan Achievement Tests, standard scores are directly comparable over all batterys and forms. According to Durost et al. (1971), "certain technical features of the standard scores make them uniquely suitable for measuring academic growth over a period of time."

Complete data were available for 73 first-second graders (hereafter, 1/2 group), 74 fourth-fifth graders (4/5 group), and 92 seventh-eight graders (7/8 group).

Following the Hollingshead Two-Factor Index of Social Positions procedure (Hollingshead, 1957) a Soocio-economic Index (SEI) number for each subject was computed from father's occupation and education information. Five socio-economic status levels were designated using Hollingshead cutoff points. Categories I and II were collapsed to form the high socioeconomic group, Category III formed the middle group and Categories IV and V formed the low group.

A three-way analysis of variance using standard scores was done by grade by socio-economic stauts by sex for both mathematics and reading change scores.

Results

Table 1 presents the results for the mathematics change score, ANOVA.

Table 1

Summary Table from Three-Way Analysis of Variance of Summer Change Scores in Mathematics

Source	DF	MS	F
Within Cells	221	55.357	
Grade	2	338.291	6.111**
Socio-Economic Status	2	54.931	.992
Sex	1	.594	.011
Grade by SES	4	21.410	.387
Grade by Sex	2	21.104	.381
SES by Sex	2	96.780	1.748
Grade by SES by Sex	4	35.376	.639

** p less than .01

Only the grade effect was significant; neither the SES nor the sex effect nor any of the interactions were significant. Tukey pairwise comparisons were performed; the 7/8 group differed significantly from the 4/5 group and from the 1/2, but the 4/5 group did not differ significantly from the 1/2 group.[1]

Table 2 presents the analysis of variance summary table for reading change scores.

[1]Note that the effect due to grade level differences is significant. However, because of the nonorthogonality of the response variable, this significance may not be interpretable in terms of real differences or educational significance. The differences in metrics across test levels may also be a factor in accounting for the difference found.

Table 2

Summary Table from Three-Way Analysis of Variance of Summer Change Scores in Reading

Source	DF	MS	F
Within Cells	221	44.789	
Grade	2	274.511	6.129**
Socio-Economic Status	2	15.833	.353
Sex	1	59.929	1.338
Grade by SES	4	2.553	.057
Grade by Sex	2	158.588	4.211*
SES by Sex	2	5.527	.123
Grade by SES by Sex	4	26.834	.599

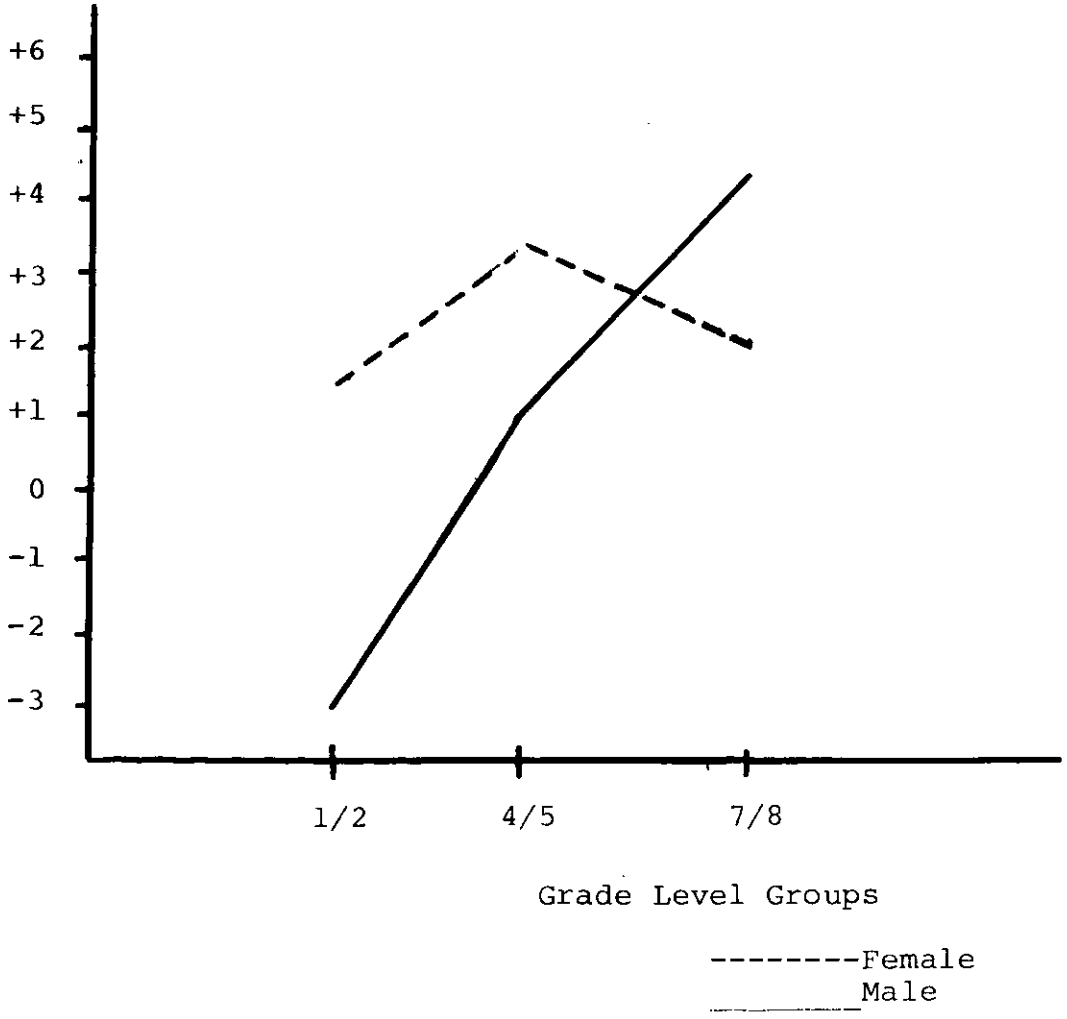
** p less than .01
* p less than .05

Here, again the grade effect was significant. Tukey pairwise comparisons indicated that the 7/8 group differed significantly from the 1/2 group but other pairwise comparisons were not significant.[2] There was a significant grade by sex interaction effect. For the 1/2 and 4/5 groups, girls gained more than boys; for the 7/8 group, the boys' gain is slightly greater than the girls' gain. Figure 1 shows this interaction graphically.

[2] Ibid.

Figure 1

Reading Change Score Grade by Sex Interaction



To clarify the direction and magnitude of change, Table 3 presents summer mean change score in reading and mathematics in both standard and grade equivalent scores.

Table 3

Summer Change Scores in Reading and Mathematics

Group	Subject	Number	Standard Score Mean Change	Standard Score, Standard Deviation	Grade Equivalent Mean Change	Grade Equivalent September Score
1/2	Reading	73	-.51	7.34	-.01	2.20
	Mathematics	73	1.18	9.53-	-.03	2.14
4/5	Reading	74	1.91**	6.44	.22**	4.23
	Mathematics	74	.73	6.08	.10	4.32
7/8	Reading	92	3.10**	6.26	.25**	8.57
	Mathematics	92	4.40**	6.26	.46**	8.81

* p less than .05
** p less than .01

Some indication of the magnitude of the ranges associated with these means is provided by the standard deviations of the means. Wide variations in both amount and direction of changes were obtained with some subjects gaining substantially and others losing dramatically. Grade equivalent change scores are included for interpretive purposes only. September grade equivalent scores are presented to show relative achievement level of students.

Table 4 presents correlations between the Socio-economic Index and May scores and summer change scores.

Table 4

Correlations of Socioeconomic Index Number with May Standard Score and Summer Change Score

Group	Subject	No.	Standard Mean Score	Standard Deviation	Socio-economic Index Mean (SEI)	SEI Correlation with May Score	SEI Correlation w/Summer Change Score
1/2	Reading/May	73	43.41	11.52	48.08	.41**	.11
	Reading/Sept.		42.90	12.60			
	Math/May		44.89	14.76		.45**	-.21*
	Math/Sept.		46.07	13.17			
4/5	Reading/May	74	63.04	16.24	51.48	.39**	.01
	Reading/Sept.		64.74	18.22			
	Math/May		72.56	15.49		.45**	-.01
	Math/Sept.		73.37	15.61			
7/8	Reading/May	92	97.09	15.59	37.65	.29**	.10
	Reading/Sept.		103.86	17.98			
	Math/May		106.65	15.25		.23*	-.06
	Math/Sept.		111.38	14.18			

* p less than .05
** p less than .01

For this analysis of Hollingshead socio-economic index numbers were reversed with low digits corresponding to low socio-economic status. The correlations between socio-economic index and May scores were moderate, positive and significant. This finding was consistent with most literature on background variables. However, all correlations between the Socio-economic Index and summer change scores were weak or nonexistent with only one--group 1/2 mathematics--being significant and it was negative.

Conclusions

The finding of substantial subject matter growth over summer vacation for older students supported the pattern found in the senior author's previous research on children of average ability. The small loss experienced by the youngest children compared with increased growth noted at each of the upper levels suggest that the differences are real and not just due to differences in test metrics.

The earlier independence of reading and the later independence of mathematics from school-related instruction is consistent with a good deal of other research (Husen, 1967; Thorndike, 1973; Purves, 1973). The interaction of grade and sex in reading achievement is not surprising; girls tend to start off higher than boys, then reach a plateau while the boys catch up. That this same interaction did not happen in mathematics suggests that achievement in that subject is much more school-related, at least in the elementary school years.

The findings of this report indicate that a norm of one month growth over the summer in reading comprehension and mathematics is correct for almost no average group of children. This finding suggests that test publishers should develop actual norms for their tests based on real changes over the summer and not just assume a growth of one month. Until this is done, using these tests to measure disadvantaged, average, or advantaged children's growth over the summer is not very useful.

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