A Critical Review of Research on Virginia's Religious Exemption

An Analysis of Ray's "A Brief Statistical Analysis of Academic Achievement Test Data from Home Educated Students Operating Under the Virginia Religious Exemption Statute" (1994)

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Introduction

Virginia is the only US state that allows parents to bypass compulsory education laws by claiming a religious exemption from school attendance, according to the University of Virginia School of Law's Child Advocacy Clinic. When legislators attempted to repeal the religious exemption in 1993, the Home School Legal Defense Association (HSLDA) commissioned a study to provide a basis for their opposition to the repeal, specifically urging their members to participate in the study.

The study, entitled "A brief statistical analysis of academic achievement test data from home educated students operating under the Virginia religious exemption statute," was conducted by Brian Ray and published in early 1994 by Ray's National Home Education Research Institute (NHERI)—which operates in practice as HSLDA's research department—rather than in a peer-reviewed journal. The study contains only one page of analysis accompanied by seven pages of tables. It is highly unlikely the study would have been published as-is in a peer-reviewed journal, as it appears to be merely a stub of an article, lacking complete analysis and any description of methodology. However, HSLDA's lobbying nonetheless defeated the repeal attempt.

In 2014, Virginia Delegate Thomas Rust proposed HJ 92, a bill which requests that the Virginia Department of Education conduct a study on the religious exemption and make recommendations to the legislature. In HSLDA's response to the proposal, they prominently cite Ray's 1994 study as evidence that HJ 92 is unnecessary, since the study purports to show that Virginia's religiously exempt homeschoolers score much higher than the national average on standardized tests.

However, despite these claims, Ray's study **does not prove** that these religiously exempt homeschoolers score 33% higher on standardized tests than public schoolers. It does demonstrate that a small percentage (around 9%) of the state's religiously exempt homeschoolers in 1994 were doing well academically; that they scored better on reading than math across the board; and that their math skills decreased with respect to public schoolers as they aged, while their language skills increased.

The homeschoolers included in Ray's study were not randomly selected and most likely included the most academically successful religiously exempt students in the state, who volunteered specifically in response to a legislative threat to their ability to continue homeschooling without restriction. Ray did not collect information on or correct for demographic factors which have been shown to affect academic success, such as race, family income, family structure, parental education, etc. Furthermore, the participants in Ray's study were overwhelmingly elementary schoolers—the number of older children sampled was so small as to be meaningless—and were probably drawn from suburban

areas of the state, as these were the primary locations of religiously exempt homeschoolers in 1994. Today, the landscape has changed somewhat—the number of religious exemptions has more than tripled, and religious exemptions are now most common in extremely rural areas. Whatever little descriptive validity Ray's study had in 1994, it is now no longer relevant.

In the sections that follow, I will first give some background of the study, then outline its major points. Next I will provide a critical analysis of the study, and finally I will summarize what his results actually mean.

Background of the study

Ray released the results of the study in January 1994, but the standardized tests he analyzed were conducted during one of three years (1991, 1992, or 1993); it is possible some participants were tested several times over multiple years, though the majority of tests analyzed (184) were administered in 1993.

Participants in the study took one of a number of standardized tests, which included the Stanford Achievement Test (SAT - 87 participants), the Iowa Test of Basic Skills (ITBS - 64 participants) or related Tests of Achievement and Proficiency (TAP - 6 participants), the California Test of Basic Skills (CTBS - 26 participants), the California Achievement Test (CAT - 17 participants), the Woodcock-Johnson Tests of Cognitive Abilities (8 participants), the Miller Analogies Test (MAT - 3 participants), the American College Testing test (ACT - 1 participant), and the Comprehensive Testing Program test (CTP - 1 participant). In a later study, Ray (2010) argued that combining scores from many standardized tests would not skew the results, though it would have been ideal to use only one standardized test in the study.

Ray states that he analyzed the standardized test scores of 213 Virginia students educated under the religious exemption law; however, this is misleading for several reasons. First, when he reports his data arranged by grade, the numbers he offers add up to 156, not 213. Second, while he may have had access to 213 test scores, he did not have demographic data for every participant. According to Ray, only 181 participants reported their grade, 152 reported their age, 184 reported their gender, and 197 reported the year they had taken the standardized test. It is unknown how many test scores were associated with a fully complete demographic survey.

Variable	Sample size
Grade	181
Age	152
Gender	184
Year	197

Not all of the standardized tests used by participants in the study contained sections on science and social studies, so Ray's sample size for those subjects was even smaller—102 for science and 78 for social studies.

Furthermore, **Ray does not discuss how he recruited his participants or how he obtained their test scores and demographic data**. In fact, he did not recruit his participants at all---they were specifically recruited by HSLDA from their membership lists to defeat the 1993 attempt to repeal the religious exemption for homeschoolers:

> Home School Legal Defense Association sent out an alert to its membership requesting that they contact their delegates and senators concerning their opposition to any attempt to repeal the religious exemption statue. In order to prepare for this possible attempted repeal, HSLDA requested its members operating under the religious exemption to [send] in copies of any standardized test scores from their children. HSLDA collected 213 students' scores and commissioned a study by Dr. Brian Ray of the National Home Education Research Institute in order to analyze the scores. The study showed that the religious exemption students K-12 scored very highly. The average percentile score for reading was the 90th percentile, math—87th percentile, language—83rd percentile, science—89th percentile, and social studies—87th percentile. The basic battery composite score average was the 89th percentile. This shows that home schoolers operating under the religious exemption statute are doing far above average, which is, of course, the 50th percentile. HSLDA and Virginia home schoolers can use this evidence in the future to defend the fact that children being home schooled under the religious exemption are being very well educated without any state regulation whatsoever.

Since Ray's participants were recruited through a particular community of interest rather than through random sampling, his data is subject to self-selection bias (for more, see this analysis of a later Ray study with the same bias). Ray's failure to mention this bias in the published version of his study is disingenuous at best.

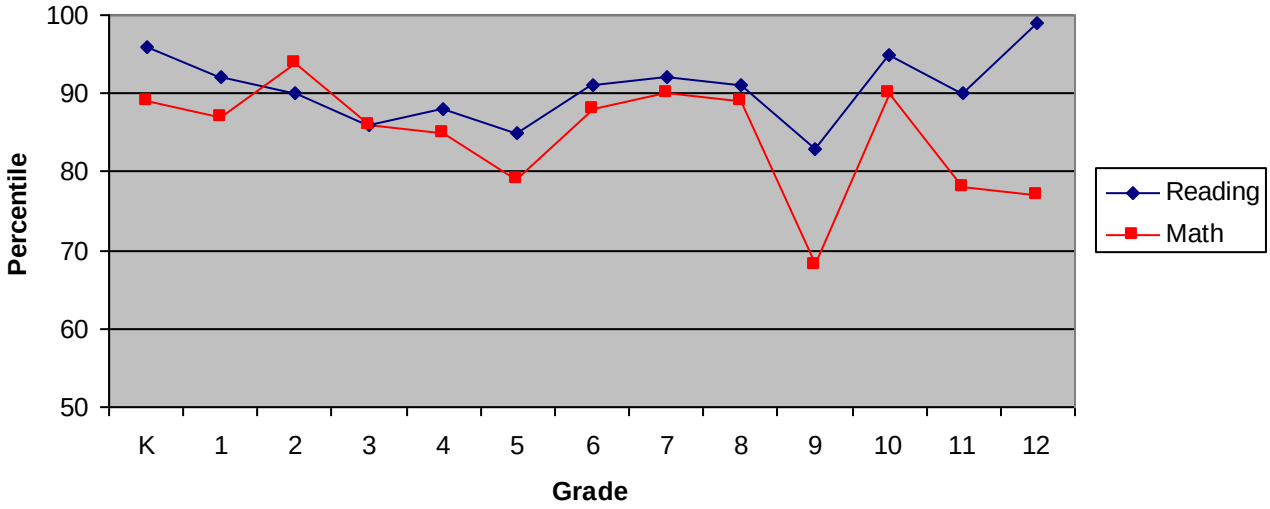
Study's major points

Ray's study is available for purchase on the NHERI website for $4. It is also available here. In one page of analysis, the findings Ray discusses are as follows:

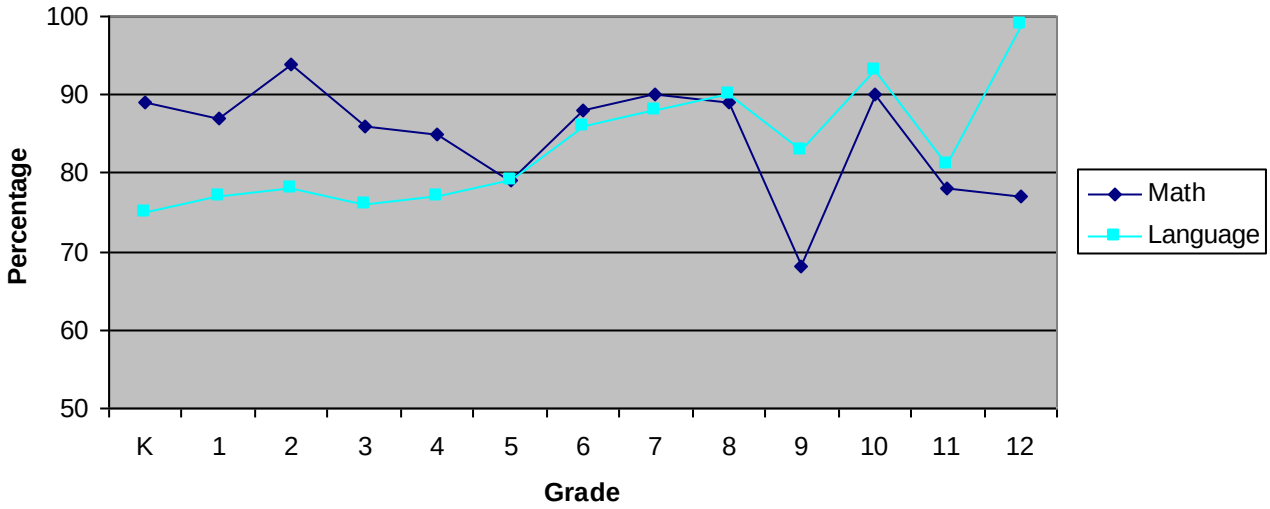
- The test scores of 213 Virginia homeschoolers operating under the religious exemption were, on average, at or above the 83rd percentile. This places them approximately 33% higher than the national average score for public schoolers on standardized tests (where the national average is, by definition, the 50th percentile).
- These homeschoolers scored, on average, in the 90th percentile in reading, the 89th percentile in science, the 87th percentile in math, the 87th percentile in social studies, and the 83rd percentile in language.
- Demographically, the sample was comparatively young; 78% of the participants were in grades K-6. The largest plurality of participants (41%) submitted scores from the SAT, while the rest submitted scores from other standardized tests.
- Ray conducted a statistical analysis of student scores on the "basic battery" (a term he does not define, but which probably refers to an average of reading, math, and language scores) by grade level. He found that there were no significant differences; that is, there was no statistical difference between the average scores of students in different grades.
- Ray concludes that homeschoolers operating under the religious exemption perform very well on standardized tests.

As Ray does not conduct a full analysis of his data or provide a full set of tables, it is not possible to determine very much more. However, from the data he provides, it is also possible to deduce the following:

- Ray's participants tended to score lower on math than on reading, a finding which is consistent with most existing research on homeschoolers.



- In general, the math scores of Ray's participants tended to decrease in comparison with the national average as students aged, while Ray's participants' language scores tended to increase in comparison with the national average (represented here by the x-axis). (Note that for grades K-2, Ray's sample size was smaller for language than for math.)



Critical analysis

Methodological problems with Ray's (1994) study include failing to discuss crucial details, failing to correct for background factors, using a sample size which is too small, and drawing a sample that is not representative of the population. The sample also fell prey to selection bias—that is, students who were more likely to score well on

standardized tests were more likely to participate in the study, which measured how well students do on standardized tests (see here for more on selection bias in Ray's work).

1) Lack of crucial details

As mentioned above, Ray does not discuss in his study how he recruited his participants, how he gathered their demographic information, how he dealt with the many incomplete demographic profiles he received, under what circumstances the participants took the standardized tests, and what statistical analyses Ray conducted. (It is standard practice to report the *p*-values for statistical tests, which he claims to have conducted, but he does not do so.)

Without this information, it is impossible to determine whether Ray's sample was truly random or was exposed to selection bias (in fact, it was exposed to selection bias); whether homeschooled students were administered the test under controlled conditions; whether Ray double-counted students who took tests in multiple years; and whether his statistical tests were valid.

This lack of crucial detail is a major reason why this study could not have been published as-is in a peer-reviewed journal.

2) No correction for background factors

Numerous studies have shown that race/ethnicity, socioeconomic class, parent education level, parental marital status, religion, and many other background factors influence children's academic success. Ray does not collect, let alone analyze, data on his participants with respect to these demographic variables. It is thus impossible to know if his participants are comparable to the average public schooler. If Ray's sample was more white, better educated, and of a higher socioeconomic class than the national average (as in much of his other research), it would be completely expected that they would score higher than the national average. It would not, however, indicate that homeschooling under Virginia's religious exemption was the **cause** of those high scores.

3) Small sample size

In the 1994-1995 school year (the earliest year for which these statistics are available), there were 7,856 students in Virginia being homeschooled under the homeschool statute compared with 1,767 students being homeschooled under the religious exemption. The 156 students whose scores on the "basic battery" of tests (reading, math, and language) were analyzed comprised 9% of all homeschoolers operating

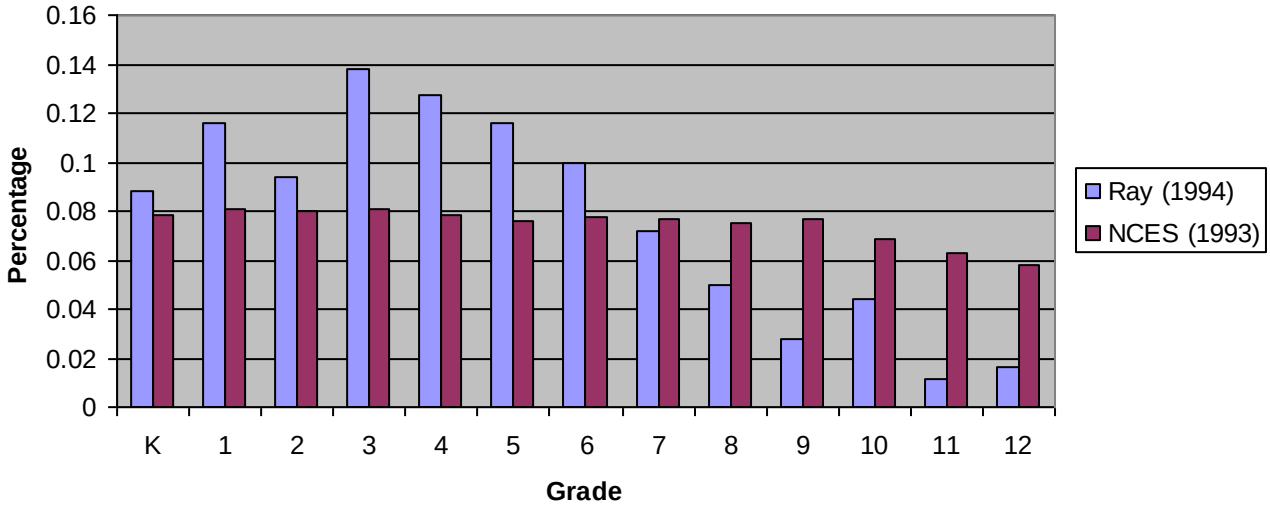
under the religious exemption. If the study were based on a random sample which was demographically balanced, this would be an acceptable sample size. However, since homeschoolers who take standardized tests are only a small portion of the entire homeschooling population (perhaps only 2-3%), and because testing is entirely voluntary for those homeschooled under Virginia's religious exemption, it is likely that this 9% of religiously exempt homeschoolers includes many of the **highest academic achievers in the state,** and unlikely that it includes students who are at the greatest risk for educational neglect. We thus know very little about the academic performance of the vast majority of religiously exempt students—91% of them—who did not participate in this study.

Furthermore, in the 2012-2013 school year (the most recent year for which statistics are available), there were a total of 29,886 homeschoolers operating under the homeschool statute in Virginia, compared with 6,429 operating under the religious exemption. If we assume the homeschooling population has stayed essentially the same in terms of demographics over the past 20 years (not necessarily a warranted assumption), Ray would need to sample 579 students today to get the same percentage of the state's homeschoolers.

4) Non-representative sample

The children whose test scores were analyzed by Ray were not representative of the state's religiously exempt homeschoolers, let alone the state's public school children, in terms of age and geographic location.

Age Ray's sample was not representative of the Virginia school-age population in terms of age. For comparison, I have graphed Ray's percentage of participants in each grade with the percentage of students enrolled in Virginia public schools in Fall 1993. Note the higher blue bars which indicate that Ray's study contained a higher percentage of elementary schoolers than Virginia public schools did in 1993. The higher red bars indicate that Ray included a smaller percentage of middle and high schoolers than were attending public school in Virginia in 1993.



Particularly for the middle and high school grades, Ray's sample sizes were so small as to be essentially meaningless—Ray only had the reading and math scores of **15 participants in grades 9-12** and **29 participants in grades 6-8**. In his analysis of reading and math scores by grade level, Ray was only able to use the scores of **two 11th graders** and **one 12th grader**. He obtained the test scores of only **six 15-year-olds**, **one 16-year-old**, and **one 17-year-old**.

Grade level	Sample size (reading and math sections)
K	12 (reading), 15 (math)
1	21
2	16
3	24
4	20
5	21
6	17
7	13
8	9
9	5
10	7
11	2
12	1

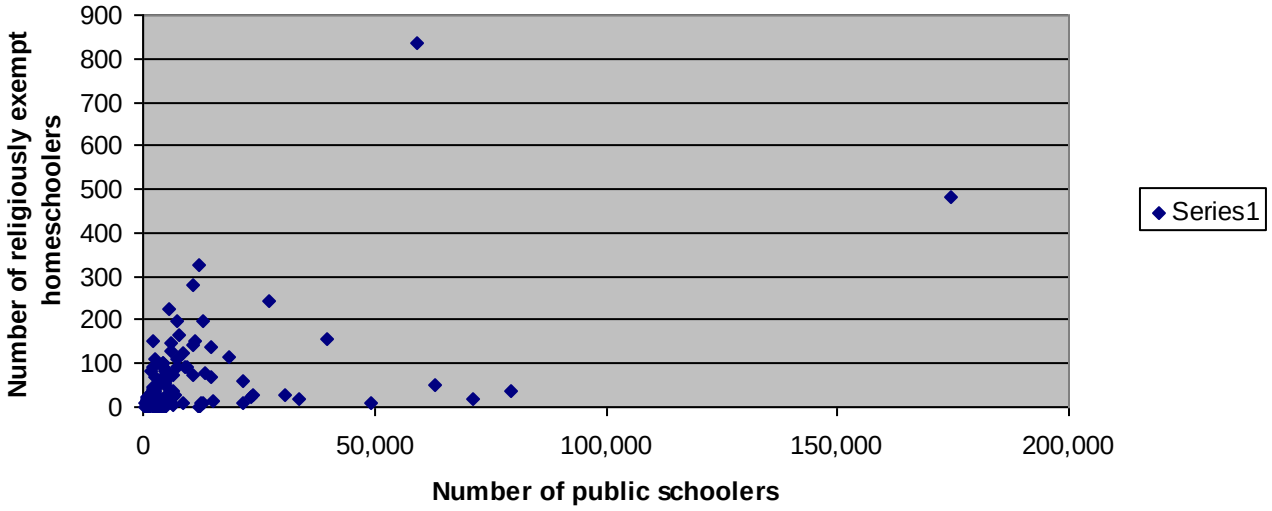
This skewing is problematic because some data indicates that homeschooling grows less common as kids age (Kunzman & Gaither 2013)—only 48% of religious and 15% of secular homeschoolers continue to homeschool for more than six years (Isenberg

2007), perhaps due to the increased difficulty of high school classes. If a large number of high schoolers are quitting homeschool and going to public or private school, that may have an effect on the average test scores for those who stay. It may also be the case that homeschooling children in high school is less effective, something that could be obscured in this study by the lower numbers of homeschoolers of high school age participating. Finally, it is impossible to claim that a sample size of one is representative.

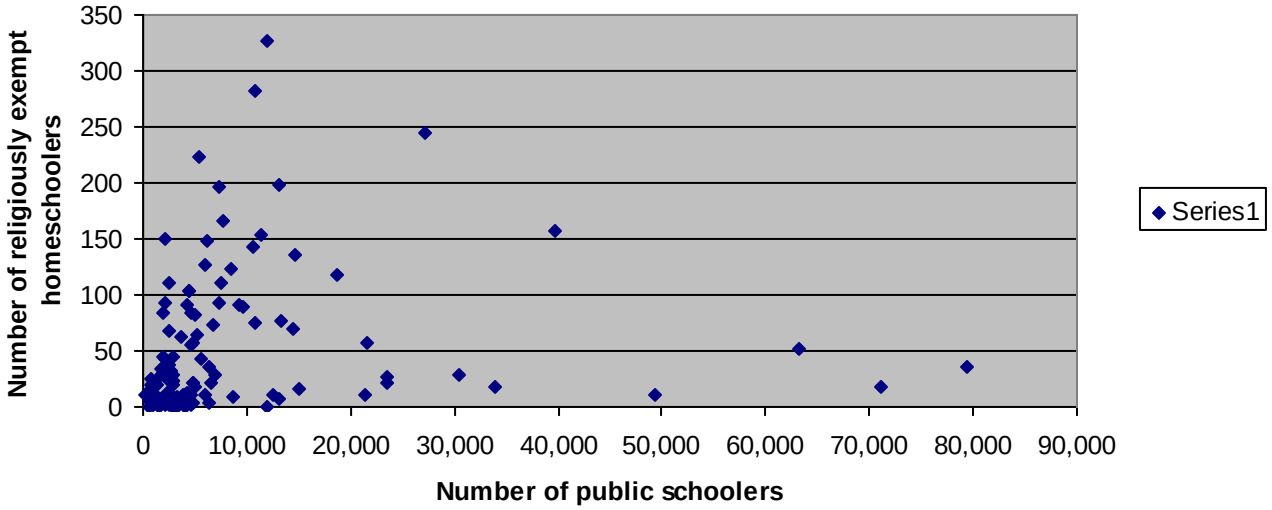
Location Ray's sample of religiously exempt homeschoolers is also not representative of Virginia's population in terms of where they live, and the population of religiously exempt homeschoolers has undergone significant geographic changes in the past 20 years. In the 1994-1995 school year (the earliest year for which data are available), about 11% of religiously exempt homeschoolers lived in a city, while the majority of religiously exempt homeschoolers (about 68%) lived in suburbs: Fairfax County, a suburb of D.C. (205); Rockingham County, a suburb of Harrisonburg (145); and Chesterfield County (136), a suburb of Richmond. Finally, 22% of religiously exempt homeschoolers lived in rural areas.

In the 2012-2013 school year (the most recent year for which data are available), only about 6% of the 6,429 religiously exempt homeschoolers lived in a city, while about 68% lived in suburbs and 26% lived in rural areas. The number of religiously exempt homeschoolers per city district increased by an average of 5 homeschoolers, while the average increase in county districts was 48 homeschoolers. The districts with the greatest increase in religiously exempt homeschoolers were Fairfax County (increasing to 600, a difference of 395); Stafford County (also a D.C. suburb, increasing from 0 to 248); Augusta County (a Staunton suburb, increasing from 23 to 250); and Rockingham County (increasing to 351, a difference of 206). On the other hand, the number of religiously exempt homeschoolers decreased or stayed the same in 29 districts, including Chesterfield County (decreasing to 55, a difference of -81).

For comparison, in the 2010-2011 school year (the most recent year for which data are available), about 28% of Virginia's public schoolers lived in a city, while about 59% lived in suburbs and 13% lived in rural areas. The districts with the highest number of public schoolers were Fairfax County (174,000 students); Prince William County (also a D.C. suburb, 79,000 students); Virginia Beach City (71,000 students); Loudoun County (also a D.C. suburb, with 63,000 students), and Chesterfield County (59,000 students). A high district population seems to correspond slightly with a high population of religiously exempt homeschoolers ($r = .5$).



However, if we remove the outliers of Fairfax and Chesterfield Counties, the correlation essentially disappears (r = .16). This means that there is little relationship between the number of public schoolers and the number of religiously exempt homeschoolers in a district.



The districts with the highest **ratio** of religiously exempt homeschoolers to public schoolers are all rural counties which do not contain a major population center: Floyd County (7:100), Madison County (5:100), and Giles, Charlotte, Highland, and Warren Counties (4:100).

It seems from this data that, at the time of Ray's 1994 study, most of Virginia's religiously exempt homeschoolers were suburban families, congregating in counties rather than in cities. This trend has held steady in the years since Ray's study—today, the majority of homeschoolers with religious exemptions continue to live in suburbs. However, religiously exempt homeschoolers are most **common** in extremely rural areas, where they comprise a higher percentage of the school-age population than in suburban areas. Religious exemptions for rural Virginia families have become more common since Ray's study—rural residents composed 22% of religiously exempt homeschoolers in 1994 but 26% today. That the religiously exempt population has undergone this shift indicates that, however relevant Ray's findings were in 1994, they are no longer applicable.

What the study actually says

Ray's 1994 study does not tell us very much. The 156 religiously exempt homeschool participants who took the "basic battery" of standardized tests scored, on average, around 33% higher than the national average of all public schoolers. However, these 156 students were not even representative of all Virginia religious exemptions—comprising only 9% of that population, the sample was a product of selection bias and contained far too few middle and high schoolers to achieve statistical reliability—let alone socioeconomically comparable to all public schoolers in the US, to whom Ray compared them.

What the study does tell us is that this tiny sample of academically successful religiously exempt homeschoolers scored better on reading than on math across the board, and that their math scores decreased with respect to the national average as they aged even as their language skills increased with respect to the national average.

Conclusion

We cannot tell how well religiously exempt homeschoolers in Virginia are doing academically in the present day from Ray's 1994 study. This study tells us only that a small, highly selective group of elementary school-age HSLDA members were doing well in 1994. We know nothing about how well the majority of religiously exempt homeschoolers were doing in 1994, and the population has undergone so many changes since then that Ray's findings are no longer relevant.

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