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Academic Achievement and Demographic Traits of Homeschool Students: A Nationwide Study

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Introduction

The body of research on home-based education has expanded dramatically since the first studies and academic articles of the late 1970s that dealt with the modern homeschool movement. Numerous researchers have examined the academic achievement of home-educated children and youth, their social, emotional, and psychological development, and their success into adulthood, and various aspects of homeschool families in general. Researchers have also explored myriad other aspects and issues related to home education in disciplines such as philosophy, sociology, and law. Only a handful of studies, however, have looked closely at a large nationwide sample of home educators and their children in the United States, and the last one of this nature was conducted about a decade ago.

Review of Literature and Conceptual Framework

Homeschooling grew from nearly nonexistent in the 1970s to roughly two million students in grades K to 12 by 2009 (Bielick, 2008; Ray, 2009a). Much of public opinion is positive toward this private educational practice. On the other hand, genuinely curious people and ideological skeptics continue to ask questions about home-based education. Research answers some of these key questions.

Concerns of Various Groups

Most children of about ages 6 through 17 have been placed in institutional schools with formally trained teachers and administrators for the past several generations. Homeschool parents, on the other hand, provide the majority of their children's academic and social and emotional instruction and training in and based out of their homes without sending their children away to a place called school. Therefore, policymakers, educators, school administrators, judges, and parents often wonder whether ordinary mothers and fathers, who are not government-certified teachers, are capable of effectively teaching and rearing their children after age five.

Academic Achievement

Is it possible for adults without specialized, university-level training in teaching to help their children learn what they need to learn? Numerous studies by dozens of researchers have been completed during the past 25 years that examine the academic achievement of the home-educated (see reviews, e.g., Ray, 2000, 2005; 2009b). Examples of these studies range from a multi-year study in Washington

State (Wartes, 1991), to other state-specific studies, to three nationwide studies across the United States (Ray, 1990, 1997, 2000; Rudner 1999), to two nationwide studies in Canada (Ray, 1994; Van Pelt, 2003). In most studies, the homeschooled have scored, on average, at the 65th to 80th percentile on standardized academic achievement tests, compared to the national school average of the 50th percentile (which is largely based on public schools). A few studies have found the home educated to be scoring about the same or a little better than public school students.

Researchers have examined relationships between several variables and homeschool students' achievement (e.g., Ray, 2000; Ray & Eagleson, 2008; Rudner, 1999). Examples are parent educational attainment, family income, race or ethnicity, number of years the child had been home educated, time spent in formal instruction, and degree of regulation of homeschooling by the state. A few of these variables (e.g., parent education level) are consistently associated with homeschool students' achievement, although the relationships are often relatively weak. Several variables studied to date show no or very little relationship to these students' achievement; examples of such variables are the degree of regulation (control) of homeschooling by the state and whether the parents have ever been state-certified teachers.

Social, Emotional, and Psychological Development

“What about socialization?” Homeschool parents call it the “S question.” Socialization questions are asked of nearly every homeschool parent, homeschool teenager, and adult who was home educated. One part of the “S question” asks whether homeschool children interact with other people outside their nuclear family members. Research shows that the large majority of home-educated students consistently interact with children of various ages and parents outside their immediate family (see, e.g., Medlin, 2000; Ray, 1997, 2009b).

The second part of the socialization question asks whether home-educated children will experience healthy social, emotional, and psychological development. Numerous studies, employing various psychological constructs and measures, show the home-educated are developing at least as well, and often better than, those who attend institutional schools (Medlin, 2000; Ray, 2009b). No research to date contravenes this general conclusion. In a few studies, on some of the sub-measures within a study, the home educated have scored slightly lower (i.e., “worse,” according to the conceptual paradigm the researcher was using) than those in institutional schools.

The “Real World” of Adulthood

A corollary of the socialization question deals with whether the home-educated child will eventually function well in the world of adulthood, in which one is responsible for getting along with others on one's own by not violating others' inalienable rights, obtaining one's own food, shelter, and clothing, and living a life that is “self-actualized,” noticeably autonomous in terms of critical thinking, or marked by some other worldview's preferred traits. Various studies have addressed this issue in multiple ways. It appears that the home educated are engaged, at least as much as are others, in activities that predict leadership in adulthood (Montgomery, 1989), doing well on their college/university SAT tests (Barber, 2001, personal communication) and ACT tests (ACT, 2005), matriculating in college at a rate that is comparable or a bit higher than for the general public (Ray, 2004; Van Pelt 2003), performing well in college (Gray, 1998; Galloway & Sutton, 1995; Jenkins, 1998; Jones & Gloeckner, 2004; Mexcur, 1993; Oliveira, Watson, & Sutton, 1994), satisfied that they were home educated (Knowles &

Muchmore, 1995; Ray, 2004; Van Pelt, Neven, & Allison, 2009), involved in community service at least as much as others (Ray, 2004; Van Pelt, Neven, & Allison, 2009), and more civically engaged than the general public (Ray, 2004; Van Pelt, Neven, & Allison, 2009). There is no research evidence that having been home educated is associated with negative behaviors or ineptitudes in adulthood.

Summary of Research Findings to Date on the Attributes of the Home Educated

More than two decades of research have shown that homeschooling – otherwise known as home-based education or home education – is associated with relatively high academic achievement, healthy social, psychological, and emotional development, and success into adulthood for those who were home educated (Galloway & Sutton, 1999; Ray, 2005). Conservatively speaking, one might say research “... simply shows that those parents choosing to make a commitment to home schooling are able to provide a very successful academic environment” (Rudner, 1999). Critics of homeschooling who emphasize the limitations of homeschool research claim, however, that research on the academic achievement of homeschool students can be used to reach “... very limited conclusions” (Reich, 2005, p. 115; see also, West, 2009). In another vein, Ray (2005, p. 11) stated it thus:

In other words, the design of most research to date does not allow for the conclusion that homeschooling necessarily causes higher academic achievement than does public (or private) institutional schooling. On the other hand, research designs and findings to date do not refute the hypothesis that homeschooling causes more positive effects than does institutional public (or private) schooling. Along these lines, Ray (2000b), after reviewing many studies on homeschooling and conducting several himself, gingerly wrote: “Assuming, for the sake of discussion and based on a multitude of studies, that home schooling is associated with high academic achievement (and possibly causes it), one could ask whether there is any link between the preceding list of positive factors and the nature of the educational ‘treatment’ known as home schooling” (p. 92).

In other words, research to date may not establish a cause-and-effect relationship between the practice of homeschooling and many positive attributes associated with homeschooling, but the research does allow for the possibility that home education causes desirable effects. Furthermore, this study should provide current information and analysis, and some of this may additionally plumb that potential causal connection.

Purpose of Study

The purpose of this nationwide cross-sectional, descriptive study (Johnson, 2001) is to examine the educational history, demographic features, and academic achievement of home-educated students and the basic demographics of their families, and to assess the relationships between the students’ academic achievement and selected student and family variables.

Significance of Study

The home-education population continues to grow (Bielick, 2008; Ray, 2009a) and the general public, parents, educators, policymakers, legal scholars, sociologists, and others are interested in those who comprise the population and the relative benefits or disadvantages, to children and society, of parent-led home-based education. The last nationwide study of significant size was done about a decade ago and people are curious about the current state of certain aspects of homeschooling. Further, this study

is designed to improve on some of the limitations of past studies (see, e.g., Welner & Welner, 1999) by attempting to include a broader sampling of families and students.

Methods

This is a nationwide cross-sectional, descriptive study (Johnson, 2001). This section provides descriptions of the survey instrument, achievement measures used, the testing services that provided data, and the procedures used to develop the dataset.

Definitions

Students were included in the study if a parent affirmed that his or her student was "... taught at home within the past twelve months by his/her parent for at least 51% of the time in the grade level now being tested." Definitions of terms that are not self-explanatory (e.g., degree of structure, structured learning time, and formal instruction) are provided in the "findings" section.

Background Survey

The background survey (questionnaire instrument) was designed by the researcher. The questions were determined by reviewing previous surveys designed and successfully used by Ray (1990, 1994, 1997, 2000) and then by Rudner (1999), prioritizing them, and selecting those that were most relevant to the objectives of the study. Current literature on home education and the objectives of this study were also considered in the development of the survey. Where possible, questions and responses were constructed to match those used by the U.S. Census, U.S. Department of Labor, and the National Assessment of Educational Progress (NAEP) to facilitate present or future comparisons of homeschool students with students nationwide.

The questionnaires used by Ray (1990, 1994, 1997, 2000) were designed by a cooperative effort of the researcher and others who had expertise in home education and survey research in the United States. The guidelines for conducting survey research delineated by Borg and Gall (1989) were followed for Ray's studies and for the present study. The present instrument was designed to answer the research questions for this study (and research questions for other studies related to home education that may be pursued at a later date). This instrument was reviewed and revised by persons who are familiar with home education (e.g., homeschool leaders and researchers) and consensus was reached on the validity of the items and their wording.

The survey was designed to be shorter than those in some previous survey instruments. An effort was made to pose all questions in an objective format, and most items were very similar or identical to those used by Rudner (1999).

The instrument was comprised of five parts that were (a) qualifiers, (b) student demographics, (c) parent and family demographics, (d) scholastic information, and (e) other information. The items were either select-type (or forced-choice) format or involved the respondent simply marking one of two or more categories. The instrument resulted in 85 variables per child/student being available for analysis. The online survey system also recorded the date and time of submission of the surveys. Recoding and the creation of additional variables (e.g., collapsing many item response categories into a few) for analysis was done later.

The instrument was electronically posted online for parents of the students to input responses and thus data were automatically input to a database for analysis by the investigator. Parents also had the option of requesting a paper copy (hard copy) of the questionnaire and for those who did, one was sent them via the U.S. Postal Service and then the parent mailed the survey to the researcher, after which the responses were input to the online survey venue.

A unique ten-digit Student ID (identification) Number was given to each student and this number was used to merge the student's background information with test-score data. A person could not complete and submit a survey more than once and have it be included in the study since the unique ID number would prevent this.

Measures of Academic Achievement

Academic achievement is considered to be the formal demonstration of learning (including knowledge, understanding, and thinking skills) attained by a student as measured by standardized academic achievement tests. For example, knowledge and ability in the areas of reading, language, and mathematics are included.

The author recognizes that there has been widespread debate for decades about the best way to measure academic achievement and how to use scores on tests (e.g., Cizek, 1988, 1993, 2001; Hardenbergh, 2008). Further, the author recognizes that within the homeschool community certain subpopulations might be less inclined to use standardized achievement tests than others. At the same time, standardized academic achievement tests have been widely used and well-regarded by the education profession and society-at-large for many decades. Standardized academic achievement tests were used to measure learning in this study.

The standardized academic achievement tests most used in this study were the Iowa Tests of Basic Skills (ITBS, Form A) and California Achievement Tests (CAT). The ITBS is published by Riverside Publishing Company. The tests were designed and developed by University of Iowa professors to measure skills and standards important to growth across the curriculum in the nation's public and private schools. The ITBS reflects many years of test development experience and research on measuring achievement and critical thinking skills in reading, language arts, mathematics, science, social studies, and information sources. The testing services (see below) using this test used the 2005 norms. Some of the homeschool students took California Achievement Tests (CAT), Fifth Edition (CAT/5), published by CTB/McGraw-Hill. The CAT likewise has a long history of development and use in the United States for use by both public and private schools. Both the ITBS and CAT are considered valid and reliable instruments, as are the other tests (e.g., Stanford Achievement Test) used in this study.

Testing Services

Several organizations in the United States provide assessment (testing) services to homeschool families and their students on a fee-for-service basis. Several of these cooperated with the researcher in the present study to gather achievement test and demographic data on the students. Rudner (1999) worked with one such large testing service, BJU Press. For the present study, four major testing services plus several smaller ones were contacted to help with the study. It was theorized that using several testing services would provide a wider variety of homeschool students and therefore data from

a more robust and representative sample of the homeschool population for the purposes of analysis (see, e.g., Welner & Welner, 1999).

In the Spring of 2008, homeschool students who were contracted to take tests via these testing services were given an achievement test and their parents were asked to complete a questionnaire, either online or a paper copy (that they would then mail to the researcher; further explained below).

Four major testing services and several smaller ones assisted in the study. BJU Press (Greenville, South Carolina, www.bjupress.com) began offering achievement testing in 1984. Both homeschool families and private schools use their services. Second, Family Learning Organization (Mead, Washington, www.familylearning.org) has provided testing services for many years. Third, Piedmont Education Services (Pfaftown, North Carolina, www.pesdirect.com, 2009) was founded in 1987 and offers many services to homeschool families. The fourth is Seton Testing Services, which is a function of Seton Home School Study that was founded in 1980 and grew out of parent-operated Catholic schools (in Manassas, Virginia, www.setonhome.org; Seton Home Study School, 2008).

Smaller testing services that were used for the study were Basic Skills Assessment and Educational Services (Oregon City, Oregon), Circle Christian School (Orlando, Florida), Covenant Home School Resource Center (Phoenix, Arizona), Idaho Coalition of Home Educators (Eagle, Idaho), and Whatcom Home School Association (Bellingham, Washington). Additionally, the several nationwide and statewide homeschool organizations that also worked closely with the researcher to contact homeschool families were Education Network of Christian Homeschoolers of New Jersey (Atlantic Highlands, New Jersey), Home School Legal Defense Association (Purcellville, Virginia), Homeschoolers of Maine (Camden, Maine), Massachusetts Homeschool Organization of Parent Educators (Holden, Massachusetts), NYS Loving Education at Home (Fayetteville, New York), and Oregon Christian Home Education Association Network (Portland, Oregon).

Data-Generation Procedures

The following steps were followed with testing services to produce data:

1. Parents contracted with the testing services to have tests administered to their children/students.
2. The testing services certified test administrators, some of whom were the students' parents.
3. The testing services sent tests, answer forms, and a letter explaining how parents could access and complete the questionnaire to the test administrators.
4. Tests were returned to the testing services who then scored them or sent them to the test publishers for scoring. Unlike in most preceding studies, the large majority of parents (i.e., the parents of 69.4% of the 11,739 students included in the study) did not know their students' scores ahead of time; that is, before completing the questionnaire and thus participating in the study.
5. Electronic copy of the test results and survey questionnaire results were sent from the testing services and the online survey administrator to the researcher. These data sets were merged to provide 11,739 cases with matching identification numbers (i.e., there were usable test score for 11,739 students for whom parents completed a survey).

Parents who did not have access to the Internet or preferred to complete a print (hard) copy of the

survey instrument requested one and it was mailed to them. They then mailed in the completed survey to the researcher for online data entry.

Reminders to participate in the study were e-mailed to the large majority of parents whose children were tested. For some of the testing services, postcards were sent via the U.S. postal service. Most parents received a second reminder. One of the four largest testing services did not send out reminders to parents.

The following steps were followed by the statewide and nationwide homeschool organization to produce data:

1. The organization notified its constituents of the study via e-mail or postal mail.
2. Parents were asked to complete the survey and mail copies of their students' test scores to the organization, with instructions on how to create Student ID Numbers to use for the survey and the test forms.
3. The organization sent a data set of test scores to the researcher to be merged with the survey data.

Several of the test administrators to whom tests were sent administered the tests to groups of students. It was estimated that about 90% of these large-group testers did not respond to the invitation to participate in the study and did not invite parents to participate in the study; there was no sure way to validate how many students were represented by the group testers who did not participate in the study.

Population and Sample

The target population was all families in the United States who were educating their school-age children at home and having standardized achievement tests administered to their children. An attempt was made to utilize a sample that was more representative than those studied by Ray (1990, 1997, 2000) and Rudner (1999). Ray's (1990) sample was drawn only from the membership of one large nationwide home education organization. Ray's (1997, 2000) sample drew from the same large membership organization and from many other organizations and those on other lists were asked to participate. Rudner's (1999) sample was large and well-controlled, but it was from only one testing service and possessed what some thought to be notable limitations (c.f., Welner & Welner, 1999). The present study attempted to improve on the samples used in the three preceding mentioned nationwide studies. This was done by using numerous testing services to provide contacts with and test-score data from potential homeschool family and student participants. The researcher began with four notably large testing services that work with families nationwide, and then included a few more smaller testing services in the study. The expectation was this approach would provide a more robust sampling by utilizing several testing services from across the nation.

A total of 11,739 students provided useable questionnaires with corresponding achievement tests. The achievement test and questionnaire results were combined to form the dataset used in this analysis.

It was very challenging to calculate the response rate. One of the main problems was that, well into the study, it was discovered that many of the large-group test administrators were not communicating to their constituent homeschool families that they had been invited to participate in the study. Based on

the best evidence available, the response rate was a minimum of 19% for the four main testing services with whom the study was originally planned, who worked fairly hard to get a good response from the homeschool families, and whose students accounted for 71.5% ($n = 8,397$) of the participants in the study. That is, of the students who were tested and whose parents were invited to participate in the study, both test scores and survey responses were received for this group. It is possible that the response rate was higher, perhaps as much as 25% for these four testing services. For the other testing services and sources of data, the response rate was notably lower, at an estimated 11.0%. These testing services and other sources of test data used a less-concentrated approach to soliciting participation and following-up with reminders to secure participation. The response rate for this study comparable to what many experience in this type of social science research (Fowler, 1988). On the other hand, the response rate in this study is lower than in many social science studies.

Pilot Study

No pilot study was done in the present study for the following reasons: (a) a pilot study was done in Ray's (1990, 1994) nationwide United States and Canada studies which were very similar to this study, (b) Ray's (1997, 2000) and Rudner's (1999) studies practically served as pilot studies to the present study, (c) similar instruments and research designs had been used by the researcher and others in previous studies on home education (Ray, 1990, 1994, 1995, 1997, 2000; Rudner, 1999), and (d) there was no reason to predict that this study would pose significant differences in terms of how home educators would respond to the requests made of them in this study.

Data Analysis and Statistical Hypotheses

The statistical software SPSS (SPSS, 2007) was used for data analysis. Students' scores on tests were handled in the following manner. Percentile equivalents were converted to z-scores (Hopkins, Glass, & Hopkins, 1987, Appendix Table A; see also the Appendix in this report). Means were calculated and statistical tests were performed using z-scores.

Converting percentile equivalents to a standard score (e.g., normal curve equivalent, NCE; z-score) before statistical analysis is the proper method (Loveless, 2002; Tallmadge & Wood, 1978; Yin, Schmidt, & Besag, 2006). Using students' scores on a variety of nationally normed standardized achievement tests in one study is a robust approach to measuring academic achievement of groups of students (Tallmadge & Wood, 1978; Tallmadge & Wood, 1978, e.g., p. 16, 19-21; Wechsler, 1991, e.g., p. 208-209), although some suggest it would be ideal to use only one test for a project such as this. Using a variety of standardized tests has been done before in research on home-educated students (e.g., Ray, 1990, 1994, 1997, 2000; Van Pelt, 2003) and thus this approach allows for a reasonable level of comparability to findings in previous studies. Further, student performance on major commercial standardized achievement tests is likely highly correlated (e.g., Horst, Tallmadge, & Wood, 1974, p. 29-30). In this study, z-scores were used because they provided the most reasonable way to aggregate scores from many students using a variety of tests, and to analyze how those scores compared to standardized test norms and to each other.

It is not assumed in this study that scores on different tests mean, necessarily, the same thing about the students who took them (Gronlund & Linn, 1990), nor is it assumed that students in this study are perfectly analogous to those students represented by norms for the standardized tests that these students took. It is assumed, however, that the use of aggregated scores from a variety of standardized

achievement tests is an acceptable practice and provides valuable information (Frisbie, 1992; Hunter & Schmidt, 1990, p. 516-518; and previous references).

In many cases, simple descriptive statistics and frequencies were appropriate and reported. A number of hypotheses related to the research questions were tested. The hypothesis tested in all cases was the null hypothesis. For example, in testing correlations, the hypothesis was that there was no relationship between the variables. In comparing groups, the hypothesis was that there was no difference between the groups.

Alpha was set at 0.01 for statistical tests in this study and for the sake of determining when to call a relationship statistically “significant” in the narrative. However, p-values are reported so that the reader can make his or her own determination of what is significant. Alpha is the “. . . level of significance used to decide whether to accept or reject a [statistical] null hypothesis. . .” (Borg & Gall, 1989, p. 352). Alpha was set at 0.01 for several reasons. First, this level of alpha (rather than .05 or .10, for example) helps to take into account multiple error rate (Good, 1984). Second, this approach was consistent with prior research (Ray, 1990, 1994, 1997, 2000). Finally, this level of alpha helps reduce the probability of Type I error in this situation where the rejection of a true null hypothesis might involve potential harm to people like those involved in the study (Shavelson, 1988, p. 286). For example, concluding that there is a statistically significant (or practically significant) relationship between parents’ teacher certification status and children’s academic achievement, when in fact there is none, could do harm to family integrity and children’s learning in terms of subsequent policy decisions related to home education.

Findings

Several selected findings from the data are presented here. Although 11,739 homeschool students were included in the analysis, the total in any given table may differ from the 11,739 students involved in the study because of missing data (e.g., no response) about the students.

Characteristics of Homeschool Students and Families

The homeschool students in the study lived in all 50 states and 2 territories (Guam, Puerto Rico); none were from the District of Columbia.

Regarding gender, 50.3% (5,872) of the students were male and 49.7% (5,809) were female.

Age

Table 1 shows the ages of the home-educated students in the study at the time of achievement testing. About 56% were ages 9 through 13.

Table 1

Participating Homeschool Students Classified by Age

Age	Frequency	%
5	95	.8

6	334	2.9
7	754	6.4
8	1066	9.1
9	1324	11.3
10	1328	11.3
11	1420	12.1
12	1337	11.4
13	1209	10.3
14	1106	9.5
15	826	7.1
16	551	4.7
17	280	2.4
18	72	.6
Total	11702	100.0

Note 1. The total in any given table may differ from the 11,739 students involved in the study because of missing data (e.g., no response) about the students.

Grade Level

Table 2 shows the grade levels of the homeschool students. Compared to students in public schools nationwide, the distribution of homeschool students in this study is somewhat positively skewed; a disproportionately high portion of them are in grades 3 through 8.

Table 2

Grade Level Completed by Spring 2008

Grade Level	Frequency	Percent of Sample	Nationwide Public Schools, Percent of Students ^a
K	224	1.9	9.54
1	614	5.3	7.56
2	865	7.4	7.39
3	1359	11.7	7.35
4	1255	10.8	7.33
5	1469	12.6	7.45
6	1339	11.5	7.52
7	1208	10.4	7.74
8	1195	10.3	7.79
9	909	7.8	8.79
10	679	5.8	7.92
11	367	3.2	7.08
12	141	1.2	6.52
Total	11624	100.0	99.98 ^b

a. National data for public schools in 2005: 3/31/09

from http://www.census.gov/compendia/statab/cats/education/elementary_and_secondary_education_s
data from <http://www.census.gov/compendia/statab/tables/09s0233.xls>

b. Total not 100 due to rounding.

Race/Ethnicity

Table 3 displays the racial/ethnic distribution of the home-educated students.

Table 3

Racial/Ethnic Distribution of Homeschool Students, in Percents

	Frequency	Percent of Sample	Nationwide ^a
White/not-Hispanic	10718	91.7	57.24
Hispanic or Latino	260	2.2	19.43
Black	137	1.2	15.22
Asian	173	1.5	3.95
American Indian or Alaskan Native	53	.5	1.16
Native Hawaiian or Pacific Islander	19	.2	.20
Other	329	2.8	2.78
Total	11689	100.0	99.98 ^b

a. National data for race/ethnicity in 2007: The 2009 Statistical Abstract, Table 8, retrieved 3/31/09 from http://www.census.gov/compendia/statab/cats/population/estimates_and_projections_by_age_sex data downloaded 3-31-09 from <http://www.census.gov/compendia/statab/tables/09s0008.xls>

b. Total not 100 due to rounding.

Marital Status of Parents

Table 4 shows the marital status of the students' parents; 97.9% of the students' homes are headed by a married couple. Nationwide, in families with children under age 18, 71.2% are headed by a married couple .

Table 4

Homeschool Students Classified by Parents' Marital Status

Marital Status	Frequency	Percent
Married	11475	97.9
Separated	44	.4
Divorced	137	1.2
Widowed	34	.3
Single	34	.3
Total	11724	100.0

Children at Home

Table 5 shows how many children aged 21 and under live in each student's home. Some 6.6% of the households have one child, 25.3% have 2 children, and 68.1% have three or more children. These homeschool families had an average of 3.5 children age 21 or under. In all families across the United States with children under age 18, 42.6% have one child, 35.6% have two children, and 19.8% have three or more children, with an average of about 2.0 (U.S. Census Bureau, 2009, Table 63).

Table 5

Homeschool Families Classified by Family Size

Number of Children ^a	Frequency	Percent
1	771	6.6
2	2945	25.3
3	3028	26.0
4	2349	20.2
5	1138	9.8

6	682	5.9
7	336	2.9
8	191	1.6
9	99	.9
10 or more children	108	.9
Total	11647	100.0

a. Number of children age 21 or under in home.

Father's and Mother's Religion

Table 6 displays the religion of the students' fathers and mothers.

Table 6

Homeschool Students Classified by Father's and Mother's Religion

Religion	Fathers, % ^a	Mothers, % ^a
Adventist, Seventh-Day	.4	.5
Assembly of God	2.6	2.6
Atheist or Agnostic	1.1	.5
Baptist	22.5	22.8
Buddhist	.1	.1
Catholic, Roman	12.4	12.6
Eastern Orthodox	.2	.2

Episcopal	.6	.6
Independent Charismatic	3.0	3.2
Independent Fundamental/Evangelical	16.5	16.6
Jehovah's Witness	.2	.2
Jewish	.4	.3
Lutheran	2.3	2.1
Mennonite	.4	.5
Methodist	1.9	1.9
Mormon	.8	.8
Muslim	.1	.0
Nazarene	1.0	1.1
New Age	.0	.0
Other	2.1	1.5
Other Christian	16.9	17.0
Other Eastern religion	.0	.0
Other Protestant	3.4	3.4
Pagan	.1	.2
Pentecostal	2.3	2.5
Presbyterian	3.8	3.9

Reformed	4.8	4.8
Total	100.00	100.0

a. Fathers, n = 11,498; mothers, n = 11,680.

Parents' Academic Attainment

Table 7 shows the formal academic or educational attainment of the students' fathers and mothers. Some 66.3% of the students' fathers had attained a bachelor's degree (i.e., a four-year degree) or higher. In 2007, 85.0% of all males aged 25 years and older nationwide had finished high school (ergo, 15.0% had not) and 29.5% had finished college (a bachelor's degree or higher) (U.S. Census Bureau, 2007, Table 1). Of the homeschool students' mothers, 62.5% had finished a bachelor's degree or higher. In 2007, 86.4% of all females nationwide ages 25 years nationwide and over had finished high school or higher (so 13.6% had not) and 28.0% of females had finished a bachelor's degree or higher (U.S. Census Bureau, 2007, Table 1).

Table 7

Educational Attainment of Fathers and Mothers

Academic Attainment Level	Fathers, % ^a	Mothers, % ^a
Did Not Finish High School	1.4	.5
Graduated from High School	8.4	7.5
Some College Education	15.4	18.7
Associate's Degree	8.6	10.8
Bachelor's Degree	37.6	48.4
Master's Degree	20.0	11.6
Doctorate Degree	8.7	2.5
Total	100.0	100.0

a. Fathers, n = 11,565; mothers, n = 11,715.

Family Income

The median family income was \$75,000 to \$79,999, while 4.8% of the families had an income of \$29,999 or less. Table 8 shows incomes of the students' families. For comparison, in 2006 in married-couple families with one or more related children under age 18, the median nationwide income was \$74,049 (in 2006 dollars; or roughly \$79,015 in 2008 dollars, Westegg.com, 2009) (U.S. Census Bureau, 2009, Table 678).

Table 8

Distribution of Family Income for Homeschool Families

Income Category	Frequency	Percent
Less than \$10,000	45	.4
\$10,000-\$14,999	62	.5
\$15,000-\$19,999	105	.9
\$20,000-\$24,999	151	1.3
\$25,000-\$29,999	197	1.7
\$30,000-\$34,999	390	3.4
\$35,000-\$39,999	392	3.5
\$40,000-\$44,999	496	4.4
\$45,000-\$49,999	564	5.0
\$50,000-\$54,999	728	6.4
\$55,000-\$59,999	536	4.7
\$60,000-\$64,999	690	6.1
\$65,000-\$69,999	542	4.8

\$70,000-\$74,999	662	5.8
\$75,000-\$79,999	562	5.0
\$80,000-\$84,999	534	4.7
\$85,000-\$89,999	473	4.2
\$90,000-\$94,999	430	3.8
\$95,000-\$99,999	545	4.8
\$100,000-\$149,999	2212	19.5
\$150,000 or more	1009	8.9
Total	11325	100.0

Computer Use

A large majority of the homeschool students, 98.3% (n = 11,499; and 1.7% do not), have a computer at home that they use. By comparison, 82% of school children nationwide whose parents held a bachelor's degree were using a computer at home and 84% of the same were using a computer at school in 2003 (i.e., children in nursery school and students in grades K-12 whose parents' educational attainment was a bachelor's degree; DeBell & Chapman, 2006).

Money Spent on Educational Materials

Table 9 shows the amount of money spent on homeschool education per student for one year. The median amount spent per this one year on the student's education for textbooks, lesson materials, tutoring, enrichment services, testing, counseling, evaluation, and so forth is \$400 to \$599.

Table 9

Homeschool Students Classified by Money Spent On Homeschool Education in 2007-2008

Amount Spent	Frequency	Percent
Less than \$200	1314	11.2

\$200-\$399	2816	24.1
\$400-\$599	2273	19.4
\$600-\$799	1268	10.8
\$800-\$999	878	7.5
\$1,000-\$1,199	1122	9.6
\$1,200-\$1,399	492	4.2
\$1,400-\$1,599	468	4.0
\$1,600-\$1,799	170	1.5
\$1,800-\$1,999	137	1.2
\$2,000 or more	754	6.4
Total	11692	100.0

Other Demographic Characteristics

Some 80.6% of homeschool mothers do not work for pay. Of the 19.4% who do work for pay, about 84.8% do so part time. Of the homeschool fathers, 97.6% work for pay, and 98.3% of these work full-time.

Of the students' 23,182 parents, 89.4% had never been certified teachers. Some 15.8% of the homeschool mothers (n = 11,668) had ever been certified teachers; 5.3% of fathers (n = 11,514) had ever been certified.

Only 10.2% of the respondents were enrolled in a full-service curriculum program (i.e., a program that serves students and their parents as a "one-stop" primary source for textbooks, materials, lesson plans, tests, counseling, evaluations, record-keeping, and the like for the year's core required subjects such as language, social studies, mathematics, and science).

Achievement Tests Used

Table 10 shows that the Iowa Test of Basic Skills (for 45.5% of students) and California Achievement Test (44.2%) accounted for a total of 89.7% of the scores used in the study.

Table 10

Academic Achievement Tests Used by Homeschool Students

Name of Test	Frequency	Percent
California Achievement Test	5189	44.2
Comprehensive Test of Basic Skills	2	.0
Iowa Tests of Basic Skills	5333	45.5
Metropolitan Achievement Test	1	.0
Stanford Achievement Test	959	8.2
Terra Nova	83	.7
Test of Achievement and Proficiency	7	.1
Woodcock Johnson	15	.1
Other	138	1.2
Total	11727	100.0

Academic Achievement

Following are descriptive statistics about the homeschool students' academic achievement. Then the relationship between several selected variables and achievement are explored in this section.

Overall Achievement

Table 11 shows the mean z-scores for home-educated students on the Reading Total, Language Total, Mathematics Total (with computation), Science, Social Studies, Core (with computation), and Composite (with computation) subtest scores. Core is comprised of combination of a student's Reading, Language, and Mathematics scores. Composite is a combination of all subtests that the student took on the test. The corresponding percentiles shown in the table are the within-grade percentile scores for the nation that correspond to the given z-scores. By definition, the 50th percentile is the mean for all students nationwide (last column).

Table 11

Mean z-Scores and Corresponding National Percentile by Subtest for Homeschool Students

Subtest	N	Mean z-score ^a	Standard Deviation, z-score	Homeschool National Percentile Mean	National Percentile Mean
Reading Total	11586	1.2185	0.7869	89	50
Language Total	11388	0.9944	0.8502	84	50
Math Total	11587	0.9986	0.8539	84	50
Science	6929	1.0630	0.7683	86	50
Social Studies	6906	1.0124	0.8107	84	50
Core	10760	1.1591	0.8018	88	50
Composite	5811	1.1079	0.7604	86	50

a. Following are a few z-score/percentile equivalents: $-0.67 = 25^{\text{th}}$ percentile; $0.00 = 50^{\text{th}}$ percentile; $0.67 = 75^{\text{th}}$ percentile; $1.00 = 84^{\text{th}}$ percentile.

Whether Parents Knew Scores Before Participating in Study

An analysis of variance (ANOVA) shows that students whose parents knew their scores before participating in the study (27.7% of students) performed no better on the tests than students whose parents did not know their scores before participating ($F=.06$; $df=1,10367$; $p=.812$, n.s.; scores known, mean=1.1588; scores not known, mean 1.1630).

It should be noted that all F ratios reported here are from an ANOVA with core z-scores as the dependent measure, and typically two independent variables (including grade level). To assure adequate cell sizes, the analyses were restricted to Grades 1 through 11. A statistically significant difference only means that there is evidence of a difference in population values. The difference may be small and not meaningful in a practical sense. Also, "n.s." is used to indicate not significant.

Years of Homeschooling

Table 12

Core z-Score Mean, Standard Deviation and Corresponding Percentile by Number of Grades Homeschooled and Grade

Homeschooled entire academic life?	Mean	Std. Deviation	N
Yes	1.1540	.79617	6168
No	1.1678	.80849	4259
Total	1.1596	.80122	10427

ANOVA – Whether homeschooled all academic life by grade

Dependent Variable: Core Z

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	75.422 ^a	21	3.592	5.647	.000	.011
Intercept	10576.460	1	10576.460	16629.809	.000	.615
grade	51.857	10	5.186	8.154	.000	.008
Homeall	.495	1	.495	.778	.378	.000
grade * homeall	16.278	10	1.628	2.559	.004	.002
Error	6617.518	10405	.636			
Total	20714.325	10427				
Corrected Total	6692.940	10426				

a. R Squared = .011 (Adjusted R Squared = .009)

Enrolled in a Full-Service Curriculum

There is no significant difference in the mean core z-scores of home-educated students enrolled in a full-service curriculum and home-educated students not so enrolled ($F=1.11$; $df=1,10399$; $p=.292$, n.s.) (Table 13). The pairs of means are quite similar at all grade levels; there is no significant interaction between enrollment in a full-service curriculum and grade level ($F=1.56$, $df=10,10399$; $p=.111$, n.s.).

Table 13

Core z-Score Mean, Standard Deviation and Corresponding Percentile by Full-service Curriculum Status and Grade

Descriptive Statistics

Dependent Variable: Core Z

Enrolled in "full-service curriculum program"	Mean	Std. Deviation	N
Total	1.3249	.74873	337
Yes	1.2075	.78581	1055
No	1.1541	.80279	9366
Total	1.1595	.80121	10421

ANOVA – Whether enrolled in a full-service curriculum by grade

Dependent Variable: Core Z

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	71.070 ^a	21	3.384	5.318	.000	.011
Intercept	4523.180	1	4523.180	7107.450	.000	.406
Grade	16.749	10	1.675	2.632	.003	.003
fullcurric	.707	1	.707	1.111	.292	.000
grade * fullcurric	9.950	10	.995	1.564	.111	.002
Error	6617.921	10399	.636			
Total	20698.500	10421				
Corrected Total	6688.991	10420				

a. R Squared = .011 (Adjusted R Squared = .009)

Student Gender

There are statistically significant differences in the achievement levels of male versus female homeschool students ($F_{\text{gender}}=13.88$; $df=1,10352$; $p<.001$), but the difference (i.e., females outperforming males) is very slight with gender explaining only one-tenth of 1% of the variance in scores (i.e., see the partial eta squared). The means are very similar at all grade levels; there is no significant interaction between gender and grade level ($F=1.23$, $df=10,10352$; $p=.264$, n.s.) (Table 14).

Table 14
Core z-Score Mean, Standard Deviation and Corresponding Percentile by Grade and Gender

Descriptive Statistics

Dependent Variable: Core

Z

Gender	Mean	Std. Deviation	N
Male	1.1217	.80803	5244
Female	1.1985	.79308	5130
Total	1.1597	.80155	10374

ANOVA – Gender by grade

Dependent Variable: Core Z

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	81.695 ^a	21	3.890	6.118	.000	.012
Intercept	11699.270	1	11699.270	18398.080	.000	.640
grade	59.450	10	5.945	9.349	.000	.009
gender	8.828	1	8.828	13.882	.000	.001
grade * gender	7.840	10	.784	1.233	.264	.001
Error	6582.798	10352	.636			
Total	20615.675	10374				
Corrected Total	6664.493	10373				

a. R Squared = .012 (Adjusted R Squared = .010)

Money Spent on Educational Materials

There is a statistically significant difference in the achievement levels of homeschool students depending on the amount of money spent per child on educational materials including textbooks, lesson materials, tutoring, enrichment services, testing, counseling, and evaluation (see Table 15). At nearly every grade level, if the family spends \$600 or more on the student, the student outperforms students for whom less is spent ($F_{\text{money spent}}=18.17$; $df=3, 10345$; $p < .001$). It should be noted, however, that the amount spent is related to a very small effect size and explains only one-half of 1% of the variance in scores. There is no significant interaction between amount spent and grade level ($F=1.413$, $df=30,10345$; $p=.067$, n.s.).

Table 15

Core z-Score Mean, Standard Deviation and Corresponding Percentile by Money Spent on Educational Materials per Student and Grade

Descriptive Statistics

Dependent Variable: Core Z

Money Spent	Mean	Std. Deviation	N
\$199 or less	1.0484	.82644	1118
\$200 - \$399	1.0830	.80055	2490
\$400 - \$599	1.1508	.79626	2021
\$600 or more	1.2298	.79089	4760
Total	1.1597	.80116	10389

ANOVA – Amount of money spent on home education by grade

Dependent Variable: Core Z

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	130.924 ^a	43	3.045	4.819	.000	.020
Intercept	8501.830	1	8501.830	13454.968	.000	.565
grade	45.946	10	4.595	7.271	.000	.007
costchildcat	34.442	3	11.481	18.169	.000	.005
grade * costchildcat	26.789	30	.893	1.413	.067	.004
Error	6536.726	10345	.632			
Total	20640.338	10389				
Corrected Total	6667.650	10388				

a. R Squared = .020 (Adjusted R Squared = .016)

Family Income

There is a statistically significant difference in the achievement of homeschool students based on family income. As shown in Table 16 students in higher income families consistently have higher mean core z-scores ($F=25.15$; $df=3,10011$; $p<.001$). The effect is small, practically speaking, with income explaining only about one-half of 1% of the variance in test scores. There is also a significant interaction of income and grade ($F =1.50$; $df=30,10011$; $p=.038$), but this interaction is minimal and explains just under one-half of 1% of the variance in scores.

Table 16

Core z-Score Mean, Standard Deviation and Corresponding Percentile by Family Income and Student Grade

Descriptive Statistics

Dependent Variable: Core Z

Income Category	Mean	Std. Deviation	N
\$34,999 or less	1.0223	.82357	852
\$35,000 - \$49,999	1.0817	.81586	1258
\$50,000 - \$69,999	1.0897	.77812	2221
\$70,000 or more	1.2206	.79669	5724
Total	1.1575	.80073	10055

ANOVA – Family income by grade

Dependent Variable: Core Z

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	145.761 ^a	43	3.390	5.386	.000	.023
Intercept	6437.775	1	6437.775	10228.973	.000	.505
Grade	27.030	10	2.703	4.295	.000	.004
incomecat	47.490	3	15.830	25.152	.000	.007
grade * incomecat	28.371	30	.946	1.503	.038	.004
Error	6300.590	10011	.629			
Total	19918.977	10055				
Corrected Total	6446.351	10054				

a. R Squared = .023 (Adjusted R Squared = .018)

Parent Certification as a Teacher

To determine whether there is a difference in achievement for students in households where at least one parent had ever held a state-issued teaching certificate, parent education level was controlled. As shown in Table 17, the achievement levels across groups are remarkably similar. Controlling for parent education level, there is a significant difference in the achievement levels of homeschool students whose parents are certified and those that are not ($F=11.155$; $df=11,10141$; $p=.001$); the students having neither parent ever certified performed slightly better. Although statistically significant, whether either parent has ever been a certified teacher explains

less than one-tenth of 1% of the variance in test scores. There is no significant interaction of parent certification status and grade ($F = .274$; $df=10,10141$; $p=.987$, n.s.).

Table 17

Core Scale Score Mean, Standard Deviation and Corresponding Percentile by Parent Teaching Certificate and Student Grade

Descriptive Statistics

Dependent Variable: Core Z

Either parent ever certified?	Mean	Std. Deviation	N
Yes	1.1734	.79955	1967
No	1.1596	.79914	8197
Total	1.1623	.79920	10164

Controlling for parent’s education level, Core z-score means:

Either parent ever certified?	Mean	Std. Error
Yes	1.125 ^a	.020
No	1.200 ^a	.010

a. Covariates appearing in the model are evaluated at the following values: Parents' education levels in three categories = 2.30.

ANOVA – Whether either parent ever a certified teacher

Dependent Variable: Core Z

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	6.843	1	6.843	11.155	.001	.001
Error	6220.410	10141	.613			

The F tests the effect of Either parent ever certified to teach?. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Parent Education Levels

Research consistently shows obvious differences in the performance levels of public school students nationwide as a function of parent’s educational level (Rudner, 1999). Differences by parent education level also appear in the performance levels of home-educated students (Table 18). At every grade level, homeschool children whose parents are both college graduates outperform children whose parents both do not have a college degree ($F=132.36$; $df=2,10215$; $p<.001$). There is also a significant interaction between grade and parent education ($F=1.995$;

df=20, 10215; $p < .005$), indicating that the effect of parent education is more pronounced in some grades. It is notable, however, that parents' education level explains only 2.5% of the variance in the scores and, at every grade level, the mean performance of homeschool students whose parents (both, if two) do not have a college degree is higher than the mean performance of students in public schools; their percentiles are at the 80th percentile or above.

Table 18
Core z-Score Mean and Standard Deviation by Parent Education and Student Grade

Descriptive Statistics

Dependent Variable:
Core Z

Parents' Education Levels	Mean	Std. Deviation	N
Neither parent has a college degree	.9535	.81969	2199
One parent has a college degree	1.0940	.79162	2821
Both parents have a college degree	1.2877	.77253	5228
Total	1.1627	.79980	10248

ANOVA – Parents' education levels by grade

Dependent Variable: Core Z

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	291.499 ^a	32	9.109	14.857	.000	.044
Intercept	9094.584	1	9094.584	14832.586	.000	.592
Grade	56.959	10	5.696	9.290	.000	.009
Edparents	162.318	2	81.159	132.364	.000	.025

grade * edparents	24.466	20	1.223	1.995	.005	.004
Error	6263.316	10215	.613			
Total	20408.445	10248				
Corrected Total	6554.816	10247				

a. R Squared = .044 (Adjusted R Squared = .041)

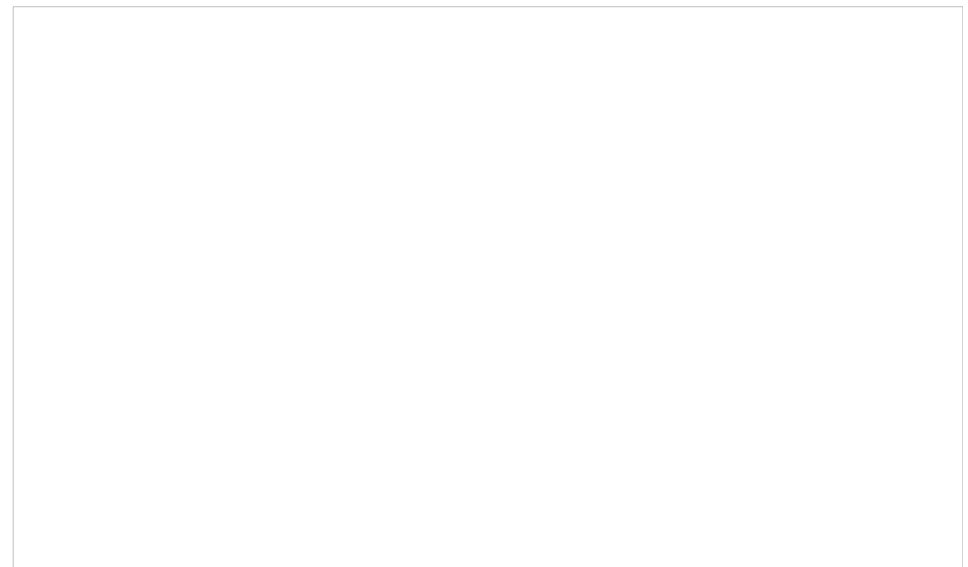
Over half of the respondents (59%) indicated that they had been home educated for every grade prior to their current grade, that is, their entire academic life. Table 12 shows that students who are homeschooled for their entire academic life perform the same as those students who have been home educated for only some of their academic years ($F=.78$; $df=1,10405$; $p=.378$, n.s.). There is a statistically significant interaction between grade and years homeschooled ($F =2.56$; $df=10,10405$, $p=.004$), indicating that the effectiveness of homeschooling varies with the student's grade, but this interaction is minimal and explains only two-tenths of 1% of the variance in scores.

Enrolled in a Full-Service Curriculum

There is no significant difference in the mean core z-scores of home-educated students enrolled in a full-service curriculum and home-educated students not so enrolled ($F=1.11$.; $df=1,10399$; $p=.292$, n.s.) (Table 13). The pairs of means are quite similar at all grade levels; there is no significant interaction between enrollment in a full-service curriculum and grade level ($F =1.56$, $df=10,10399$; $p=.111$, n.s.).

Student Gender

There are statistically significant differences in the achievement levels of male versus female homeschool students ($F_{gender}=13.88$; $df=1,10352$; $p<.001$), but the difference (i.e., females outperforming males) is very slight with gender explaining only one-tenth of 1% of the variance in scores (i.e., see the partial eta squared). The means are very similar at all grade levels; there is no significant interaction between gender and grade level ($F =1.23$, $df=10,10352$; $p=.264$,



n.s.) (Table 14).

Money Spent on Educational Materials

There is a statistically significant difference in the achievement levels of homeschool students depending on the amount of money spent per child on educational materials including textbooks, lesson materials, tutoring, enrichment services, testing, counseling, and evaluation (see Table 15). At nearly every grade level, if the family spends \$600 or more on the student, the student outperforms students for whom less is spent (F money spent=18.17; $df=3, 10345$; $p < .001$). It should be noted, however, that the amount spent is related to a very small effect size and explains only one-half of 1% of the variance in scores. There is no significant interaction between amount spent and grade level ($F = 1.413$, $df=30, 10345$; $p = .067$, n.s.).

Family Income

There is a statistically significant difference in the achievement of homeschool students based on family income. As shown in Table 16 students in higher income families consistently have higher mean core z-scores ($F=25.15$; $df=3, 10011$; $p < .001$). The effect is small, practically

speaking, with income explaining only about one-half of 1% of the variance in test scores. There is also a significant interaction of income and grade ($F = 1.50$; $df = 30, 10011$; $p = .038$), but this interaction is minimal and explains just under one-half of 1% of the variance in scores.

Parent Certification as a Teacher

To determine whether there is a difference in achievement for students in households where at least one parent had ever held a state-issued teaching certificate, parent education level was controlled. As shown in Table 17, the achievement levels across groups are remarkably similar. Controlling for parent education level, there is a significant difference in the achievement levels of homeschool students whose parents are certified and those that are not ($F = 11.155$; $df = 11, 10141$; $p = .001$); the students having neither parent ever certified performed slightly better. Although statistically significant, whether either parent has ever been a certified teacher explains less than one-tenth of 1% of the variance in test scores. There is no significant interaction of parent certification status and grade ($F = .274$; $df = 10, 10141$; $p = .987$, n.s.).

Parent Education Levels

Research consistently shows obvious differences in the performance levels of public school students nationwide as a function of parent's educational level (Rudner, 1999).

Differences by parent education level also appear in the performance levels of home-educated students (Table 18).

At every grade level, homeschool children whose parents are both college graduates outperform children whose parents both do not have a college degree ($F=132.36$; $df=2,10215$; $p<.001$). There is also a significant interaction between grade and parent education ($F=1.995$; $df=20, 10215$; $p<.005$), indicating that the effect of parent education is more pronounced in some

grades. It is notable, however, that parents' education level explains only 2.5% of the variance in the scores and, at every grade level, the mean performance of homeschool students whose parents (both, if two) do not have a college degree is higher than the mean performance of students in public schools; their percentiles are at the 80th percentile or above.

Degree of State Regulation

Students' scores were examined according to the degree of state regulation (definitions below) in their states at one point in time, the Spring of 2008, close to when most of the data were collected. Table 19 shows that there is no significant relationship between degree of state regulation of homeschooling and test scores ($F=3.113$; $df=2,10410$; $p=.045$, n.s.).

Low state control	1197	1.1212	.79988	.02312	1.0758	1.1665	-1.75
Medium state control	7692	1.1708	.79390	.00905	1.1531	1.1886	-2.33
High state control	1524	1.1309	.83734	.02145	1.0888	1.1730	-2.05
Total	10413	1.1593	.80125	.00785	1.1439	1.1747	-2.33

ANOVA – Degree of state regulation of homeschooling in 2008

Core Z	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.995	2	1.998	3.113	.045
Within Groups	6680.513	10410	.642		
Total	6684.508	10412			

Low control states – AK, GU, ID, IL, IN, MI, MO, NJ, OK, PR, TX

Medium control states – AL, AZ, AR, CA, CO, CT, DE, FL, GA, HI, IA, KS, KY, LA, ME, MD, MN, MS, MT, NE, NV, NH, NM, NC, OH, OR, SC, SD, TN, UT, VA, WV, WI, WY.

High control states – MA, NY, ND, PA, RI, VT, WA.

The effect of the degree of state regulation over home-based education was also examined for only students who had been homeschooled for at least 5 years in a state in which the degree of regulation had not changed for at least 5 years (Table 20). In this analysis, also, there is no significant relationship between degree of state regulation of homeschooling and test scores ($F=3.190$; $df=2,5602$; $p=.041$, n.s.).

Table 20

Degree of State Regulation of Homeschooling and Test Scores, for students being home educated for 5 years or more in a state with same degree of regulation for those 5 years (Spring 2003 through Spring 2008)

Descriptives								
Core Z	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	
					Lower Bound	Upper Bound		
Low state control	731	1.1228	.78154	.02891	1.0660	1.1795	-1.64	
Medium state control	3922	1.1865	.78030	.01246	1.1621	1.2110	-2.33	
High state control	952	1.1336	.82466	.02673	1.0811	1.1860	-2.05	
Total	5605	1.1692	.78847	.01053	1.1486	1.1899	-2.33	
ANOVA – Degree of state regulation of homeschooling for five years								
Core Z		Sum of Squares	df	Mean Square	F	Sig.		
Between Groups		3.963	2	1.981	3.190	.041		
Within		3479.972	5602	.621				

Groups														
Total			3483.935		5604									

Low control states – AK, GU, ID, IL, IN, MI, MO, NJ, OK, PR, and TX.

Medium control states – AL, AS, AZ, AR, CA, CO, CT, DE, DC, FL, GA, HI, IA, KS, KY, LA, ME, MD, MN, MS, MT, NE, NV, NH, NM, NC, NMI, OH, OR, SC, SD, TN, VI, VA, WV, WI, and WY.

High control states – MA, NY, ND, PA, RI, VT, and WA.

Finally, the effect of the degree of state regulation over homeschooling was examined for only students who had been homeschooled for at least 12 years in a state in which the degree of regulation had not changed for at least 12 years (Table 21). In this analysis, also, there is no significant relationship between degree of state regulation of homeschooling and test scores ($F=2.499$; $df=2,243$; $p=.084$, n.s.).

Table 21

Degree of State Regulation of Homeschooling and Test Scores, for students being home educated for 12 years or more in a state with same degree of regulation for those 12 years (Spring 1996 through Spring 2008)

Descriptives								
Core Z	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Low state control	35	1.1914	.63397	.10716	.9737	1.4092	-.10	
Medium state control	151	1.3295	.74737	.06082	1.2094	1.4497	-.64	
High	60	1.0887	.72199	.09321	.9022	1.2752	-1.18	

state control							
Total	246	1.2511	.73078	.04659	1.1594	1.3429	-1.18

ANOVA – Degree of state regulation of homeschooling for twelve years					
Core Z					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2.637	2	1.318	2.499	.084
Within Groups	128.204	243	.528		
Total	130.840	245			

Low control states – GU, ID, IL, IN, MI, MO, NJ, OK, PR, and TX.

Medium control states – AL, AS, AZ, CA, CO, CT, DE, DC, FL, GA, HI, IA, KS, KY, LA, MD, MN, MS, MT, NE, NH, NM, NC, NMI, OH, OR, SC, SD, TN, VI, VA, WI, and WY.

High control states – MA, NY, ND, PA, RI, VT, and WA.

Number of Children in the Family

There is a significant inverse relationship between the number of children (aged 21 and under) living in the home and core z-scores ($r = -.081$, $n = 10348$, $p < .001$). That relationship, however, is very small and explains only about one-half of 1% of the variance in scores.

Degree of Structure in the Home Education

Parents were told, in the survey instrument, the following: “The ‘degree of structure’ in the practice of home education varies greatly. It ranges from a very unstructured learning approach, (e.g., centered upon the child’s interests or the eclectic nature of the teaching parent) to the use of a preplanned, structured, and highly prescribed curriculum.” Parents then rated their own practice, with their student, on a 7-point scale from “very unstructured” (with a value of 1) to very structured (with a value of 7). There is a significant relationship between degree of structure and core z-scores ($r_{\text{Spearman}} = .058$, $n = 10417$, $p < .001$). That relationship, however, is very small and explains only less than one-half of 1% of the variance in scores.

Structured Learning Time

Parents were told, in the survey instrument, the following: “Structured learning’ is time during which the child is engaged in learning activities planned by the parent; it is a time during which the child is not free to do whatever he or she chooses.” Then parents indicated how many hours per day, on average, this child has been engaged in structured learning. There is a statistically significant relationship between amount of structured learning time in which a homeschool student is engaged and core z-scores ($r=.083$, $n=10405$, $p<.001$). That relationship, however, is very small and explains only about one-half of 1% of the variance in scores.

Age at Which Formal Instruction Began

Parents were instructed, in the survey instrument, as follows: “Consider ‘formal instruction’ to be planned or intentional instruction in areas such as reading, writing, spelling, or mathematics; it is done to meet a learning objective.” Parents then indicated the age at which they began formal instruction of this child. For analysis, students were selected whose parents reported they began formal instruction of the student some time from age 1 through 13. There is a significant inverse relationship between age at which formal instruction began and core z-scores ($r=-.080$, $n=10652$, $p<.001$). That relationship, however, is very small and explains only about one-half of 1% of the variance in scores.

Overall Adjustment to Test Scores?

Since the test scores of the homeschool students are so high, on average, an efforts was made to find whether there might be some clear ways to account for the relatively high scores.

Parents Knew Scores Before Participating Versus Did Not Know

As presented earlier, students whose parents knew their scores (mean of 88th percentile) before participating in the study performed no better on the tests than students whose parents did not know their scores (mean of 88th percentile) before participating.

“All” Scores Provided Versus Full Participants’ Scores

The scores of all students tested by three of the four major testing services were sent to the researcher. The scores of these students, a total of 22,584, nearly all of whom were home educated, are presented in Table 22. (That is, the testing services reported that a tiny minority might have been taught in small private schools.) These comprise the scores of both those who participated and those who did not participate in the present study.

Table 22

Mean z-Scores and Corresponding National Percentile by Subtest for All Students From Three Major Testing Services (i.e., Participants and Non-Participants)

Subject	N	Mean z	Std. Deviation	National Percentile
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Reading	22362	1.1150	.83183	87
Language	22515	.8744	.88439	81
Math	22343	.8358	.90915	80
Science	12830	.8985	.80392	82
Social Studies	12814	.8526	.86598	80
Core	21445	1.0138	.85266	84
Composite	12602	.9537	.83149	83

Table 23 presents the subtest mean z-score and national percentiles of all students tested by the three testing services and only the participants in this study. The means of the all-student group were lower than the means of the participant-only-student group, with z-scores differences ranging from 0.10 to 0.16, and percentile differences ranging from 2 to 4. These are very small differences, in a practical sense.

Table 23

Comparison of Mean z-Score and National Percentiles of All Students Tested by Three Major Testing Services and Participants in the Study

Subtest	Participants' z-score ^{a, b}	Participants National Percentile	All z-Score (Participants and Non-Participants)	All National Percentile	Difference in z-Score	Difference in Percentile
Reading Total	1.2185	89	1.115	87	0.1035	
Language Total	0.9944	84	0.8744	81	0.1200	
Math Total	0.9986	84	0.8358	80	0.1628	
Science	1.063	86	0.8985	82	0.1645	

Social Studies	1.0124	84	0.8526	80	0.1598
Core	1.1591	88	1.0138	84	0.1453
Composite	1.1079	86	0.9537	83	0.1542

a. Following are a few z-score/percentile equivalents: $-0.67 = 25^{\text{th}}$ percentile; $0.00 = 50^{\text{th}}$ percentile; $0.67 = 75^{\text{th}}$ percentile; $1.00 = 84^{\text{th}}$ percentile.

b. Sample sizes and standard deviations are presented in preceding tables.

Higher-Response-Rate Versus Lower-Response-Rate Student Groups

Another approach to accounting for the relatively high scores was to compare the scores of the participants from the four major testing services for whom the response rate was more readily calculated and was higher to the participants via the other eleven relatively minor test-score sources for which it appears the response rate was lower (see preceding section on response rates). Table 24 presents the Core subtest scores and shows that they are identical (88^{th} percentile).

Table 24

Test Scores of Major Testing Services and Minor Testing Services

	Major Testing Services (4)	Minor Testing Services (11)
N	8039	2718
z-score (percentile)	1.16	1.16
s.d.	0.8118	.7718
National percentile	88	88

Summary of Major Findings in This Study

Major findings: Demographics

- The median income for home-educating families (\$75,000 to \$79,999) was similar to all married-couple families nationwide with one or more related children under age 18 (median income \$74,049 in 2006 dollars; or roughly 78,490 in 2008 dollars).

- Homeschool parents have more formal education than parents in the general population; 66.3% of the fathers and 62.5% of the mothers had a college degree (i.e., bachelor's degree) or a higher educational attainment. In 2007, 29.5% of all adult males nationwide ages 25 and over had finished college and 28.0% of females had done so.
- These homeschool families are notably larger – 68.1% have three or more children – than families nationwide.
- The percent of homeschool students in this study who are White/not-Hispanic (91.7%) is disproportionately high compared to public school students nationwide.
- Almost all homeschool students (97.9%) are in married couple families. Most homeschool mothers (81%) do not participate in the labor force; almost all homeschool fathers (97.6%) do work for pay.
- The median amount of money spent annually on educational materials is about \$400 to \$599 per home-educated student.

Major findings: Achievement

- Homeschool student achievement test scores are exceptionally high. The mean scores for every subtest (which are at least the 80th percentile) are well above those of public school students.
- There are no statistically significant differences in achievement by whether the student has been home educated all his or her academic life, whether the student is enrolled in a full-service curriculum, whether the parents knew their student's test scores before participating in the study, and the degree of state regulation (control) of homeschooling (in three different analyses on the subject).
- The scores of all students (both participants and non-participants in the study for whom test scores were obtained) were only 2 to 4 percentile points (i.e., 0.10 to 0.16 z-score) lower than the scores of only the homeschool students who participated in the study.
- There are statistically significant differences in achievement among homeschool students when classified by gender, amount of money spent on education, family income, whether either parent had ever been a certified teacher (i.e., students of non-certified parents did better), number of children living at home, degree of structure in the homeschooling, amount of time student spends in structured learning, and age at which formal instruction of the student began. However, of these variables, only parent education level explained a noticeable or practically significant amount of variance, 2.5%, in student scores; the other variables explained one-half of 1% or less of the variance.

Discussion

The findings of the present study, in the context of all preceding research on the scholastic achievement of home-educated students, bring three main things to mind. First, the overall scores are well above public school student averages. This is consistent with the body of extant research. It is not a surprise. At the same time, however, some research and many anecdotes within the homeschool community and news stories suggest that the demographic, philosophical, and pedagogical variety within the

homeschool movement has been broadening over the past decade and one might have expected homeschool achievement scores to lower or regress toward the mean somewhat. There is no evidence of such a decrease in academic performance in the present findings.

Second, the test scores seem, in some ways, notably too high. The researcher was expecting, if anything, a lowering of the scores compared to what was found in previous large-scale nationwide studies (Ray, 1990, 1997, 2000; Rudner, 1999). Reasons for this might have been a demographic broadening of the homeschool population (e.g., perhaps less focused on academic achievement), regression toward the mean, and with nationwide focus on efforts such as No Child Left Behind that emphasize academic achievement in government schools the relative performance of the home educated might be lower than before (Hong & Youngs, 2008, e.g., p. 4). But applying simple controls within the data set (e.g., such as checking whether there was any difference in scores based on whether the parents knew the student's scores before participating in the study) and finding no major differences in scores suggest that the scores are solid and rather dependable. Furthermore, comparing all students' scores from the major testing services and comparing them to only participants' scores revealed rather small differences between the two groups. Perhaps homeschool students are simply doing as well or better than in the past on achievement tests due to their and their parents' educational efforts. Perhaps the difficulty level of standardized tests has been reduced somewhat over the past decade. Or perhaps the ability of the norm group (public and private school students) has declined somewhat over the past decade. Finally, perhaps the present study captured a sample of the homeschool population at large that is over-represented by high achievers even though it was designed to sample from a broad and robust sampling of the homeschool community that uses standardized tests.

The third notable finding is the lack of statistically significant relationships and effect sizes of practical importance between academic achievement and the several factors examined. It was intriguing to find that the students of parents who had never been state-certified teachers did better than those whose parents were certified, although the effect size appears basically trivial. Only parent education level explained a noticeable or practically significant amount of variance in student scores, and that was 2.5%. One explanation for why so few practically significant effect sizes were found might be that since the scores are relatively high overall that there is attendant range restriction. That is, when the range of scores is relatively narrow, practically significant associations are less likely to be found.

Developing a sample from the widest source ever of homeschool student test scores, this study offers plentiful information concerning the students' demographics and achievement. It shows, as did Rudner's (1999) study, that homeschool students and their families are in some ways a select population: although the income for homeschool families with school-age children in this present study is at about the national median, "... education levels are well above national averages. The family structure is traditional with married couples as parents, several children, father as bread winner, and a stay-at-home mother. Home school families do not spend a great deal of money on educational materials and tend not to subscribe to pre-packaged full-service curriculum programs."

It must also be kept in mind that there are notable limitations to this study. First, homeschool families and their students do not appear to be a completely representative cross-section of all families in the United States. And it was not possible within the constraints of this study to confirm whether this sample is representative of the population of home-educated students.

The content of the standardized tests used is another major limitation of this study. Again, as Rudner (1999) aptly noted: "While home schools teach the basic skill areas of reading, mathematics, social studies, and science, they do not necessarily follow the same scope, sequence, or emphasis as traditional public and private schools. The primary focus of many home schools is on religious and moral values. Public and private schools usually select [a standardized test] ... due to its close alignment with their curriculum; home schools select the test primarily out of convenience."

As previously noted, the results of the present study are consistent with preceding studies of the academic achievement of homeschool students (Ray, 1990, 1994, 1997, 2000; Rudner, 1999; van Pelt, 2003). The above-average nature of these achievement test scores is also consistent with state-provided data in states that have mandated or used testing of the home educated (e.g., Alaska Department of Education, 1993; Arkansas Department of Education, 1998; Oregon Department of Education, 1999). Comparisons between home-educated students and institutional school students nationwide should, however, be interpreted with thoughtfulness and care. As stated at the beginning of this report, this is a nationwide cross-sectional, descriptive study (Johnson, 2001). It is not an experiment and readers should be careful about assigning causation to anything.

One could say, as Rudner (1999) wrote: "This study simply shows that those parents choosing to make a commitment to home schooling are able to provide a very successful academic environment." On the other hand, it may be that something about the typical nature and practice of home-based education causes higher academic achievement, on average, than does institutional state-run schooling (Ray, 1997; 2000, p. 91-100; 2005). Similar to what Holt (1983) suggested nearly three decades ago, academic leaders could entertain this possibility and consider what those ingredients might be, and how the theoreticians and practitioners involved in conventional institutional schools might be informed by their counterparts in the parent-led home-based education community.

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