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ABSTRACT

This study investigates the relationship between the academic background of teachers of advanced placement (AP) classes and the scores of their students on the nationally administered advance placement examinations. The effect of teacher characteristics on the exam scores was found to be significant. Classes which did poorly on the exams were more likely to have had teachers with weak backgrounds. Conversely, classes in which the average exam score was 4+ (out of 5) were far more likely to have had teachers with strong backgrounds. In addition, classes in which teachers were inexperienced in teaching at the AP level tended to do less well while classes of teachers who had more than 10 years of experience teaching advanced placement classes did much better than average. Regression analysis showed the interaction of the ranking of the teacher's undergraduate university and the teacher's undergraduate grade-point average in the AP subject to have a significant effect on student score. (Author)

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Does the Academic Background of Teachers Affect the Performance of Their Students?

by

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University of California, Berkeley

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to the
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abstract

This study investigates the relationship between the academic background of teachers of advanced placement classes and the scores of their students on the nationally administered advanced placement examinations. The effect of teacher characteristics on exam scores was found to be significant. Classes which did poorly on the exam were more likely to have had teachers with weak backgrounds. Conversely, classes in which the average exam score was 4+ (out of 5) were far more likely to have had teachers with strong backgrounds. In addition, classes in which teachers were inexperienced in teaching at the AP level tended to do less well while classes of teachers who had more than 10 years experience teaching advanced placement classes did much better than average. Regression analysis showed the interaction of the ranking of the teacher's undergraduate university and the teacher's undergraduate grade-point average in the AP subject to have a significant effect on student score.

A teacher without any mathematical training (he took advanced algebra 19 years ago) is assigned to teach an advanced algebra class because he has a general secondary credential. A teacher with an undergraduate major in English and no graduate degree is assigned to teach an advanced placement (college-level) chemistry class because he has a chemistry minor and no one with a chemistry major is available to teach the 32 students who want to take the class. A teacher with an undergraduate grade-point average in history of 2.75 is assigned to teach an advanced placement course in American History.

DOES IT MATTER ------ ?

Does a teacher's academic background correlate with his competence as a teacher? In 1981, Schlecty and Vance[1] wrote that, despite researchers inclinations to the contrary, "many policy makers seem willing to bet...that people who perform poorly on tests of academic ability will not, as a group, make good teachers." Recent reform proposals, including A Nation Prepared: Teachers for the 21st Century and Tomorrow's Teachers seem to consider that correlation to be almost axiomatic. Furthermore, some writers in the literature of teacher education believe the university element in a teacher's background to be of sufficient importance that teachers should be trained only at schools capable of supporting full-scale graduate programs.[2]

However, some researchers remain unconvinced. Evertson and her coauthors[3], after reviewing the available research literature, believe there is not as much significance to the level of a prospective teacher's academic performance as others

would maintain; Robbins[4] writes that no research indicates a higher grade-point average implies better teaching; Murnane[5] found no significant difference in the achievement of students related to the undergraduate major of their teacher; and Davy[6] states that, at least for elementary school teachers, the ability to empathize with children is far more important than academic ability.

This study addresses a part of the question of whether a correlation exists. Specifically, it asks whether the academic background of teachers of high school advanced placement (AP) courses is correlated with the scores earned by their students on the AP tests administered by the College Board.

Advanced placement courses are normally considered to be college courses. Students need to develop a thorough understanding of their subject if they are to do well on the comprehensive year-end examination. They are doomed to get a low score if their grasp of the subject matter is shallow, incomplete, or incorrect. Nevertheless, not all AP teachers have strong backgrounds in their subjects.

If, all things considered, the students of teachers with weak backgrounds receive more than their share of the low scores, the implication is that the weaker preparation of their teachers is at least partly a fault. Furthermore, the notion that, at least for teachers of academic courses in secondary schools, a

solid academic background in the subject being taught should be a requirement, not just a suggestion, is given a solid boost.

If, on the other hand, low student test scores are found to be unrelated to their teachers' academic background, the arguments of the Holmes Group, The Carnegie Task Force, and others that the overall academic ability level of teacher trainees needs to be raised would be dealt a significant blow.

Method

Sample

In this study, 43 public high schools in the San Francisco Bay Area were randomly selected from among those which met the following criteria: advanced placement preparation courses in calculus, English literature, or American history were offered during the 1986-87 school year; the 1987 AP exam in one of those subjects was taken by at least 5 students;[7] the principal was willing to have the school participate in the study. Permission was obtained from the principal for the College Board to release the summary of the school's AP test results to the researcher; information on the school's AP teachers' backgrounds and on student characteristics in individual AP classes was obtained from the teachers themselves; and information about general student body characteristics was obtained from the school's AP coordinator.

Subjects in which fewer than eight schools in the sample gave examinations were eliminated from consideration. In the remaining subjects, the number of classes[8] ranged from 8 in chemistry to 30 in English Literature and Composition. In between lie American History (20 classes), Biology (12 classes), English Language and Composition (11 classes), French Language (9 classes), Mathematics (calculus) AB[9] (21 classes), Mathematics (calculus) BC (9 classes), and Spanish Language (14 classes). Computer Science also fell into this range; however, because most computer science teachers indicated that they were self-taught in their field, the researcher concluded that any analysis would be meaningless. Thus, data was obtained and analyzed for a total of 132 classes.

Data Collection

A letter was sent to the principal of each school requesting the cooperation of the school and permission for the researcher to have access to the school's summary college board scores. Principals from whom no response was received were contacted by phone to again request participation. After the second request 32 schools (72.42%) agreed to participate in the study.

School and teacher questionnaires were mailed to each of the participating schools. When questionnaires were not received, either from a school or from a teacher, follow-up phone calls were made by the researcher. Probably in part because she is

also a high school AP teacher and has conducted a number of workshops for the College Board on teaching advanced placement classes, she was able to obtain nearly a 100% response rate. The only exceptions involved teachers who left teaching at the end of the 1986-1987 school year and, in one case, a teacher who was on long-term sick leave at the time follow-up phone calls were made. These few were eliminated from the analysis of teacher effects.

Variables

The variables were divided into three categories: school, class, and teacher. The school variables include the number of students; the percent of the student body on Aid to Families with Dependent Children (AFDC)[10], the percent of the student body with limited or no English proficiency (LEP/NEP), and the percent of the student body which is underrepresented minority,[11] all of which were assigned the value reported by the school; the average of the previous three variables (composite); and the number of AP exams given and the percent of the school's exams that received grades of 3 or better,[12] both of which were supplied by the College Board, the body which administers the Advanced Placement Program.

The class variables were taken from data supplied by the College Board: the number of exams given in a subject (when more than one teacher was involved; the school provided a breakdown by

teacher); percent of exams graded 3 or better; the difference, by subject, between the school's percent and the state average percent; the class average grade; and the difference between the class average grade and the state average grade for the subject. It should be noted that students must be permitted to take the AP exam even if they are not enrolled in the school's AP class (or even enrolled in the school). In several instances, teachers commented that a non-member (of the class/ school) had received a grade that was atypical of the class. It is impossible to correct for this in assigning variable values as individual student scores are not available.[13]

Finally the teacher variables were determined from data supplied by the teachers themselves. The number of years the teacher has taught AP and the teacher's undergraduate grade-point average (GPA) in the AP subject were assigned the values reported by the teacher; undergraduate major in AP subject,[14] graduate degree, and, if yes, in the AP subject were assigned a 1 if yes and a 0 if no; the rank of the teacher's undergraduate institution was assigned a numeric value from 1 to 5 by the researcher, based primarily on the rank of the school assigned by Roizen, Fulton and Trow.[15] Finally, the product of the GPA (GPA x U RANK) and the university rank was computed by the researcher.

Analysis and Results

Analysis was carried out in several modes because students

cannot be assumed to have equal academic ability (AP students range from somewhat above average to brilliant); teacher GPA's are subject to the influences of time and of the quality of the institution; and some schools expect all students in AP classes to take the AP test while others discourage weaker students from taking the exam.

The researcher first considered whether student body characteristics of the school affected examination scores. Two types of statistics were calculated. First, the correlation between the percentage of each school's exams scored 3 or better and student body characteristics was computed. Table 1 summarizes the coefficients.

Insert Table 1 about here

The only correlation which was at all substantial was the negative one between the number of examinations given and the composite; it was not significant. Clearly, in the sample, relatively high numbers of students on AFDC, LEP/NEP students, or underrepresented minority students has no significant relationship to percentage of exams scored 3 or better. Furthermore, across the sample, it does not depress the opportunity to take AP examinations. The correlation between the

school size and the percent of exams scored 3 or better (-.06) indicates that school size is also not a determiner of opportunity to take AP exams.

The correlation coefficient between the number of exams given by the school and the percent of exams scored 3 or better (.56 - .44 with outliers removed) indicates that students in schools with well developed AP programs are more likely to do better on the exams than students in schools with small programs. Size of program was also weakly, but not significantly, correlated with the composite (-.22).

Because the percentage of exams scored greater than 3 was influenced by the combination of exams administered at the school (state average percentages varied, by subject, from 60.6 to 83.2), that statistic may be biased. A better one is the difference, within subject, between the percentage of exams scored 3 or better at the school and statewide. This method of analysis also permits average exam scores to be analyzed. Table 2 summarizes these differences.

Insert Table 2 about here

The fact that none of the differences are significant

indicates that attendance at a school with relatively high percentages AFDC, LEP/NEP, and underrepresented minority students, did not have a negative influence on a student's performance on AP tests. If anything, it had a positive influence.

teacher influence

Student data were scrutinized and scores compared to those of the sample as a whole and of the entire state if the teacher belonged to any of the following groups: a) undergraduate major in other than the AP subject; b) GPA less than 3.0; c) the undergraduate school ranked 2 or lower d) the GPA greater than 3.6; e) first year of teaching an advanced placement class; f) second or third year of teaching an AP class; g) ten or more years teaching an AP class; h) the product of the rank of the university and the GPA is greater than 13.125; and i) GPA of less than 3.3 and neither a major nor a graduate degree in the AP subject. Table 3 summarizes the analysis of teacher-related differences.

Insert Table 3 about here

Significant difference in student performance was found when

the teacher's undergraduate GPA in the AP subject was less than 3.0, when the teacher's undergraduate GPA in the AP subject was less . . 3.3 and the teacher had neither undergraduate major nor graduate degree in the AP subject, and when the product of the teacher's GPA and school rank was greater than 13.125. In addition, all differences associated with the strength of a teacher's academic background were positive for indicators of strong background and negative for indicators of weak background. Truncated and small ranges both contribute to a lack of significance in statistical analysis.[16] Thus, it may be worth noting that when the range of two explanatory variables, GPA and University rank, was expanded by multiplying them together, the difference in means became significant. (The significance is probably also related to interaction between the two variables.)

Range truncation in dependent variables cannot be easily compensated for. However, it should be noted. As an example of the effect of range truncation, 83.2% of students scored 3 or better on the Calculus BC exam statewide. Thus, the maximum positive difference between the class and state statistics was 16.8%. On the other hand, one negative difference of 41.5% occurred in a sample school. Nearly three classes in which every student scored at least 3 were required to balance out that one school.[17] Yet, because the teacher of that one class had taught AP for over 10 years, had a GPA x U RANK product greater than 13.125, and attended a high-ranking undergraduate school, the

effect of the performance of his class entered into several statistics.

The experience of a teacher in teaching advanced placement classes also has a clear effect on student performance although it is statistically significant only in the regressions (discussed below). This is especially worth noting in light of the findings by other researchers that there is a leveling off or even a decrease in teacher effectiveness after about 5 years.[18]

In addition, the background of the teacher was examined for classes in which a) the percentage of the AP exams scored 3 or better was more than 5% below the state average (of 3 or better scores) for the subject; or b) the mean AP exam score was more than .25 below the state average for the subject. In most categories, the number of classes in a single subject was not sufficient to justify significance testing by subject. This in addition to the aforementioned possible bias in both the percentage of exams scored 3 or better and the average exam score when considered without regard to subject, determined that the analysis considered the difference between the class and state statistics. If the mean difference, within subject, in percentage of exams scored 3 or better was more than 5%, that difference was considered significant. Similarly, if the difference between the class average score and the state average score for the subject was greater than .25 (5% of the possible

5), that difference was also considered significant. Table 4 summarizes this analysis.

Insert Table 4 about here

These figures again indicate that the academic background of a teacher has a definite influence on the performance of students. The teachers of classes in which student performance was significantly below the state average level (and even farther below the sample average level) attended lower ranked universities, had lower grade-point averages, and had lower GPA x U RANK composites.

Related to these figures are the teacher figures for English Language and Composition and for Spanish Language, the only two subjects, among those considered, for which the percent of exams scored 3+ and the average exam score were below the state means. These two subjects had the lowest mean number of years teaching AP. Furthermore, the former had the lowest GPA and composite means and the latter had one of the three lowest.

A similar analysis was performed for the teachers of classes in which the average exam score was 4 or greater (4 is considered to be an A-, 5 an A). Table 5 summarizes the results.

Insert Table 5 about here

The implication of this analysis is that students are more likely to achieve excellence on an advanced placement examination if their teacher's own academic record shows evidence of high achievement. The experience of the teachers in this group is also, on the average, greater than that of the sample as a whole, although not significantly so.

regressions

In the final phase of the analysis, the difference, by subject, between the percentage of students who scored 3+ in a class and in California and the difference, by subject, between the class mean and the California mean were each regressed on two different sets on teacher characteristics. These two dependent variables, while clearly correlated with each other, are not related causally. As an example, in a calculus BC class, if all of the students received a score of 3, the first difference would be 16.8 and the second, -.72 while if all received a 5, the first would still be 16.8 while the second would be 1.28. Classes in which the second situation occurred and the first nearly did are part of the sample. As a consequence, separate regressions were run for both variables.

Before discussing the results, several other comments are necessary in order to explain why the regressions were run as they were. First, they were not performed on the entire set of teacher variables because the almost total correlation (.94) between the "university rank" and the "product of that rank and the GPA" meant that both could not be included as explanatory variables in the same equation. In addition, the "in field" variable is partially dependent upon the "graduate degree" variable (the former is 0 if the latter is).

Second, regressions by subject were not considered for two reasons. The small number of cases made the F necessary for significance so large that the standard deviations of the variables precluded any significance. In addition, within some subjects, all teachers had subject-area majors. Thus regression involving that variable was impossible.

The study regressions were a) the difference, by subject, between the percentage of students who scored 3+ in a class and in California on number of years teaching AP, university rank, major in AP subject, grade-point average in AP subject, and graduate degree; b) the difference, by subject, between the class mean and the California mean on number of years teaching AP, university rank, major in AP subject, grade-point average in AP subject, and graduate degree; c) the difference, by subject, between the percentage of students who scored 3+ in a class and

in California on number of years teaching AP, major in AP subject, and the product of the university rank and the grade-point average in the AP subject; and d) the difference, by subject, between the class mean and the California mean on number of years teaching AP, major in AP subject, and the product of the university rank and the grade-point average in the AP subject. Table 6 summarizes these regressions.

Insert Table 6 about here

In the regressions involving university rank and GPA separately, university rank was significant both times. In determining the difference of the means, it was significant at the .01 level. In addition, years teaching AP, major in the AP subject, and graduate degree were each significant in at least one of the two equations. Grade-point average was significant in neither equation.

In the second pair of regressions, the product of university rank and GPA was the only significant independent variable in either equation. However, years teaching AP just missed being significant in both equations and major in the AP subject just missed significance in determining the difference in the means. In the latter case, the large standard error and, in turn, the

dichotomous nature of the variable may have contributed to the near miss.

Discussion

Any analysis of teacher effects on student performance must first consider whether that influence is confounded by student body characteristics. In this study, such factors were found to have little correlation with student AP exam scores. While, at first glance, this would seem to conflict strongly with almost all previous research on student body effects, it is, in fact, not surprising. Students who take advanced placement (or honors) classes have passed over several selection hurdles: they have demonstrated the ability to do quite well in school in general and in the AP subject in particular; they have chosen to attempt college-level work while in high school; and they have done well enough in the class to invest $54[19] in taking an exam that is graded rigorously enough that even the most selective of universities offer credit to students who do well on it.

The analysis of teachers' influence on student test scores indicates that all of that factors considered except undergraduate GPA (independent of school attended) exert significant influence.

There are several possible explanations as to why GPA, by itself, seems to have no influence. In entering data into the

computer, the researcher noted that a large proportion of the high GPA's were at lower-ranking universities. Whether such high GPA's mean the same thing as high GPA's at high-ranking universities is open to speculation. The significance of the influence of the product of university rank and GPA lends credence to the position that teachers who establish themselves as academic achievers are more likely to produce academic excellence in their students than are those who didn't excel themselves. This certainly vindicates groups such as the Carnegie Task Force and the Holmes Group in their push for establishing high standards of excellence for teachers, at least for teachers of advanced high school courses.[20]

It is, however, also possible that GPA was not found to be significant in this study because the teachers in the sample do not represent teachers as a whole[21] in this respect. Only 8 members of the sample reported a GPA of less than 3.0 and the sample mean GPA was 3.6. The fact that the mean GPA both of teachers with a GPA less than 3.0 and of teachers with a GPA less than 3.3 and no degree in the AP subject were found to be significantly different from the sample mean lends weight to this possibility.

Finally, it is possible that the lack of variance across the sample in this variable contributed to its lack of significance. In any case, the findings of this study do not imply that subject

area GPA's in the 2.75 and lower range are insignificant in determining student achievement.

Experience teaching advanced placement classes and an undergraduate major in the AP subject also appear to be important influences on student achievement. Successful AP teachers must move beyond the limitations of a textbook as they seek to develop understanding in their students. Key among the resources necessary for such movement is a thorough understanding of the subject on the part of the teacher. Usually this understanding requires breadth in both scope and length of study in order to develop.

Finally, both the rank of the university at which the teacher received his undergraduate degree and the composite of university rank and GPA bear significantly on student achievement on AP exams. Again, the explanation of this significance is not definitive. The Holmes Group, the Carnegie Task Force, and others imply that those who are academically more able are more likely to make better teachers. In California, the academically more able tend to attend higher-ranking universities. Furthermore, those who earn high GPA's at such universities show clear evidence of strong academic ability on their own part. On the other hand, there may be another explanation for the significance of these variables. This study was not designed to determine explanations.

Conclusion

The findings of this study support the contention that, at least for secondary students in academic classes, the academic background of the teacher does contribute to student achievement. All analyses indicate that the students of teachers with strong backgrounds scored better, on average, than did students of teachers with weak backgrounds. They were also more likely to score above the state mean for their subject.

Students with scores of 1 or 2 were more likely to have had a teacher with a weak background than were those who scored 3 or better. While most students scored at least 3, students with a score of 4 or 5 were much more likely to have had a teacher with a strong background than were students with a score of 3, 2 or 1. Thus, while the students of teachers with weaker backgrounds were normally able to achieve at a satisfactory level, excellence was more likely to be achieved by the students of teachers with strong backgrounds.

This study has implications both for those who set the standards for admission to teacher education programs and for those who hire teachers. The academic background of teachers does make a difference. Teachers with strong academic backgrounds not only are less likely to have students who don't

do well, but they are also far more likely to have students who achieve excellence. Not only an ability floor but also evidence of academic strength are important considerations in deciding who will teach.

TABLE 1

Correlations between the percentage of each school's exams scored 3 or better and student body characteristics

% AFDC	% LEP/NEP	% underrepresented minority	composite %
-.03	.11	-.1	-.04

Correlation between the composite and the number of examinations given by school

-.36

Correlation, with outliers removed~, between the composite and the number of examinations given by school

-.26

~Three schools each gave more than 100 exams more than any other school. The school which gave the most exams is 23% AFDC and 20.3% underrepresented minority.

Table 2

	difference between school and state percentages of exams by subject	difference between school and state averages, by subject
mean across sample	4.60	.17
mean for schools with >10% of students on AFDC	12.04 (7.44)~	.80 (.63)
mean for schools with >10% of students LEP/NEP	5.52 (.92)	.36 (.19)
mean for schools with >20% of students underrepresented minority	5.73 (1.13)	.32 (.15)
mean for schools with composite >10%	10.12 (5.52)	.46 (.29)

~ figures in parentheses represent the difference from the sample mean. None of the differences are significant.

ranges, means, of sample percentages : AFDC (0-43, 7.89); LEP/NEP (0-50, 6.78); underrepresented minority (3-82, 22.58); composite (1.33-47.67, 12.42)

Table 3

scored 3 or greater	difference between school and state percentages of exams by subject	difference between school and state averages, by subject
mean across sample	4.60	.17
mean teacher's major not in AP subject (n = 20)	-5.92 (-10.52)	-.08 (-.25)
mean teacher's GPA < 3.0 (n=8)	-16.83* (-21.43)	-.33* (-.50)
mean teacher's undergraduate school low ranking (n = 43)	-2.61 (-7.21)	-.11 (-.28)
mean teacher's GPA > 3.6 (n = 36)	6.49 (0.07)	.22 (.05)
mean teacher in first year teaching AP (n = 18)	-0.94 (-5.54)	-.05 (-.22)
mean teacher in 2nd or 3rd year teaching AP (n = 24)	-5.04 (-9.64)	-.18 (-.35)
mean teacher taught AP > 10 years (n = 20)	9.72 (5.12)	.41 (.24)
mean teacher GPA <3.3 and neither major nor grad degree in AP subject (n = 8)	-7.34* (-13.74)	-.13 (-.30)
mean product of GPA and university rank >13.125 (n = 33)	14.28* (9.68)	.49 (.32)

* significantly different at .05 level
figures in parentheses represent difference from sample mean

Table 4

	years AP teacher	U rank	major?	GPA	UxGPA	grad deg	in field
mean across all classes	6.23	3.04	.81	3.49	10.37	.70	.46
mean across classes in which % of students scoring 3+ was more than 5% below state average for subject (n = 38)	5.49	2.67*	.72	3.44	9.04*	.62	.44
mean across classes in which average grade was more than .25 less than state average for subject (n = 36)	4.72	2.66*	.75	3.45	9.01*	.64	.42

* significantly different at .05 level

Table 5

	years AP teacher	U rank	major?	GPA	UxGPA	grad deg	in field
mean across all classes	6.23	3.04	.81	3.49	10.37	.70	.46
mean across classes in which average exam grade was 4+ (n = 18)	7.42	3.96*	.71	3.6	14.23*	.86*	.57

* significantly different at .05 level

Table 6

Independent Variables

Number of years teaching AP (YRSAP)
University rank (URANK)
Major in AP subject (MAJOR)
Grade-point average in AP subject (GPA)
Graduate degree (GRAD)
Product of URANK and GPA (COMP)

DEPENDENT VARIABLES

Difference between class percent and CA percent (%DIFF)

Difference between class mean and CA mean (AVEDIFF)

n=116[22]

Regression of %DIFF on YRSAP, URANK, MAJOR, GPA, and GRAD

Constant = -65.729

Variable	Coeff.	Beta	F-ratio	sig. level	Std. Error
YRSAP	0.605	0.130	2.09	ns	0.419
URANK	4.780	0.258	8.48	.05	1.642
MAJOR	9.736	0.174	3.93	.05	4.914
GPA	10.384	0.150	2.86	ns	6.145
GRAD	7.645	0.157	2.96	ns	4.445

Regression of AVEDIFF on YRSAP, URANK, MAJOR, GPA, and GRAD

Constant = 1.370

Variable	Coeff.	Beta	F-ratio	sig. level	Std. Error
YRSAP	0.034	0.254	8.59	.05	0.012
URANK	0.167	0.310	13.09	.01	0.046
MAJOR	0.125	0.077	.82	ns	0.138
GPA	0.259	0.129	2.26	ns	0.172
GRAD	0.262	0.186	4.44	.05	0.125

Regression of %DIFF on YRSAP, MAJOR, and COMP

Variable	Coeff.	Beta	F-ratio	sig. level	Std. Error
YRSAP	0.953	0.204	5.38	ns	0.411
MAJOR	9.021	0.160	3.35	ns	4.928
COMP	1.536	0.291	10.98	.05	0.464

Regression of AVEDIFF on YRSAP, MAJOR, and COMP

Constant = -27.490

Variable	Coeff.	Beta	F-ratio	sig. level	Std. Error
YRSAP	0.790	0.170	3.75	ns	0.408
MAJOR	9.425	0.168	3.70	ns	4.902
COMP	1.610	0.306	12.19	.05	.461

NOTES

1. 1981, p.106.

2. See, for example, Joyce and Clift (1984), Clark (1984), and Weaver (1984 a&b).

3. 1984, p.8.

4. 1985, p.20.

5. 1983, p.565. It should be noted that Murnane works primarily with data on elementary school teachers and students.

6. 1983, p.554.

7. There were 26 different advanced placement examinations available in the spring of 1987. Depending upon their school curriculum and upon the choices of students, an individual school in the sample administered 5 or more exams in anywhere from one to twenty different subjects.

8. When more than one teacher in a school taught advanced placement classes in a single subject, each class was treated as if it were a different school.

9. Two advanced placement examinations are offered in mathematics, the AB which covers only part of the first year of calculus and the BC which covers most of it.

10. Some schools supplied the percent of students eligible for a free or reduced price lunch for the percent on AFDC. The former is larger because it includes those whose parents are employed, but poor.

11. The State of California considers underrepresented minorities to be black, Hispanic, Native American, Philippino, and Pacific Islander.

12. Advanced placement examinations are graded 1, 2, 3, 4, or 5. Most universities give credit and placement to students who score 3, 4, or 5. Thus, these scores are often termed "passing."

13. The number of non-members of the class who took an exam is impossible to determine, but seems to be no more than one or two students in a few schools. The number of non-students who took exams at a particular school is determinable and ranges from 0 to 5 (the latter at a school which gave a large number of exams); however, the particular exam(s) taken by these

individuals is not determinable.

14. It should be noted that California requires teachers to have academic majors of some sort; credentials are earned at the graduate level.

15. 1978. Schools ranked Quality 1 by Roizen et al were assigned a rank of 5, Q2 assigned 4, Q3 assigned 3, Q5 assigned 2, and Q6 assigned 1 (there were no Q7 schools). Q4 schools were ranked according to the perception of the college counselor at the high school at which the researcher teaches as to the selectivity of the school's admissions process as compared with that other ranked schools. Modifications in the rankings were made on the same basis (for example, the University of California, Berkeley, was ranked 4 not 5 and the University of California, Santa Cruz was ranked 3.75, not 4).

16. See Bodenhausen (1987) for a discussion of the effect of truncated ranges and small ranges on statistical analysis.

17. The magnitude of the effect is further illustrated by the fact that the average score for the class with a difference of -41.5 is 2.42, while for the classes with a difference of 16.8, the averages are 5.00, 4.70, 4.76, and 4.05.

18. See, for example, Murnane (1975) and Bridge et al (1979).

19. AP exams cost most students $54 per exam. Students who meet stringent income limitation criteria can pay a reduced fee of $24, but all students must invest financially in the exam.

20. It is the belief of the researcher that the implications go beyond teachers of advanced courses. At the high school at which she teaches, several of the teachers of AP and honors classes also choose to teach remedial classes. Their students do better, on the average, than do most remedial students.

21. See Schlecty and Vance (1981) for a general discussion of teacher GPA's.

22. The classes of one school were removed from teacher effects analysis because its selective admissions policies may bias the scores in the school.

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