A Comparative Analysis of Preservice Science Teachers' College Achievement

John K. Hicks and Edwin P. Christmann

***Abstract*—This study employed a multiple regression analysis to examine the relationship between aptitude and achievement factors that predict preservice science teacher's college achievement. Subsequently, this is an analysis of correlations and descriptive statistics for preservice science teachers among 15 undergraduate students enrolled as preservice science teachers. A comparison of SAT–Critical Reading Scores (Verbal), SAT--Quantitative Section (Mathematics), High School Grade Point Average, and College Grade Point Average found significant relationships. Of greatest interest is that the mean high school GPA obtained by the preservice science majors is a 3.55 (*SD* = .38) and the mean college GPA is 3.08 (*SD* = .57), which resulted in the highest correlation, *r* = .528, *n* = 15, *p* <.05.**

***Index Terms*—Science, SAT, GPA, preservice, achievement.**

I. Introduction

For over four decades, the criticism of America's education system for having ill-prepared teachers is widespread [1]. Subsequently, an area of concern is science achievement, which is under scrutiny by test and policy makers [2]-[4]. Regretfully, however, there is a paucity of research examining the factors that predict the college-level achievement of preservice science teachers. Subsequently, as colleges prepare students to become productive science teachers, it seems that an examination of the factors that predict higher achievement for preservice science teachers at the college-level is worthy of consideration. More specifically, this study seeks to explore whether the SAT predicts college achievement for preservice science teachers any better than high school grades.

There is research showing that students of teachers who have greater academic ability (e.g., as measured by GPA, SAT scores, intelligence quotient, or even the selectivity of the university attended) perform better as classroom teachers [5]. Although Lauren Gatti disagrees [6], it has been substantiated that college achievement may indeed offer educational planners a way to predict effective in-service teaching [7]. Therefore, it seems plausible that the selection of better teacher candidates to education programs could offer schools better teachers. Hence, in conformance with this assertion, an analysis of the factors that best predict college-level achievement among preservice science teachers could help clarify the selection process of in-service teachers and bolster science achievement in the schools [5].

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II. Literature Review

A review of the literature suggests that there is a significant positive relationship between students' ability and academic [8]. For example, SAT scores and high school grades are factors that predict the percentage of students who graduate from college [9]. Moreover, high school GPA was better at predicting college achievement than SAT scores (verbal and mathematics scores combined) [8]. However, there is little research on how the SAT predicts college achievement when examining verbal and mathematics SAT scores separately [10]. Moreover, although there have been studies that investigate the relationship between factors that predict college GPA, there is a paucity of studies that ascertain the factors that predict college GPA among preservice science teachers [11].

David Labaree of Stanford University shows that until more is known about the factors that can predict science preservice teacher achievement, the addition of more testing requirements for science teacher preparation could make "A simple induction process unnecessarily complicated." Ironically, although mathematics and science content is an area of standardized testing emphasis, the factors that predict preservice science teacher's college achievement needs to be investigated [12], [13]. Moreover, this ongoing concern for education stakeholders and policymakers has resulted in policy decisions that have been both radical and have raised more questions about the pool of America's teachers [14]. For example, the Bush Administration declared that "American Education is in a recession" and this sentiment resounds in a cadre of books [15]-[17]. Hence, there are concerns among scholars that teaching as a profession feeds off a sense that anyone can be a teacher [18]. is a resounding impression of the public [18]. Unfortunately, it seems that teaching maintains lower status among the professions and the brightest gravitate into higher status professions, e.g., medicine, law, and engineering.

In response to these criticisms, the No Child Left Behind Act (NCLB) of 2001, which requires each school district to "Ensure that all teachers hired after such day and teaching in a program supported with [NCLB] funds are highly qualified" [19]. Subsequently, although educational planners emphasize standardized tests to measure the academic achievement of preservice teachers, it seems plausible that teacher preparation institutions can investigate achievement and test result patterns that can predict preservice science teachers' college achievement [20].

Correspondingly, as mentioned earlier, the selectivity of a

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preservice teacher's undergraduate institution may be a useful indicator of teacher quality [5], [21]. However, although this is not always the case [22], it was found that some studies show a marginal relationship between a teacher's undergraduate school's selectivity (i.e., an emphasis on High School GPA and SAT scores) and future academic achievement [23].

In contrast to these reports, measured increases in teachers' academic ability indicates that teaching may be improving [24]. Moreover, it has been found that teaching's occupational prestige and esteem are on the rise because more high-ability individuals are choosing teaching over other professions [14]. Although the NCTQ has raised questions about the quality of preservice teachers and the procedures in place for entry into teacher education programs, researchers are debating what is most effective for preparing science teachers [25].

In response to these assertions, this study is a diagnostic effort to determine the factors that predict the overall college achievement of preservice science teachers enrolled in a teacher certification program. Hopefully, this analysis will result in a better understanding of what predicts the academic achievement of preservice science teachers, as well as to clarify the program quality of similar programs.

III. Method

A. Overview

The observed high school grade point averages and SAT verbal and SAT mathematics scores for students who enrolled as preservice science teaching majors who were in their final year of undergraduate study. Moreover, the college and high school GPAs from students' academic records are based on the standard grades of a 4-point scale.

B. Subjects

The subjects were 15 undergraduate students enrolled in a preservice science teaching certification program at a comprehensive northeastern public university enrolling approximately 8100 students. The subjects were 44 undergraduate-level preservice science education majors.

C. Research Design

The study employed a multiple regression analysis that examined the relationship between predictor variables and the criterion variable among the preservice science teachers. The criterion for this study is college grade point average (GPA). The Pearson product-moment correlations (*r*) were computed between each pair of variables. In addition, multiple correlations (R) and multiple regression results show a relationship between variables.

Predictor Variables

1) SAT – Critical Reading Scores (Verbal)
2) SAT - Quantitative Section (Mathematics)
3) High School Grade Point Average (GPA)

Criterion Variable

1) College Grade Point Average (GPA)

Research Hypotheses:

H_0 = There is no significant relationship between High School GPA, SAT Verbal Scores, SAT Mathematics Scores, and College GPA.

H_1 = There is a significant relationship between High School GPA, SAT Verbal Scores, SAT Mathematics Scores, and College GPA.

IV. Results

A. Intercorrelation Coefficients

Intercorrelation between College GPA (COLLGPA), High School GPA (HSGPA), SAT Math (SATMATH), and SAT Verbal (SATVERBAL) are shown in Table I. The analysis measured the strength and directions of correlations among the College GPA (COLLGPA), High School GPA (HSGPA), SAT Math (SATMATH), and SAT Verbal (SATVERBAL) SCORES. Interestingly, a significant positive and a significant negative relationship were revealed.

TABLE I: Intercorrelation Coefficients

Correlations

		HSGPA	SATVerbal	SATMath	CollGPA
HSGPA	Pearson Correlation	1	.385	-.329	.528*
	Sig. (2-tailed)		.156	.232	.043
	N	15	15	15	15
SATVerbal	Pearson Correlation	.385	1	.024	-.233
	Sig. (2-tailed)	.156		.933	.404
	N	15	15	15	15
SATMath	Pearson Correlation	-.329	.024	1	-.617*
	Sig. (2-tailed)	.232	.933		.014
	N	15	15	15	15
CollGPA	Pearson Correlation	.528*	-.233	-.617*	1
	Sig. (2-tailed)	.043	.404	.014	
	N	15	15	15	15

*. Correlation is significant at the 0.05 level (2-tailed).

TABLE II: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
HSGPA	15	3.04	1	3.5580	.38384
SATVerbal	15	430	3	542.66	65.18837
SATMath	15	410	600	501.33	52.76182
CollGPA	15	00	3.96	3.08	.57057

Table II shows the means and standard deviations for the variables. As reflected in Table I, we found a variety of relationships between the variable. For example, given that SAT verbal and mathematics scores should predict a science major's overall GPA, we examined the relationship between these variables. The mean total SAT Mathematics score for science majors was 501.33 (SD = 52.76) and the overall mean College GPA was 3.08 (SD = .57), thus resulting in a significant negative relationship, r = -0.617, n = 15, p <.05.

Fig. 1 shows the relationship between science majors' mean SAT Mathematics score and their mean College GPA.

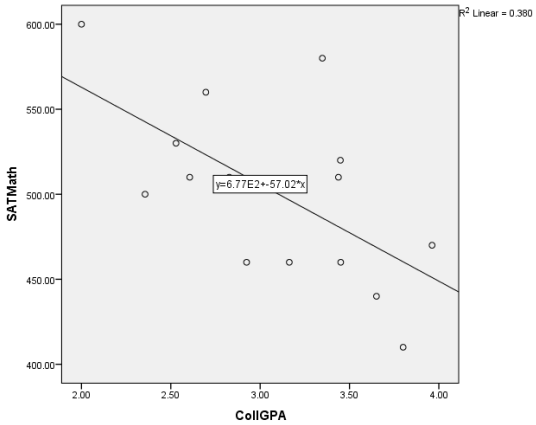

Fig. 1. Relationship between science majors SAT mathematics scores and college GPA.

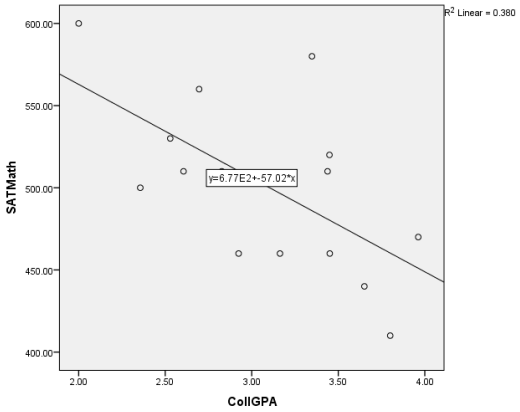

Fig. 2. Relationship between high school GPA and college GPA.

The mean high school GPA obtained by the preservice science majors is a 3.55 (SD = .38) and the mean college GPA is 3.08 (SD = .57), thus resulting in a significant correlation, r = .528, n = 15, p <.05, two tails (see Fig. 2). This is of interest in that it exceeds the overall SAT-1 predictive validity coefficient of .44, as provided by Bridgeman et al. (2000). Hence, educational planners should give greater emphasis to high school GPA as a predictor of college achievement for preservice science teaching majors [26].

The mean SAT Mathematics score obtained by the preservice science teaching majors is a 501.33 (SD = 52.76) and the mean college GPA is 3.08 (SD = .57), thus resulting in a significant negative correlation, r = -.617, n = 15, p <.05, two tails (see Fig. 3). This is of interest here because it shows an inverse relationship between SAT Math scores and College GPA. Perhaps mathematical reasoning is not commensurate with certain aspects of college coursework. If not, this might explain why the highest correlation in this study was between the mean SAT Mathematics scores and mean College GPA scores of preservice science teachers. Whatever the case, further research to better determine what predicts preservice science teachers' achievement is needed (e.g., critical reading, reasoning, grammar skills, etc.) to improve the selection of America's teachers.

Fig. 3 is a Path Analysis, which shows the correlations between the high school and college grade point averages and the SAT Verbal and Mathematics results. Moreover, this provides a visual of the multiple regression analysis. Table III shows the results of the multiple regression analysis and standardized regression coefficients, which links the predictors (High SchooGPA, SAT Verbal, and SAT Mathematics) to the criterion variable (College GPA). Moreover, the R^2 value for the dependent variable appears above the College GPA rectangle on the Path Analysis diagram, R^2 = .66.

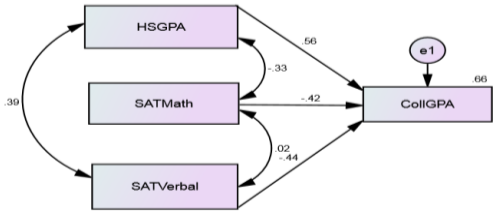

Fig. 3. Path analysis of variables impacting college grade point average.

TABLE III: RESULTS OF MULTIPLE REGRESSION ANALYSIS

Predictor	*Beta*
High School GPA	.66*
SAT Mathematics	-.42*
SAT Verbal	-.44*

* P < .05

The standardized regression weights represent the amount of change in the dependent variable that is attributable to a single standard deviation unit's worth of change in the predictor variable (see Table III). As a result of identifying these correlations, the best predictor of College GPA among preservice science teachers is High School Grade Point Average.

V. DISCUSSION

The present study explored the relationship between preservice science teachers' SAT Verbal scores, SAT Mathematics scores, High School GPAs, and College GPAs. As a result, while there are significant correlation between variables, High School GPA appears to be the best predictor of College GPA among pre-service science teachers. This is of interest in that the state and federal policy makers continue to explore the criteria for entry into the teaching profession. Undoubtedly, the literature is legion with reports on the results of standardized tests and positive correlations with achievement results. However, success in high school is more often than not prerequisite to increases in college achievement.

In agreement with this assertion, researchers found that College GPA predicts teacher competency [7]. Moreover, a five-year-study of the relationship between standardized test data and grade-point average (GPA) among 1,800 teacher education students found that College GPA is useful to predict effective teaching [27]. Subsequently, a report was proffered showing that GPA measures are better predictors of end of program performance measures than standardized test results [26]. Hence, there is a question as to whether the National Observational Teaching Exam (NOTE) is a useful new instrument to measure effective teaching. Therefore, knowing that GPA relates to effective teaching, researchers

need to explore how the variables examined in this study relate to the results of the National Observational Teaching Exam in terms of concurrent and/or predictive validity [28].

However, given the emphasis of standardized tests in education, it is important to consider other factors that predict effective teaching, e.g., personality traits, motivation measures, conscientiousness, etc. It is the opinion here that virtually any education department would do well to examine the relationships among its students' performances. Nevertheless, although this study highlights the relationship between high school (GPA) and college (GPA), the question remains as to whether there is a relationship between academic achievement and effective teaching.

As a matter of practice, there are those who insist that good grades and high standardized test scores do not make for effective teaching. Undoubtedly, there are documented cases where poor teachers have high grades and high standardized test scores. However, that is not to insinuate that low grades predict successful teaching. Therefore, it is our opinion that a reasonable starting point is to first consider pre-professionals' past academic achievement, i.e., High School GPA. Undoubtedly, one of the best predictors of the future is the past achievement, which seems like a plausible starting point for entry into teacher training for prospective science teachers of the twenty-first century.

VI. Conclusion

Educational planners commonly use High school GPA and SAT results to predict future academic performance in higher education. Therefore, the results of this study reveal that high school GPA is the best significant predictor of the college GPA of preservice science teachers of the factors examined. Hence, the present research offers new estimates of how factors predict the college GPAs of preservice science teachers. This research also provides guidance on the potential benefits of using high school GPA as a covariate in education research studies, particularly in studies of undergraduate learning effectiveness of preservice teachers. In so doing, it is hoped that this research deepens our understanding of the research tools at our disposal and will contribute to enhancing the selectivity and rigor of preservice science teacher training.

VII. Limitations

The sample size of (n=15) of preservice science students enrolled in the science certification program is limited. At the institution where the study takes place, students need a minimum basic skill level for degree candidacy admission, i.e., 2.80 college GPA at 60 credits and a minimum equivalent of 500 on each section of the SAT. In addition, it is acknowledged that teacher generated-grades at both the high school and collegiate-levels have unspecified levels of reliability and content validity.

VIII. Suggestions for Further Research

To this point, there is limited understanding of the factors that predict preservice science teachers' college GPA. Hence, this study serves as a baseline for further research to better understand the nature of the predictive factors among preservice sceince teachers and other areas of preservice teaching, e.g., mathematics, social studies, elementary education, etc. Giving the fact that SAT scores and high school GPA are not the only factors that predict college academic performance, there is a need for more research on other possible predictors of college academic performance among preservice teachers, e.g., motivation, gender, study habits, high school class size, and socioeconomic status. In addition, it would be of interest to determine how well other standardized tests predict college GPA and/or Teaching Effectiveness, e.g., Preservice Academic Performance Assessment (PAPA), Praxis Core Academic Skills for Educators, ACT, National College Teaching Exam (NOTE), etc. Undoubtedly, additional research is essential to determine the most effective policies for future teachers and the most efficient means for them to maximize student achievement in America's schools.

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