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Abstract

This study synthetically analyzes the effect of variables influencing or correlating with students' achievement. Correlation coefficients and data derived from compared groups based on the National Educational Longitudinal Study were converted to effect size. Variables influencing students' achievement were classified into five factors: demography, family support of learning, schools' promotion of learning, students' accumulated achievement, and students' involvement in learning. Accumulated achievement had the largest effect size; demography has a medium one, while the remaining three factors have only moderate (ranging between small and medium) effect sizes. The effect size of students' accumulated achievement grew steadily from grade 8 through grade 12. The results of the present study were compared with other meta-analyses evaluating the effect of variables influencing or correlating with students' achievement.

Keyword: NELS; Meta-analysis; Academic Achievement

Determinants of academic achievement: Synthetic analysis of researches using data of NELS

One of the purposes of the National Educational Longitudinal Study (NELS) was to provide trend data about critical transitions experienced by students as they leave 8th grade and progress through secondary school and either into college or their careers. (National Center for Educational Statistics, 1990). Follow-up studies of NELS-88 at intervals of two years have been carried out. After the publication of the surveyed data, a significant number of educational researchers began to analyze and interpret the relationship between variables. Many authors focused on the correlates of students' academic achievement. Achievement is not only important for a student's academic career, but is also a crucial indicator of effective schooling. Students with higher achievement test scores would increase their odds of attending a 4-year postsecondary educational institution (PEI) relative to a 2-year PEI, and never enrolling (Plank & Jordan, 2001). On the other hand, a higher achievement in reading or mathematics decreases the odds of early dropout among students (Goldschmidt & Wang, 1999). Students also continue to identify failure in school and dislike for school as major factors leading to dropping out

(McMillen, et al., 1993；Jordan, W. J., Lara & Portland, 1994. Peng & Lee's , 1992). Regression analysis also showed that the lowest quartile in achievement measured by the combined reading and mathematics test scores contributed significantly to the dropout rate. Therefore, students' achievement is deemed an important intervening variable determining a student's success or failure in school.

Hill's (2003) study chiefly found that graduate degrees of teachers in the field the student is studying, homework, small-class size, and fewer classroom distractions have a significant effect on achievement tests in mathematics, reading, and science. Taking into consideration cost-effectiveness, Hill suggested that: (a) scarce resources might be better spent by encouraging teachers to pursue graduate degrees in their field while school districts should seek to hire teachers that have graduate degrees in the field in which they are to teach; (b) an appropriate increase in homework and in the amount of time spent in learning in the classroom would represent a low-cost policy solution to increase students' achievement; (c) class-size reductions, however, is one of the more expensive reform measures because it requires the hiring of additional teachers and the building of additional classroom space. Therefore, school districts should concentrate on low-cost reforms that exert a positive

effect on students' achievement.

If we regard schooling as a way of promoting students' learning in accordance with student-centered learning theory, the variables that influence students' academic achievement may be categorized into six factors: (a) demography, (b) family support of learning, (c) schools' promotion of learning, (d) students' cumulative achievement (accumulated abilities), (e) students' academic commitment and (f) peer support of learning. The factor "demography" refers to the demographic variables of school, family, student, and peers. This factor is outside the control of the student.

Zigarelli（1996）utilized NELS-derived data for the years 1988, 1990, and 1992 to assess the effects of school variables on student achievement (estimated IRT scores on reading, mathematics, science and history). He reduced school variables into six constructs: employment of quality teachers, teachers' participation in school policy decisions and satisfaction, principal leadership and involvement in improving teaching, a culture emphasizing academic achievement, the school's relationship with the central school administration, and the voluntary involvement of parents in school-related activities. He listed school variables, with student, parent, and school demographics variables under controlled conditions, in a regression equation

and found that statistically significant variables were school culture (the school emphasizes achievement, and minutes per day students were in class), the principal's influence over hiring and firing staff, teachers' perception of whether teachers' morale is high, student variables (pretest score, academic track, hours of homework completed, and teachers' perception of student effort), students' race (White was higher than Black and Hispanic), students' sex (male was higher than female), parent variables (parent's socioeconomic status and educational expectation), location of school (schools located in the North, Midwest and South were higher than the West in the USA), and school size (larger schools were higher than smaller schools).

By controlling variables for sex, socioeconomic status (SES) background, and ethnicity, Von Secker (2002) examined the effect of student-centered, inquiry-based teacher practices on a standardized science test. Five elements were identified in an inquiry-based science teaching: (a) eliciting students' interest and engagement in science, (b) providing opportunities for students to develop appropriate laboratory techniques to collect evidence, (c) requiring students to solve problems using logic and evidence, (d) encouraging students to conduct further studies to develop more elaborate reports, and (e) requiring students to write scientific reports on the basis of evidence. The

measurement of teaching practices was based on the reports of teachers on the degree to which they emphasize these five practices. His findings suggest that the more a teacher employs inquiry-based teaching practices, the higher the science achievement of his students is. Von Secker also confirmed the findings of other researchers that male, White and Asian students with a higher SES background had higher achievements in science.

Brunsma and Rockquemore (1998) investigated the effect of student uniforms and other control variables on academic achievement (standardized test composite of reading and mathematics). The results of their study indicated that the achievement of students required wearing uniforms was lower than those not required wearing uniforms after the variable “Catholic school” was introduced in the regression equation. Other results of their study showed that the achievement of White students was higher than their Black and Hispanic counterparts; SES, however, had no significant effect. The achievement of students of Catholic, non-religious private, and religious private schools was higher than that of students in public schools; the achievement of students enrolled in general high school programs was higher than those enrolled in vocational-technical and other programs, but lower than students on an academic track. The achievement of suburban students was

higher than rural students; students who go to class with paper, pencil, books, and homework well prepared were higher than those that did not, and finally the students with a positive school attitude scored higher on the composite reading and mathematic achievement test. The finding of non-significance of the effect of SES on achievement is inconsistent with that of previous research, such as the studies of Zigarelli (1996), Von Secher (2002), and Ainsworth (2002).

Singh, Bickley, Trivette, Keith, Keith and Anderson (1995) conceptualized parental involvement as a complex construct with four dimensions and examined their effect on academic achievement. The four dimensions were parental aspiration for children's scholastic achievement, parent-child communication about school, home environment (family rules about watching TV, doing homework, or maintaining a grade average), and parental participation in school-related activities. Employing three control factors (previous grades in English, mathematics and science, ethnicity, and family SES background) they investigated the effect of the four components of parental achievement on standardized achievement tests in reading, math, science, and social studies taken by their children, and found that the strongest influence on present achievement was their previous achievement

in English, math, and science. SES had a significant effect on achievement as well as on parental aspirations for their children. White and Asian students had a higher level of achievement than Hispanic, Black, and Native Americans. Parental aspirations did have an effect, but parent-child communication about school, the home environment and parental participation in school activities did not have a direct, positive effect on achievement.

Ainsworth (2002) investigated the effects of the neighborhood on educational achievement. Significant variables leading to higher mathematics/ reading achievement test scores were (a) higher proportion of college graduates and employed persons with professional and managerial occupations among adults over 24 years of age as neighborhood residents, (b) higher family SES, (c) fewer number of siblings, frequently discussing course selection, school events and topics studied in class with parents, (d) parental involvement in school-related events, (e) race/ethnicity (Asian and White students had higher achievement scores than their Black, Hispanic, and Native American counterparts), (f) more highly qualified teachers, (g) more time spent on homework, (h) higher educational expectations of the student, (i) fewer close friends who dropped out of school, (j) higher occupational expectations of the student, (k) more positive school environment perceived

by school administrators. However, three variables (number of siblings, discussion school events with parents, and parental involvement in school-related events) turned out to be non-significant after another three variables (the number of parents of student's close friends whom a student's parent knows, student's occupational expectations, and school environment perceived by school administrators) were introduced into the regression model.

Granville, and Dika (2002) drew a 25% random sample (3227 cases) from NELS and also found a significant direct effect of academic time (more time spent on science homework and less time on TV) on the level of achievement for mathematics as well as science, which were proxied by two indicators (grades earned and scores of standardized achievement tests in mathematics and science).

Burkam, Lee, & Smerdon (1997) examined the effect of sex, the overall high school program, the total units of science completed previously, and science class activities on 10th-grade physical and life (biology) science achievement tests. Dependent variables were a 17-item test of physical science and an 8-item test in life science achievement drawn from the 10th-grade NELS science test. In their full models of regression analysis,

some variables had a consistently significant effect on the 10th-grade physical and life science achievement: (a) scores for males were higher than for females; (b) Whites performed better than Blacks, and Hispanics; (c) scores on 8th - grade achievement composed of 9-item life and 16-item physical science subtests, had a positive effect on 10th - grade achievement; (d) student enrollment in academic-track high schools is linked with higher achievement than enrollment in general, vocational and other programs; (e) additional coursework in physical science was positively linked with physical science achievement, and was also true for achievement in life science; (f) student-reported weekly hours of science homework did not affect the achievement in physical science or life science; (g) student-reported frequency of active class procedures, such as choosing which science topics to study and devising methods to solve science problems, and the frequency of using computers to collect and calculate science data were negatively associated with achievement, while a student-reported science course environment that emphasized increasing interest in science, learning science facts and rules, encouraging further study in science, using various ways to solve science problems, and believing in the importance of science to life had a positive impact on achievement; (h) teacher-reported frequency of

student-focused lab activities was positively associated with achievement, and (i) students in advanced courses outperformed academic class students. The finding of the non-significant effect of student-reported weekly hours of science homework seems to be opposed to the results of other studies (Zigarelli, 1996; Ainsworth, 2002).

Quirk, Keith, and Quirk (2001) investigated the effects of employment during high school on student grades while controlling latent variables, such as gender, ethnicity, SES and previous achievement. They found that employment had an overall negative and curvilinear effect on high school GPA. Working more than 11-13 hours per weak led to significant decline in academic performance.

From the above literature review, it was found that most of the studies concentrated on the demographic factor, school factor (Zigarelli, 1996; Von Secker, 2002), family factor (Singh, et al., 1995; Ainsworth, 2002), and individual student factor (abilities and involvement) (Burkam, et al, 1997; Singh, et al., 2002; Quirk, et al., 2001). The peer factor was less studied. The present study intends to calculate how effective these factors are on the achievement of students, and how these factors influence students' achievement for the 8^{th}, 10^{th}, 12^{th} grades and after the 12^{th} grade.

Method

Data collection

The decision rules for inclusion are:

1. Studies must sample their data from the database of the NELS survey, and contain independent variables influencing or correlating with achievement tests, grades, proficiency, completion of high school, or enrollment in college.
2. Studies presenting only abstracts were excluded. The full-text of studies must be available in electronic databases or libraries

The PsycINFO, ERIC (full-texts were retrieved from Http://www. eric. ed. gov), ProQuest Education Journals and ProQuest digital dissertations databases were searched for studies investigating the effect of variables on students' academic achievements. Achievement was defined broadly in the present study to include achievement tests, self-reported grades or proficiency, and academic outcomes, such as completion of high school and enrollment in colleges. The term used in the search was "National Educational Longitudinal Study and Achievement". Additionally "Journal of Educational Research", "American Educational Research Journal ", and "American Educational Research Journal" were systematically searched

manually. Some usable empirical articles also were traced from references listed in articles.

Calculation of effect size

Effect sizes were calculated from the number of samples, means and standard deviations of performance outcome of comparison groups, or correlation coefficients. The following formulas were used in calculations.

(1) $es = \frac{Me - Mc}{SDc}$

Where es = effect size, M_e and M_c are the means of the comparison group, respectively. SD_C is the standard deviation of the control group. This formula was used for the data in which the standard deviation of the control group only was available.

(2) $es = \frac{M_e - M_c}{\sqrt{\frac{(n_e - 1)SD_e^{\,2} + (n_c - 1)SD_c^{\,2}}{n_e + n_c - 2}}}$

Formula (2) was used for the data in which the standard deviations of the both comparison groups were available.

(3) $es = \sqrt{\frac{4(N-1)}{N}} * \frac{r}{\sqrt{1 - r^2}}$

Where N is the sample size, and r is the correlation coefficient when both variables are continuous (Hedge & Olkin, 1985, P. 77).

Formulas (1) – (3) have taken sample size into consideration, because the significance of effect size could be influenced by sample size (Fan, 2001).

Some valuable studies were not included in the present investigation because of insufficient data, as for example, Peng & Lee's (1992) study, in which standard errors of the achievement score instead of the standard deviation were given, and the number of samples for each category was not available; therefore it was not possible to calculate the effect sizes for each variable from Table 1 of their article.

One important task in meta-analysis is to determine the direction of influence of a variable on the achievement. Variables within a factor having opponent directions are to be avoided. For instance, "frequency of drug use" has negative correlation with the achievement, whereas "come to class with homework done" has a positive correlation with it. If the direction of variables within a factor was not identical, the averaged effect size of that factor would be diminished. Therefore the variable "frequency of drug use"

has to be changed into “lower frequency of drug use” and the sign of correlation coefficients with the achievement is reversed to positive. The sign of correlation coefficients in the present study, when not specifically mentioned, was positive and not reversed.

The literature review has been helpful in determining the direction of influence of a variable. Once the direction of influence of a variable is determined, it remains consistent throughout the present study. For instance, in terms of the effect of gender, if the direction of gender is set so that males have a higher score than females, then a positive effect size will be assigned, when the male has higher achievement score on math, but the sign of effect size will be indicated as negative, in the event females have a higher score for reading. Positive and negative signs will be taken into account when the effect size of gender on students’ achievement is averaged. Most of the directions of variables in the present study are based on the study of Rock et al. (1991) with several notable exceptions. For instance, for the calculation of effect sizes of ethnicity, they set Black, non-Hispanic as the control group (i. e., Black, non-Hispanic = 0, others = 1), but not all studies included in the present study have this category “Black, non-Hispanic”, whereas all studies have the category “White,

non-Hispanic". Therefore, the category "White, non-Hispanic" has been set as the control group in the present study (i. e., White, non-Hispanic = 1, others = 0). Hence the sign of effect sizes was still positive, with the exception of Asian, which had a negative sign because Asian students had higher mean achievement scores than White, non-Hispanic students. In Rock's (1991) study, the effect size of each category of variable was given. At the same time, N, mean, SD of the test score of each category of variables were also listed, so it was easy to recalculate the effect size of each category when the reference (omitted) category was changed.

It is possible that different authors may employ the same or overlapping sample of participants or variables; a different sampling would not significantly bias the mean effect sizes because all samples have been retrieved from the same NELS database.

A regression coefficient was not used in the present study, because of multi-collinearity, for example, Quirk et al. (2001) showed that ethnicity and SES had a significant direct effect only on scholastic achievement for 1988, but had no significant impact on grades for 1992. It is possible that due to multi-collinearity, ethnicity and SES were partialed out by the 1988 achievement as the 1988 achievement was also in the model. It might be

the case that when variables with a more direct and stronger effect on the dependent variable enter in the regression equation, the originally significant but weaker predictor will turn out to be not significant, or the originally non-significant predictor will turn out to have a negative significance. For example, in Table 2 of the study carried out by Burkam et al. (1997, 315-316), the variable “active lab” was initially significant at the .001 level in model 5, but it turned out to be non-significant after several other variables were entered into the equation (model 6, and model 7). In Table 3 of their study, the variable “female” was at first non-significant in model 1 and model 2, but turned out to be negatively significant after other variables were entered into the equation (model 4 and model 5). The significance of a predictor may be affected by control variables in a regression equation. Data derived from more than one-way analysis of variance were also excluded from the analysis because of the confounding of effects of various variables. In order to obtain a pure and stable effect of variables influencing or correlating with students’ academic achievement the present study has converted only the correlation coefficients and means and standard deviations of the compared group into effect sizes.

Results

A total of 27 studies were included in the present investigation, and data were converted into 1967 effect sizes. Mean effect sizes of five factors influencing student achievement are presented in Table 1. According to Cohen's (1977) criterion that an effect size of 0.2 is small, 0.5 is medium and 0.8 is large; accumulated achievement exhibited a large effect size. The accumulated achievement is defined as a student's previous and concurrent grades or achievement tests of the same or not the same subject matter. It reflects a student's accumulated academic abilities in a discipline or cross-disciplines. Demography has a medium effect size, while the remaining three factors have only small effect sizes. Due to the heterogeneous variance of residuals, the difference of means can only be tested by non-parametric statistics. Kruskal Wallis one-way ANOVA showed that the difference of means of the five factors is significant.

Upon the initial inspection of Table 1, it appears that the mean effect size correlated with the number of effect size. But after examining other tables it turns out to be not the case. Thus it is not appropriate to infer that the large mean effect size is due to the large number of effect size.

There were only seven effect sizes of “peer support of learning”. Among them, only the variable “peer support of education during 10th grade” had an effect size of 0.37 on “high school completion” and 0.39 on college enrollment. The variable “peer support of education during 10th grade” is defined as the belief of close friends that schooling is important. The remaining five effect sizes were around zero. Hence the factor “peer support of learning” was not included in the statistical testing.

Insert Table 1 about here

The mean effect sizes of the various demographic variables are provided in Table 2. “Ethnic by educational expectation interaction” had the largest mean effect size. A student from a White or Asian family with the expectation of earning an advanced degree had higher achievement. The effect of SES also approached the large category. Age had 0.75 of effect size showing that being too old in a class is a disadvantage, especially for those who have been held back. The type and community type of the school had a medium effect size indicating that students in public schools and urban schools had lower levels of achievement. The remaining

demographic characteristics had small effect sizes.

Insert Table 2 about here

In Table 3, parents' educational expectations or aspirations for their children had a medium size of effect. The learning environment in the home and parental involvement had only small effect sizes.

Insert Table 3 about here

Although the variance of residuals is homogeneous, as shown in Table 4, and Levene's Test for homogeneity of variance of residuals revealed no significance, the residuals must also be independently distributed if the parametric statistics are to be used to test the significance of difference of means. The residuals of the 118 effect sizes were created by using "center" in the ARIMA procedure to subtract each effect size from the mean effect size (SAS Institute Inc., 1984, 131). The result showed lag 1 autocorrelation was .235, with standard error = .097, $p < .05$. It demonstrated that the data were not independent, and could not be

analyzed with parametric statistics. Therefore, the Mann-Whitney U test was applied. The result of testing manifested that the mean effect size of a good teaching climate was significantly higher than that of administrative support.

Insert Table 4 about here

As can be seen in Table 5, post hoc comparisons revealed that as students' performances were measured by standardized achievement tests, the mean effect sizes of accumulated achievement were higher than that measured by self-reported grades or grade records.

Insert Table 5 about here

The variable "Attitude and motivation" and "students' academic commitment in school" had medium effect sizes, and their effect sizes were significantly larger than that of "academic commitment out of school" (see Table 6).

Insert Table 6 about here

Table 7 displays the mean effect sizes of the five factors influencing achievement for the 8th, 10th, and 12th grades, and post-secondary achievement. It is noteworthy that the effect size of students' accumulated achievement increased from the 8th grade through the 12th grade. The influence of the remaining four factors on students' achievement did not show any systematic longitudinal trends. In some cells of the table the number of effect size is too small to be conclusive.

Insert Table 7 about here

Discussion

The present study serves to investigate the magnitude of various factors influencing students' achievement. Because the method used to calculate effect size was setting a category of the variable that had the lowest or highest

achievement score as reference category, most of the variables would have a positive influence, thereby rendering the effect size of each factor relative. Variables influencing students' achievement were classified into five factors: demography, family support of learning, school promotion of learning, students' accumulated achievement, and students' involvement in learning. Accumulated achievement had the largest effect size; demography had a medium effect size, while the remaining three factors had only moderate (between small and medium) effect sizes. An alternative interpretation of why the three factors (family support of learning, school promotion of learning, and students' involvement in learning) had only a moderate effect on achievement is that the majority of data measuring these factors were collected through the Likert scale survey. It is postulated that the Likert scale instrument could not precisely measure the true function of these process factors, whereas the data of demography and standardized achievement tests were precise and well defined. Other important findings of this investigation are as follows:

1. A student from a White or Asian family with the expectation to earn an advanced degree had the large achievement. The effect of SES was also approaching the large category. The type and community form of a school had a medium effect size indicating that students in public schools and

urban schools had lower levels of achievement.

2. Parents' educational expectations or aspirations had a higher effect size than the learning environment in the home and parental involvement.
3. The mean effect size of a good teaching climate was significantly higher than that of administrative support.
4. As students' performances were measured by standardized achievement tests, the mean effect sizes of accumulated achievement were higher than those measured by self-reported grades or grade records. Can this phenomenon be attributed to the fact that standardized achievement tests have a lower proportion of measurement errors than self-reported grades or grade records? This is only a conjecture. The influence of measurement error can inflate as well as deflate the effect size.
5. "Attitude and motivation" and "student academic commitment in school" had medium effect sizes, and their effect sizes were significantly larger than those of "academic commitment out of school".
6. The effect size of students' accumulated achievement grew steadily from the 8^{th} grade through the 12^{th} grade. Does this phenomenon support the hypothesis that education enlarges, rather than reduces, individual differences? This result is suggestive, but the present author is wary of

over-generalizing based only on this evidence. Further research is needed.

A main purpose of meta-analysis is to consolidate the body of scientific knowledge of a field. Other meta-analyses have evaluated the effect of variables influencing or correlating with students' achievement. The appendix compares their results with that of present study. Due to the fact that different studies use different methods to calculate effect size, including vote counting, correlation coefficients, conversion of regression coefficients while others employ the classic method proposed by Glass (1976) or its variant, comparisons focus only on direction instead or magnitude of influence or correlation.

From the Appendix it can be seen that the variables analyzed in the present study supplement and corroborate other meta-analyses evaluating the effect of variables influencing or correlating with students' achievement. No contradictions have been found between the results of the present study and other meta-analysis studies (such as Findley & Cooper, 1983; Uguroglu, & Walberg, 1979; White, 1982; White et al., 1992; Williams et al. 1982). Most of the meta-analyses concentrated on the factor "school promotion of students' learning". The evaluation of the effect of accumulated

achievement is unique to the present study. It is possible to analyze such an effect only under the condition that the data were collected by a longitudinal study such as NELS.

The present author acknowledges that the studies included in the present meta-analysis are only a portion of relevant articles published. Some relevant articles published in the USA and other countries were not referred to in the present study because of the present author's limited ability to find them. The present author desires only to make a modest but meaningful contribution to the accumulation of knowledge in the field of educational science.

References

References marked with an asterisk indicate studies included in the meta-analysis. The in-text citations to studies selected for meta-analysis are not preceded by asterisks.

Ainsworth, J. W. (2002). Why does it take a village? The mediation of neighborhood effects on educational achievement. *Social Forces, 81*, 117-153.

*Andermen, E. M. (1998). The middle school experience: Effects on the math and science achievement of adolescents with LD. *Journal of Learning Disabilities, 31*, 128-139.

Bangert-Drowns, R. L. (1993). The word processor as an instructional tool: A meta-analysis of word processing in writing instruction. *Review of Educational Research, 63*, 69-93.

Bangert-Drowns, R. L., Kuilk, J. A., Kuilk, C. -L. C. (1983). Effect of coaching programs on achievement test performance. *Review of Educational Research, 53,* 571-585.

Bangert-Drowns, R. L., Kulik, J. A., & Kulik, C. - L. C. (1985). Effectiveness of computer-based education in secondary schools. *Journal of Computer-based Instruction, 12*, 59-68.

Bredderman, T. (1983). Effects of activity-based elementary science on student outcomes: A quantitative synthesis. *Review of Educational Research, 53,* 499-518.

*Brunsma, D. L., and Rockquemore, K. A. (1998). Effects of student uniforms on attendance, behavior problems, substance use, and academic achievement. *Journal of Educational Research, 92*, 53-62.

*Brunsma, D. L., and Rockquemore, K. A. (2003). Statistics, sound bites, and school uniform: A reply to Bodin. *Journal of Educational Research, 92*,72-78

*Burkam, D. T., Lee, V. E., and Smerdon, B. A. (1997). Gender and science learning early in high school: Subject matter and laboratory experiences. *American Educational Research Journal, 34*, 297-331.

*Butty, J.-A. L. M. (2001). Teacher instruction, student attitudes, and mathematics performance among 10th and 12th grade black and Hispanic students. *The Journal of Negro Education, 70*, 19-38.

Cohen, P. A. (1977). *Statistical power analysis for the behavioral sciences* (2nd. Ed.). New York: Academic Press.

Cohen, P. A. , Kulik, J. A. & Kulik, C-L. C. (1982). Educational outcomes of tutoring: A meta-analysis of findings. *American Educational Research*

Journal, 19(2), 237-248.

*Fan, X. (2001). Statistical significance and effect size in education research: Two sides of a coin. *The Journal of Educational Research, 94*, 275-282.

Findley, M. J. & Cooper, H. M. (1983). Locus of control and academic achievement: A literature review. *Journal of Personality and Social Psychology, 44,* 419-427.

Fletsch-Flinn, C. M. & Gravatt, B. (1995). The efficacy of computer assisted instruction (CAI): A meta-analysis *Journal of Computing Research, 12,* 219-242.

Fuller, B. (1987). What school factors raise achievement in the third world? *Review of Educational research, 57,* 255-292.

Giaconia, R. M. & Hedges, L. V. (1982) Identifying features of effective open education. *Review of Educational Research, 52,* 579-602.

Glass, G. V. (1976). Primary, secondary, and meta-analysis of research. *Educational Research, 5,* 3-8.

Goldschmidt, P., and Wang, J. (1999). When can schools affect dropout behavior? A longitudinal multilevel analysis. *American Educational Research Journal, 36*, 715-738.

Greenwald, R., Hedges, L. V., & Laine, R. D. (1996). The effect of school

resources on student achievement. *Review of Educational Research, 66,* 361-396.

Gutiérrez, R. & Slavin, R. E. (1992). Achievement effects of the nongraded elementary school: A best evidence synthesis. *Review of Educational Research, 62,* 333-376.

*Hamilton, L. S., and Snow, R. E. (1998). *Exploring differential item functioning on science achievement tests.* Los Angeles, CA: National Center for Research on Evaluation, Standards, and Student Testing. (ERIC Document Reproduction Services No.ED427077).

*Hanson, S. L. (2004). African American women in science: Experiences from high school through the post-secondary years and beyond 1. *NWSA Journal, 16*, 96-116.

Hattie, J., Marsh, H. W., Neill, J. T., & Rishards, G. E. (1997). Adventure education and outward bound: Out of class experiences that make a lasting difference. *Review of Educational Research, 67,* 43-87.

Hedger, L. V. & Olkin, I. (1985). *Statistical methods for meta-analysis.* Orlando: Academic Press.

*Hernandz-Gantes, V. M. (1995). *What influence eighth-grade Hispanic student academic achievement? A structural equation analysis.* Paper

presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA, April 18-22. (ERIC Document Reproduction Service No. ED386505).

Hill, A. T. (2003). A panel study of the effects of teacher education, class size, and time-on task on students achievement: Evidence from NELS: 88. Unpublished doctoral dissertation, University of Delaware, Newark.

Horak, V. M. (1983). A meta-analysis of research findings on individualized instruction in mathematics. *Journal of Educational Research, 74,* 249-253.

Horton, P. B., McConney, A. A., Gallo, M., Woods, A. L., Senn, G. J., & Hamelin, D. (1993). An investigation of the effectiveness of concept mapping as an instructional tool. *Science Education, 77,* 95-111.

*Jeynes, W. H. (1999). Effects of remarriage following divorce on the academic achievement of children. *Journal of Youth and Adolescence, 28*, 385-394.

Johnson, D. W., Maruyama, G., Johnson, R., Nelson, D., & Skon, L. (1981). Effects of cooperative, competitive, and individualistic goal structure on achievement: A meta-analysis. *Psychological Bulletin, 89,* 47-62.

Jordan, W. J., Lara, J., and McPartland, J. M. (1994). *Exploring the complexity*

of early dropout causal structures. Baltimore, MD: Center for Research on Effective Schooling for Disadvantaged Students. (ERIC Document Reproduction Service No. ED375227).

Kulik, J. A., Bangert, R. L., & Williams, G. W. (1983). Effects of computer-based teaching on secondary school students. *Journal of Educational Psychology, 75,* 19-26.

Kulik, C. C. & Kulik, J. A. (1982). Effect of ability grouping on secondary school students: A meta-analysis of evaluation findings. *American Educational Research Journal, 19,* 415-428.

Kulik, C. -L. C., Kulik, J. A. & Bangert-Drowns, R. L. (1990). Effectiveness of mastery learning programs: A meta-analysis. *Review of Education Research, 60,* 265-299.

Kuilk, C. -L. C, Schwalb, B. J. & Kuilk, J. A. (1982). Programmed instruction in secondary education: A meta-analysis of evaluation findings. *Journal of Education Research, 75,* 133-138.

Kuilk, J. A. & Kuilk, C-L. C. (1984). Effects of accelerated instruction on students. *Review of Educational Research, 54,* 409-425.

Kuilk, J. A., Kuilk, C. -L. C., Cohen, P. A. (1980). Effectiveness of computer-based college teaching: A meta-analysis of findings. *Review of*

Educational Research, 50, 525-544.

*Le, V.-N. (1999). *Identifying differential item functioning on the NELS: 88 history achievement test.* Los Angeles, CA: National Center for Research on Evaluation, Standards, and Student Testing. (ERIC Document Reproduction Service No.443879)

Lee, J. (1999). Effectiveness of computer-based instructional simulation: A meta-analysis. *International Journal of Instructional Media, 26,* 71-89.

*Lee, D., Coladarci, T., Donaldson, G. A. (1996). *Effects of school choice on academic commitment and academic achievement: Evidence from NESL: 88.* Paper presented at the Annual Meeting of the American Educational Research Association, New York, NY, April 8-12. (ERIC Document Reproduction Service No. ED4293790).

*LePore, P. C., and Warren, J. R. (1997). A comparison of single-sex and coeducational catholic secondary schooling: evidence from the national educational longitudinal study of 1988. *American Educational Research Journal, 34*, 485 -511.

Liao, Y-K. C. (1998). Effects of hypermedia versus traditional instruction on students' achievement: A meta-analysis. *Journal of Research on Computing in Education, 30,* 341-360.

Lou, Y., Abrami, P. C., Spence, J. C., Poulsen, C., Cambers, B., & d'Apollonia, S. (1996). Within-class grouping: A meta-analysis. *Review of Educational Research, 66,* 423-458.

Lysakowski, R. S. & Walberg, H. J. (1982). Instructional effects of cues, participation, and corrective feedback: A quantitative synthesis. *American Educational Research Journal, 19,* 559-578.

*Martinez, M. r. (2003). *The impact of communally structured high school and social support resources on the minority education attainment GAP.* Unpublished doctoral dissertation, New York University, NY.

*McCoy, L. P. (2005). Effect of demographic and personal variables on achievement in eight-grade algebra. *The Journal of Education Research, 98*, 131-136.

McMillen, M., Hausken, E. G., Ingels, S., Dowd, K., Prankel, M., & Quian, J. (1993). *Dropping out of school: 1982 and 1992.* Washington, DC: National Center for Education Statistics. (ERIC Document Reproduction Service No. ED364571).

*Muller, C. (1998). Gender differences in parental involvement and adolescents' mathematics achievement. *Sociology of Education, 71*, 336-357.

National Center for Education Statistics. (1990). *National Educational Longitudinal Study of 1988: Base year student component data file user's manual.* Washington, DC: U. S. Department of Education.

Paschal, R. A., Weinstein, T., & Walberg, H. J. (1984). The effects of homework on learning: A quantitative synthesis. *Journal of Educational Research, 78,* 97-104.

Peng, S. S., Lee, R. M., (1992). *Measuring student at-riskness by demographic characteristics. Paper presented at the annual Meeting of the American Educational Research Association. San Francisco, CA, April 20-24, 1992.* (ERIC Document Reproduction Service No. ED347679).

Plank, S. B., and Jordan, W. J. (2001). Effects of information, guidance, and actions on postsecondary destinations; a study of talent loss. *American Educational Research Journal, 38*, 947-979.

*Quirk, K. J., Keith, T. Z., and Quirk, J. T. (2001). Employment during high school and student achievement: longitudinal analysis of national data. *The Journal of Educational Research, 95*, 4-10.

Readence, J. E. & Moore, D. W. (1981). A meta-analytic review of the effect of adjunct pictures on reading comprehension. *Psychology in the Schools,*

18, 218-224.

*Ream, R. K. (2003). Counterfeit social capital and Mexican-American underachievement. *Educational Evaluation and Policy Analysis, 25*, 237-263.

Rock, D. A., et al. (1991). *The tested achievement of the National Educational Longitudinal Study of 1988 eighth grade class*. Washington, DC: National Center for Education Statistics. (ERIC Document Reproduction Service No. ED335365).

Singh, K. (1998). Part-time employment in the high school and its effect on academic achievement. *The Journal of Educational Research. 91*, 131-139.

*Singh, K., Bickley, P. G., Trivette, P., Keith, T. Z., Keith, P. B., and Anderson, E. (1995). The effects of four components of parental involvement on eighth-grade student achievement: structural analysis of NELS-88 data. *School Psychology Review, 24*, 299 -317.

* Singh, K. & Ozturk, M. (2000). Effect of part-time work on high school mathematics and science course taking. *The Journal of Education, 94*, 67-75.

*Singh, K., Granville, M., and Dika, S. (2002). Mathematics and science

achievement: effects of motivation, interest, and academic engagement. *The Journal of Educational Research, 95(6)*, 323-332.

Slavin, R. E. (1987). Ability grouping and student achievement in elementary schools: A best-evidence synthesis. *Review of educational Research, 57,* 293-336.

Slavin, R. E. (1990). Achievement effects of ability grouping in secondary schools: A best-evidence synthesis. *Review of Educational Research, 60,* 471-499.

Smith, M. L. (1980). Teacher expectations. *Evaluation in Education, 4,* 53-55.

Springer, L., Stanne, M. E., & Donovan, S. S. (1999). Effects of small-group learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis. *Review of Education Research, 69 ,* 21-51.

*Thomas, J. P. (1999). *Influences on mathematics learning among African American high school students*. (ERIC Document Reproduction Service No. ED430806).

*Thomas, J. P. (2000). Influences on mathematics learning and attitudes among African American high school students. *The Journal of Negro Education, 69*, 165-184.

*Trusty, J. (1999). African American's educational experiences: Longitudinal

causal models for women and men. *Journal of Counseling and Development: JCD, 80,* 332-346.

Uguroglu, M. E. & Walberg, H. J. (1979). Motivation and achievement: A quantitative synthesis. *American Educational Research Journal, 16,* 375-389.

Vaughn, V. L., Feldhusen, J. F., & Asher, J. W. (1991). Meta-analysis and review of research on pull-out programs in gifted education. *Gifted Child Quarterly, 35,* 92-98.

Veenman, S. (1995). Cognitive and noncognitive effects of multigrade and multi-age classes: A best-evidence synthesis. *Review of Educational Research, 62(4),* 319-381.

Von Secker, C. (2002). Effects of inquiry-based teacher practices on science excellence and equity. *The Journal of Educational Research, 95*, 151-160.

Williams, P. A., Haertel, E. H., Haertel, G. D., & Walberg, H. J. (1982). The impact of Leisure-time television on school learning: A research synthesis. *American Educational Research Journal, 19,* 19-50.

White, V. R. (1982). The relation between socioeconomic status and academic achievement. *Psychological Bulletin, 91,* 461-481.

White, K. R., Taylor, M. J., & Moss, V. D. (1992). Does research support claims about the benefits of involving parents in early intervention programs? *Review of Educational Research, 62,* 91-125.

*Yeung, A. S., Marsh, H. W., and Suliman, R. (2000). Can two tongues live in harmony: analysis of the national education longitudinal study of 1988 (NELS88) longitudinal data on the maintenance of home language. *American Educational Research Journal, 37*, 1001-1026.

Zigarelli, M. A. (1996). An empirical test of conclusions from effective schools research. *Journal of Educational Research, 90*, 103-110.

Appendix

Comparisons of the Results of Other Studies Synthesizing the Effect of variables influencing or correlating with students' achievement with that of the Present Study

Authors	Independent or correlated variables (factor) [c]	Results and Comparison
Bangert-Drowns (1993)	Using the word processor as an instructional tool (3)	ES = 0.27 [a]
Bangert-Drowns, et al. (1983); Horak (1983)	Individualized instruction (3)	ES was 0.1 and –0.07, respectively
Bredderman (1983)	Activity-based elementary science (3)	ES was 0.35
Cohen, Kulik, & Kulik (1982).	Tutoring (3)	Positive effect on achievement of both tutors and students
Findley & Cooper (1983)	Locus of control (5)	Internal control had a mean correlation of .21 and .16 with achievement and grades, respectively (same) [b]
Fletsch-Flinn & Gravatt (1995); Ryan (1991);	Computer assisted instruction (3)	Computer assisted instruction had a positive effect on students' achievement at all

Kulik, et al. (1983); Bangert-Drowns, et al. (1985); Kulik, et al. (1980)		levels of education. The effect sizes ranged from 0.25 to 0.67.
Fuller (1987)	School quality (Financial expenditures, physical facilities, teachers' quality, teaching practices and class organization, and school management) (3)	Increasing school quality could result in the improvement of students' achievement in the third world.
Giaconia & Hedges (1982)	Open education (3)	The effect sizes of open education were around zero and negative for language, math, and reading.
Greenwald, et al. (1996)	School resources (3)	School resources are systematically related to students' achievement.
Gutiérrez & Slavin (1992)	Non-graded elementary school (3)	Better than the traditional elementary school
Hattieet al. (1997)	Adventure education and outward bound (3)	ES = 0.34
Horton et al.	Concept mapping as an	Better than traditional

(1993)	instructional tool (3)	instruction
Johnson et al. (1981)	Cooperative learning (3)	Generally, cooperative learning outperformed competitive learning
Kulik & Kulik (1984)	Accelerated instruction (grade skipping) (3)	ES was 0.88
Kulik, Schwalb, & Kulik (1982)	Programmed instruction in secondary education (3)	ES was 0.08
Kulik & Kulik (1982); Vaughn et al. (1991)	Ability grouping for the gifted (3)	ES was 0.33 and 0.77 respectively
Kulik, Kulik, & Bangert-Drowns (1990)	Mastery learning programs (3)	ES = 0.52
Lee, J. (1999)	Computer-based instructional simulation (3)	Better than traditional instruction method, but not better than computer tutorial method
Liao (1998)	Hypermedia (3)	ES was 0.484
Lou et al. (1996)	Within-class grouping (3)	Effect size on the standardized test was 0.07, but on the tests constructed by teacher or research was 0.42 and 0.34 respectively.
Lysakowski &	Cues, participation, and	ES for the three teaching skills

Walberg (1982)	corrective feedback (3)	was 1. 28, 0.88, and 0.94 respectively
Paschal et al. (1984)	Homework (5)	ES = 0.36
Readence & Moore (1981)	Adjunct pictures on reading comprehension. (3)	ES = 0.22
Ross (1988)	Training students to control variables in experiment (3)	ES was 0.73
Shymansky et al. (1900)	Inquiry-based science curricula (3)	ES was 0.3 for science achievement test.
Slavin (1987; 1990)	Ability grouping (3)	ES of Ability grouping in the elementary as well as secondary schools was around zero.
Smith (1980)	Teacher expectations (3)	ES =0.38
Springeret al. (1999)	Small-group learning on undergraduates in science, mathematics, engineering, and technology (3)	ES = 0.51
Uguroglu & Walberg (1979)	Motivation (5)	Positively correlated with achievement tests and grades (same)

Veenman (1995)	Multi-grade and multi-age classes (3)	Multi-grade and multi-age classes had an ES of –0.02 and –0.08 respectively.
White et al. (1992)	Parental involvement in early intervention programs (2)	ES was 0.348 (same)
White (1982)	Socioeconomic status (1)	Mean r = .68 on the school level and .245 on the student level (same)
Williams et al. (1982)	Leisure-time television watching time (5)	Negative correlation with achievement (same).

[a] ES = mean effect size

[b] (same) means the direction of influence or correlation is same as that of the present study. When the comparison is not specified, it means that the variables analyzed in that article were not the same as that of the present study.

[c] The number in parentheses refers to the variable belonging to the factor classified in the present study. (1) demography, (2) family support of learning, (3) school promotion of learning, (4) students' accumulated achievement, (5) students' involvement in learning

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Table 1

The Mean Effect Sizes of the Five Factors Influencing Students Achievement

Factors influencing students' learning	K	M	SD
1. Demography	568	0.472	0.482
2. Family support of learning	151	0.320	0.267
3. School promotion of students' learning	118	0.275	0.356
4. Students' accumulated achievement	840	0.939	0.701
5. Students' involvement in learning	290	0.392	0.285
Total	1967	0.636	0.611
Levene's Test for homogeneity of variance	F (4, 1962) = 58.002***		
Kruskal Wallis one-way ANOVA by rank	χ^2 (4, N=1967) = 409. 045 ***		
Post hoc comparisons	4 > 1 > 5 > (2, 3) [a]		

Note. In all of the tables of the present article, K = Number of effect size, M = Mean, and SD = Standard deviation.

[a] In the post hoc comparisons, 4 > 1 > 5 > (2, 3) means that the effect size of "students' accumulated achievement" (4) is larger than that of "demography" (1), and the effect size of the latter (1) is greater than that of "students' involvement in learning" (5), of which the effect size is larger than that of

“family support of children’s learning” (2) and “school promotion of learning” (3). No significant difference was found between the two least effective factors.

*** p < . 001

Table2

Mean Effect Size of Each Subcategory of the Factor "Demography"

Influencing Students' Achievement

Subcategory of demography	K	M	SD	Independent or correlated variables and their coding
1. Family: ethnic	145	0.35	0.48	White and non-Hispanic = 1, others = 0[a]
2. Family: Ethnic by educational expectation interaction	24	1. 28	0.45	White by advanced degree = 1, others = 0
3. Family: Number of siblings	12	0.32	0.05	More than two = 0 [a]
4. Family: SES	101	0.70	0.29	Low quartile = 0
5. Family: SES by ethnic	86	0.68	0.45	White and high quartile = 1, others = 0
6. Family: structure	20	0.29	0.18	Reconstituted family = 0; Neither of parents live in household = 0
7. Personal: age	8	0.75	0.20	1972 or before = 0
8. Personal: gender	47	0.11	0.69	Female = 0
9. School: coeducational form	24	0.16	0.18	Coeducation = 0, Single sex = 1
10.School: type of community	34	0.50	0.23	Suburban = 1, others = 0
11. School: grade span	8	0.14	0.05	Middle school, junior high school = 0

12. School: region	32	0.16	0.13	South Atlantic = 0
13. School: selectivity	4	0.36	0.06	Not selective = 0
14. School: size	8	0.11	0.06	1000 or more = 0
15. School: type	15	0.49	0.32	Public = 0
Total	568	0.47	0.48	
Levene's Test for homogeneity of variance	F (14, 553) = 6. 883***			
Kruskal Wallis one-way ANOVA by rank	χ^2 (14, N=568) = 220.255 ***			

[a] In all of the tables in this article, “1” means this category of variable has higher achievement than the “0” category of that variable. In all of the tables in the present study, when only the reference category = 0 is shown, it implies that others = 1. The majority of categories coded with 0 are expected to have the lowest achievement score. Under this mechanism all the effect sizes in an aggregated mean effect size will have the same direction of influence or correlation.

*** p < . 001

Table 3

Mean Effect Size of Each Subcategory of the Factor "Family Support of Children's Learning" Influencing Students' Achievement

Subcategory of family support of children' learning	K	M	SD	Independent or correlated variables and their coding
1. Parents' educational expectations or aspirations	24	0.53	0.27	High school or less = 0
2. Language spoken in home	16	0.30	0.16	Non-English = 0
3. Learning environment in home	12	0.35	0.36	Do not have a specific place for study = 0; Do not have newspaper, magazines, books = 0
4. Parental involvement[a]	99	0.27	0.24	
Total	151	0.32	0.27	
Levene's Test for homogeneity of variance	F (3, 147) = 3. 842 ***			
Kruskal Wallis one-way ANOVA by rank	χ^2 (3, N=151) = 15. 626 ***			

[a] For the group comparisons, the following coding was used: Parents rarely or never check if homework is done = 0; Parents rarely or never limit TV

watching = 0; Parents rarely or never speak to teacher = 0; Parents have no rules about maintaining grades or watching TV = 0; Parents warned about attendance or behavior or grades more than twice = 0; Discussion with parents about study: not at all = 0

*** p < . 001

Table 4

Mean Effect Size of Each Subcategory of the Factor "School promotion of Students' Learning" Influencing Students' Achievement

Subcategory of School promotion of learning	K	M	SD
1. Good teaching environment [a]	82	0.348	0.31-7
2. Administrative support [b]	36	0.104	0.407
Total	118	2.74	0.36
Levene's Test for homogeneity of variance	F (1, 116) = 0.064 ns		
Mann-Whitney U test	Z = -3. 403***		

[a] Correlated variables were: "Academic Climate"; "Academic Rigor", "Prevalence of Collective Responsibility among teachers for Learning ", Quality of Student-Teacher Relationship", "Quality of instruction (teacher's review of previous work and emphasis on thinking about problem solving)", "Quantity of Instruction (hours devoted to math)", "Students' perception of Good teaching environment"; and "Classroom environment (not afraid to ask questions in mathematics class)". For group comparisons, the following coding was used: traditional type = 0, reform type = 1. Reform type of instruction in math refers to the class of math emphasizing more on (a) increasing students' interest in math, (b) showing the importance of math in daily life, (c) conceiving and analyzing the effectiveness of multiple

approaches to problems, (d) developing an awareness of the importance of math in basic and applied sciences, (e) learning about the application of math to business and industry, (f) having students raise questions about, discuss and formulate conjectures about math, and (g) having students work together in cooperative groups.

I often feel put down by my teachers: Strongly agree = 0; Student disruptions get in the way of learning: Strongly agree = 0; Students' view of teacher-students' interactions: Least positive = 0; Curricular track: academic > other programs > general > vocational/ technical program; English/math class type: regular English/math class > remedial English/math class > No English/math class;

[b] The correlated variable was "Quality of Professional Relationship between teachers, principal, and staff", "Resources Available to Support college Attendance".

For the group comparisons, the following coding was used: Student uniform = 0; Student was robbed, offered drugs, threatened: More than twice = 0; I don't feel safe at this school: strongly agree = 0

*** $p < .001$, ns = non-significant.

Table 5

Mean Effect Size of Each Subcategory of the Factor "Students' Accumulated achievement" Influencing Students' Achievement

Subcategory of students' accumulated achievement	K	M	SD
Achievement test scores correlated with accumulated achievement test or grade scores of the same subject matter	109	1.14	0.94
Grade scores correlated with accumulated achievement test or grade scores of the same subject matter	69	0.67	0.59
Achievement test scores correlated with accumulated achievement test or grade scores of other subject matter	398	1.05	0.68
Grade scores correlated with accumulated achievement test or grade scores of other subject matter	264	0.76	0.59
Total	840	0.94	0.70
Levene's Test for homogeneity of variance			
Kruskal Wallis one-way ANOVA by rank	χ^2 (3, N=840) = 34.153 ***		
Post hoc comparisons	(1, 3) > (2, 4)		

Note. The correlation coefficients of non-English first language proficiency and home language speaking frequency with achievement test and grade scores of other subject matter were reversed; Learning Disability = 0; Previously held back = 0; Average self-reported grade: low quartile = 0; Averaged grade since 6th grade: mostly D's or lower = 0; Limited English proficiency = 0; Limited English proficiency and understanding same or less than speaking = 0; Language you usually speak now: Spanish = 0; Spoke other (non-English) languages before starting school: yes = 0.

*** p = .001

Table 6

Mean Effect Size of Each Subcategory of the Factor "Students' Involvement in Learning" Influencing Students' Achievement

Subcategory of students' personal involvement in learning	K	M	SD
1. Attitude and motivation [a]	79	0.496	0.371
2. Academic commitment in school [b]	104	0.393	0.276
3. Academic commitment out of school [c]	107	0.315	0.176
Total	290	0.392	0.285
Levene's Test for homogeneity of variance			
Kruskal Wallis one-way ANOVA by rank	χ^2 (2, N=290) = 12. 41 **		

** p < .01, *** p < .001

[a] Locus of control: external control = 0; Self concept: low = 0; Student post secondary plans: won't finish high school = 0; Expected high school program: vocational, technical, business = 0; Pro-school attitude: negative = 0

[b] Feel bored at school: most of the time = 0; Any discipline problems this year: more than two = 0; How often cut or skip classes: sometimes = 0; Come to class without pencil, paper: usually = 0; Come to class without books: usually = 0; Come to class without books: usually = 0; Come to class without homework done: usually = 0; Absenteeism: more absent = 0; Trouble

behavior: more = 0; Drug abuse: more = 0; School tasks prepared: less = 0

[c] Hours of TV on weekdays: 4-5 hours or more = 0; How much outside reading per week: none = 0; Hours of homework (science, English, math, or social studies) per week: 2 or fewer hours = 0; Fewer hours spent in part-time work. The sign of correlation coefficients of “part-time work hours” with “achievement test or grade scores” was reversed. The variables for which the signs of correlation coefficients were also reversed were “frequency of drug use”, and “school behavior problems”.

Table 7:

Mean Effect Sizes of Factors Influencing Students' Achievement Tests and Grade Scores in the 8th-, 10th-, 12th Grades, and Postsecondary Success

	8th grade			10th grade			12th grade			Postsecondary		
Factors	K	M	SD	K	M	SD	K	M	SD	K	M	SD
1. Demography	466	0.49	0.49	54	0.33	0.41	42	0.50	0.44	6	-0.06	0.06
2. Family support of learning	144	0.32	0.27	1	0.72	.	2	0.08	0.03	4	0.37	0.18
3. School promotion of learning	76	0.35	0.28	20	0.13	0.64	10	0.10	0.22	12	0.19	0.14
4. Students' accumulated achievement	209	0.79	0.60	264	0.91	0.73	367	1. 05	0.72			
5. Student s' involvement in learning	250	0.40	0.28	16	0.43	0.20	24	0.34	0.35			
Total	1145	0.49	0.47	355	0.75	0.72	445	0.93	0.72	22	0.15	0.19