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and Associates, Inc.**

**A PRELIMINARY REVIEW AND ANALYSIS OF
THE VIRGINIA STANDARDS OF QUALITY**

REPORT TO THE VIRGINIA DEPARTMENT OF EDUCATION

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Introduction

This report was prepared by Augenblick, Palaich and Associates (APA) in response to a request (Informal Request for Proposals, RFP # DOE 2009-11, issued on April 15, 2009) from the Virginia Department of Education (VDOE) to “review and evaluate the current Virginia Standards of Quality (SOQ) as to the appropriateness of the existing K-12 staffing standards for instructional positions and the establishment of ratio standards for support positions.” APA responded to the RFP and was awarded a contract to undertake the services it had proposed in May 2009.

APA is an education consulting firm that was founded in 1983 and is located in Denver, Colorado. Much of APA’s work has been for state-level policy makers in the area of school finance, including developing state aid allocation systems, evaluating school finance formulas, and providing technical assistance on education funding-related issues. APA has made significant contributions to designing the state aid formulas of several states, including Colorado, Kansas, Kentucky, Louisiana, Maryland, New Jersey, and Pennsylvania. In recent years, APA has focused its attention on the adequacy of education resources, which has required the development of procedures to cost out the resources school districts with different characteristics need in order to meet state student performance expectations.

In order to review and evaluate Virginia’s Standards of Quality, APA undertook several tasks. We: (1) conducted a review of the personnel ratios used in other states or recommended by established organizations and the research that might support specific ratios; (2) reviewed the available efficiency review reports for school divisions in Virginia (located at: <http://www.doe.virginia.gov/VDOE/efficiencyreview.html>); (3) conducted phone interviews with state officials in two states that use personnel ratios as the basis of allocating state aid to school districts; and (4) analyzed data provided by VDOE comparing the numbers of SOQ personnel for which school divisions receive funding based on SOQ staffing standards, or based on prevailing costs, and the numbers of personnel school divisions actually employed for corresponding SOQ categories, as found in the Annual School Report, in order to understand what relationships might exist between numbers of personnel per 1,000 students and division characteristics such as their size (enrollment levels) and education needs.

The Role of Personnel Ratios in Allocating State Aid to School Divisions in Virginia

Virginia’s School Finance System

Like almost every other state, Virginia uses a form of the “foundation program” (sometimes referred to as a “minimum foundation program” because it sets a base) as the primary basis of allocating state aid to school districts (divisions). Under a foundation program, a state sets a target level of funding for each school district and divides that amount between state and local sources based on the relative fiscal capacities of school districts. The funding target level can be set in a variety of ways, from simply specifying a per student amount (e.g., \$4,000) to setting an amount and adjusting it by factors related to uncontrollable cost pressures associated with student and district characteristics (such as students with

individualized education programs or small school districts) to building the amount based on specific expenditures, such as those for personnel and textbooks. For the Standards of Quality, Virginia calculates the target revenue level for each school division primarily on the basis of numbers of personnel of different types and the salary levels assigned to those types of personnel; it also uses school division expenditure data primarily to fund support costs.

Many states that are members of the Southern Regional Education Board (SREB) have used approaches similar to Virginia's in setting the target funding levels for school districts over the past 40 years; however, several states have moved to a dollar amount per student with adjustments for student and district uncontrollable cost pressures (such as Florida, Kentucky, Louisiana, Maryland, and Mississippi). North Carolina goes even further than Virginia in precisely defining the foundation target for each district by using the actual salaries that each individual employee is eligible for based upon the statewide salary schedule and their individual education level and experience (and the state pays the entire cost rather than sharing it with local districts).

Under almost all foundation programs, school districts are free to supplement foundation funding with local revenues without limit. This is easier to do when school districts are fiscally independent (that is, they, through their school boards, determine whether additional revenue is desired and, if so, set local tax rates). For example, in Kentucky, school districts can generate up to 15 percent of foundation revenue through school board decisions and an additional 30 percent with voter approval. However, in Virginia, school districts are dependent upon their local governing bodies (county boards of supervisors and city councils), and cannot make such decisions.

Strengths and Weaknesses of Using Personnel Ratios in a Foundation Program

The use of personnel ratios as part of a school finance system serves several purposes. First, personnel ratios create a direct linkage between state programmatic requirements and the funding allocated to school districts; in many states programmatic requirements are disconnected from funding, sometimes creating what are referred to as unfunded mandates. Second, to the extent that there is a close relationship between the numbers of staff the ratios assure and the numbers of staff that are needed either to deliver the educational services required by the state or to achieve the state's educational objectives, they increase the likelihood that all districts will meet state expectations. Third, the use of personnel ratios increases the probability that all districts will provide similar services so that students across the state are treated in the same fashion, depending upon the autonomy of the local school board. Finally, the requirement that all districts employ specific numbers of staff in several personnel categories assures that districts that might otherwise not choose to employ certain kinds of staff will do so.

Of course, the use of personnel ratios has its weaknesses. The use of ratios may not take into account the numbers of personnel needed in districts with different characteristics or special circumstances. When a state holds school districts accountable for student performance, as most states do under what is sometimes referred to as "standards-based reform," the use of personnel ratios undermines local responsibility to organize education services by specifying how services should be delivered. And, since

local governing bodies may appropriate local funding to school districts to employ additional personnel, the existence of minimum personnel requirements does not assure resource equity across school districts.

Virginia's Personnel Ratios

Virginia's use of personnel ratios to drive the allocation of state aid to school divisions is part of the state's employment of Standards of Quality for public education. The Standards of Quality (SOQ) are referred to in Article VIII of the Virginia Constitution, under which they are to be "determined and prescribed" by the State Board of Education, subject to revision only by the Virginia General Assembly, which has the responsibility to determine the manner in which funds are to be provided that support the SOQs, including apportioning their cost between the Commonwealth and local governments. Standards of Quality were first adopted by the State Board of Education in 1971.

There are eight Standards of Quality, the second of which prescribes staffing standards (primarily for core instructional positions) for school divisions, which are the primary determinant of funding for each of the state's school divisions. The staffing standards are personnel ratios (students to personnel or personnel to students, sometimes expressed in per 1,000 student terms) and class size caps that both specify the numbers of personnel that each school division should employ and serve as the basis for determining, in large part, how much revenue each school division needs. Some personnel ratios are expressed in division-wide terms while others are expressed in school-wide terms. Personnel ratios exist for specific types of instructional staff and some support staff. Some ratios provide basic personnel while others reflect student characteristics, such as students with individualized education programs and students who are English language learners. Several are related to school characteristics, such as school size, or whether a school is an elementary, middle, or high school. In essence, the application of all personnel ratios to the numbers of students in schools and school divisions determines a roster of personnel for each school division, which can be multiplied by standard salary and benefit rates to determine the total cost for each school division. School divisions can choose to both employ additional personnel and pay all personnel at rates above those used by the state to determine the revenue needs of school divisions, although any added costs are likely funded through resources other than those specifically related to a particular ratio.

An example of a division-wide ratio is the one that applies to classroom teachers in grades one, two, and three, which is based on 24 students per teacher. An example of a school-wide ratio based on school size is the one that applies to librarians, which provides a part-time librarian for elementary schools with fewer than 300 students, a full-time librarian for elementary schools with 300 or more students, a half-time librarian for middle and high schools with fewer than 300 students, a full-time librarian for middle and high schools with between 300 and 999 students, and two full-time librarians for middle and high schools with 1,000 students or more. These kinds of ratios have built in "cliffs" whereby the number of personnel shifts at a specific point (such as 300 students), below which point one figure is used and above which point a different number is used; this approach does not permit any "smoothing" as enrollment changes.

Other ratios, such as the one for art, music, and physical education teachers in grades kindergarten through five is expressed as five staff per 1,000 students, which produces exactly five staff at 1,000 students but fewer staff as the number of students differs – this ratio would provide three staff at 600 students and 1.5 staff at 300 students, thereby avoiding a “cliff” at any point. A last type of ratio is the one used to provide staff for prevention, intervention, and remediation, which is based upon a population of children needing services (determined by free lunch factors) according to a pupil teacher ratio in range of 10:1 to 18:1, based upon division-level failure rates on Standards of Learning (SOL) English and mathematics tests for all students.

In the case of some support positions, school divisions are required to provide services necessary for the efficient and cost-effective operation of the schools although funding is based on prevailing statewide expenditures (as in pupil transportation and plant operations and maintenance).

Additional Research

Efficiency Studies

As part of this study, APA reviewed all of the division level efficiency studies conducted in the past few years, which were posted on the Virginia Department of Education’s website.¹ The studies were undertaken by a few different companies and have been completed for 34 school divisions to date. The earliest study was posted in January 2004, with the most recent study posted in May 2009. The efficiency studies look at a number of areas of division operations, ranging from educational service delivery to transportation. APA focused its review on any information regarding the SOQ ratios.

APA found very little information in the efficiency studies that would suggest needed changes to the current SOQ ratios. Almost uniformly the studies indicate that districts are currently meeting the minimum SOQ ratios. The SOQ ratios examined in the efficiency studies are generally instructional ratios such as those for teachers, principals and assistant principals. The studies often note the districts are meeting the SOQ ratios and then change the analysis to division comparisons to determine if a district is staffing in an efficient manner, rather than analyzing whether ratios should be increased or decreased. In a few cases the SOQ ratios are used as an efficiency measure. If a district has more staff than the SOQ ratios require the study might suggest a reduction in the level of staffing; this was almost always related to school level administration. Again, overall the studies provided little guidance as to any needed changes to the SOQ ratios.

Phone Calls

APA also agreed to interview states that use personnel as the principal factor in funding school districts. With the help of Michael Griffith, Senior Policy Analyst from the Education Commission of the States (ECS), APA identified six states that use this type of funding system. The states are Alabama, Delaware, Idaho, North Carolina, Tennessee and West Virginia. It is important to note that none of these states

¹ <http://www.doe.virginia.gov/VDOE/efficiencyreview.html>

fund exactly like Virginia. An example of the differences is that every state has some sort of ratio for teachers, but some states include funding for teachers such as art or P.E. teachers in that figure while others do not. These differences make it very hard to compare specific ratios state to state. However, after further examining the six states APA identified four states to contact, Alabama, Delaware, North Carolina and Tennessee. Table 1 below describes the allocations for the four states APA contacted. Again, it is important to remember that the ratios are not necessarily comparable since the systems implement the ratios differently. After repeated attempts to make contact with each of the four states APA was able to conduct interviews with Alabama and North Carolina.

In each of the interviews APA asked questions, such as:

1. Where did the ratios come from?
2. Are the ratio levels correct? Should any of them be higher? Lower?
3. Should other ratios be used?
4. As far as support staff goes, do you think any ratios are particularly important?

APA spoke to Craig Pouncey with the Alabama Department of Education. He mentioned that the ratios were set in 1995 and applied based on the ADM. The ratios used in Alabama focus on all certified teaching staff positions for the districts. At this point Alabama is comfortable with the ratios that are used. The state funds administrators and support staff based on the Southern Association of Colleges and Schools (SACS) ratios from 2000. The state has recently created funding streams for both technology coordinators and nurses. Both position types have been funded through line item appropriations that can be eliminated at anytime. Other operational staff members are allocated based on per teaching unit amounts.

The interview in North Carolina was with Philip Price from North Carolina Department of Education. He mentioned that North Carolina has used the personnel ratios since 1985. A full study was done at that time to set the ratios in order to meet the staffing needs of districts. Though some of the ratios have been changed since, notably the K-3 staffing ratio, many ratios have remained the same. The system has been challenged in court and been upheld. Any changes that have been made to the ratios have generally been to increase staffing levels. The state currently allocates a dollar amount per ADM to allow districts to decide what type of non-instructional support to provide with those dollars. The state is unique in that it guarantees a minimum salary amount for teachers, principals, assistant principals and guidance counselors. This means the district gets a minimum level of funding but also means they have little flexibility in how they use the funds allocated for these types of personnel. However, school districts in North Carolina do not have full autonomy like divisions in Virginia do.

Since APA was not able to interview a representative from either Delaware or Tennessee directly, APA examined existing documents regarding each state's funding system. The information for both states, in addition to Alabama and North Carolina, is contained in Table 1 on the following page. Information for Virginia is also included for comparison.

Table 1
Comparison of Staffing Allocations Between Virginia and Five Other States

State	Principal	Assistant Principal	Classroom Teachers	Resource Teachers	Instructional Technology Resource Teachers and Technology Support	English Language Learner (ELL) Teachers	Librarian	Guidance Counselor	Clerical Staff	Professional Instructional Positions and Aides	Nurses
Alabama	1 principal per school	Varies based on size of school and varies based on type of school. For Elementary, 0 below 660 students, .5 between 660 and 879, 1 between 880 and 1099, 1.5 between 1100 and 1319, 2 1320 and above	1 per 13.8 (grades K-3); 1 per 21.4 (grades 4-6); 1 per 20.1 (grades 7-8); 1 per 18.0 (grades 9-12)				Varies based on size of school and varies based on type of school. Cliff style approach to funding.	Varies based on size of school and varies based on type of school. Cliff style approach to funding.	1 for each 10 units for first 100 units, then 1 for each 12 units over 100 units	2 in lieu of a teacher in certain Special Education settings	One per system and an additional \$35.44 per ADM for additional nurses
Delaware*	1 for each 15 or more units in a school	1 for each 30, 55, 75, 95 units in a school	1 per 34.8 (half-day K); 1 per 17.4 (grades 1-3); 1 per 20 (grades 4-6); 1 per 20 (grades 7-12)								Part of Certified Instructional Support allocation of one per 200.10 ADM. District controls the allocations.
North Carolina	Any school above 100 students entitled to a principal	One month of assistant principal time per 80 ADM	1 per 18 (grades K-3); 1 per 22 (grades 4-6); 1 per 21 (grades 7-8); 1 per 24.5 (grade 9); 1 per 26.64 (grades 10-12)	Base allocation with a minimum of one teacher assistant per eligible LEA	Base allocation with a minimum of one teacher assistant per eligible LEA	Base allocation with a minimum of one teacher assistant per eligible LEA	Part of Certified Instructional Support allocation of one per 200.10 ADM. District controls the allocations.	Part of Certified Instructional Support allocation of one per 200.10 ADM. District controls the allocations.	Can be converted from the Certified Instructional Support allocation at two Non-Certified positions for every one certified position.	Part of Certified Instructional Support allocation of one per 200.10 ADM. District controls the allocations.	

*In Delaware, a district earns one unit for every 20 regular secondary education students, 17.4 regular elementary students, 10 mild special education students, six moderate special education students or four severe special education students. Staffing allocations are then based on the number of units a district has. If a district has more than half of the number of students required to generate a unit, the units are allocated for a full unit. (Report on Education Funding in Delaware, LEAD Committee 2008)

Table 1 (Continued)
Comparison of Staffing Allocations between Virginia and Five Other States

State	Principal	Assistant Principal	Classroom Teachers	Resource Teachers	Instructional Technology and Technology Support	English Language Learner (ELL) Teachers	Librarian	Guidance Counselor	Clerical Staff	Professional Instructional Positions and Aides	Nurses
Tennessee	1 half-time per school (with less than 225 students); 1 full-time per school (225 students or more)	1 half-time per school (elem with 660-678); 1 full-time per school (elem with 880-1,099 students); 1.5 per school (elem with 1,100-1,319 with more than 1,319 students); 1 half-time per school (secondary with 300-649 students); 1 full-time per school (secondary with 650-999 students); 1.5 per school (secondary with 1,000-1,249 students); 2 per school (secondary with more than 1,250 students) + 1 for each additional 250 students	(i) 24:1 in kindergarten with no class being larger than 29 students, if the average daily membership in any kindergarten class exceeds 24 pupils, a full-time teacher's aide shall be assigned to the class; (ii) 24:1 in grades 1, 2, and 3 with no class being larger than 30 students; (iii) 25:1 in grades 4 through six with no class being larger than 35 students; and (iv) 24:1 in English classes in grade 6 through 12.	Local school boards shall employ five full-time equivalent positions per 1,000 students in grades kindergarten through five to serve as elementary resource teachers in art, music, and physical education.	Local school boards shall employ two full-time equivalent positions per 1,000 students in grades kindergarten through 12, one to provide technology support and one to serve as an instructional technology resource teacher.	17 full-time equivalent instructional positions for each 1,000 students identified as having limited English proficiency.	Librarians in elementary schools, one part-time to 299 students, one full-time at 300 students; librarians in middle schools, one full-time at 300 students; two full-time at 1,000 students; librarians in high schools, one half-time to 299 students, one full-time at 300 students	Guidance counselors in elementary school, one hour per day per 100 students, one full-time at 500 students, one hour per day additional time per 100 students or major fraction thereof; guidance counselors in middle schools, one period per 80 students, one full-time at 400 students, one additional period per 80 students or major fraction thereof; guidance counselors in high schools, one full-time at 1,000 students, one period per 70 students, one additional period per 70 students or major fraction thereof	Clerical personnel in elementary schools, part-time to 299 students, one full-time at 300 students; clerical personnel in middle schools, one full-time and one additional time for each 600 students beyond 200 students and one full-time for the library at 750 students; clerical personnel in high schools, one full-time and one additional full-time for each 600 students beyond 200 students and one full-time for the library at 750 students.	1 per 16.67 vocational FTEADM (grades K-3); 1 SpEd assistant per 60 SpEd students; 1 instructional assistant per 75 ADM (grades K-6); SpEd staff based on disability	1 per 3,000 ADM
Virginia	Principals in elementary schools, one half-time to 299 students, one full-time at 300 students; principals in middle schools, one full-time, time at 900 students; assistant principals in middle schools, one full-time for each 600 students; assistant principals in high schools, one full-time, to be employed on a 12-month basis	Assistant principals in elementary schools, one half-time at 600 students, one full-time at 900 students; assistant principals in middle schools, one full-time for each 600 students; assistant principals in high schools, one full-time, to be employed on a 12-month basis	For each 600 students	For each 600 students	For each 600 students	For each 600 students	For each 600 students	For each 600 students	For each 600 students	For each 600 students	For each 600 students

Literature Review

Additionally, APA conducted a review of relevant literature. Over the years, there have been a plethora of studies on staffing ratios. The research can be categorized into three categories: (1) Empirical research; (2) Papers that utilize the research to produce conclusions on appropriate ratios; and (3) Accreditation standards. Some of this research can be used as the basis to set minimum or maximum staffing ratios in schools that may improve the odds of attaining particular student outcomes. For other staff positions, the relationships between ratios and outcomes are less direct. For example, clerical staff may not interact with students at all, yet the need for at least some clerical staff within the school is not disputed. Research on the direct and indirect relationships is presented in this analysis.

This analysis presents the empirical basis for lower student-to-staff ratios and then presents more specific information on suggested ratios (if available in the literature).

Teachers

There is a wide body of literature documenting the positive impact of small class sizes for students in grades K-3. Specifically, the research documents that smaller classes are especially beneficial for reading and math achievement and for low-income and minority students (Robinson, 1990; Achilles, 1999; Gerber, Finn, Achilles, & Boyd-Zaharias, 2001; Grissmer, 1999; Nye, Hedges, & Konstantopoulos, 2002; Finn & Achilles, 1999; Miller, 2002).

An early meta-analysis of class sizes studies was completed by Glass and Smith in 1979. This meta-analysis concluded that class sizes of 20 students or fewer can have a positive effect on academic achievement (Glass & Smith, 1979). An evaluation of a class size reduction policy in Indiana documents the positive impacts of class sizes of 15 students or less (Chase, Mueller, & Walden, 1986). Probably the most influential study to date is the Tennessee Project STAR, a large-scale randomized study of students in grades K-3. Data from this study indicated that students in classes with 13-17 students outperformed students in classes with 22-26 students, even when the larger classes added an aide (Word, et al., 1990; Gerber, Finn, Achilles, & Boyd-Zaharias, 2001). Subsequent analysis of STAR data has shown that small classes in the early grades produce lasting benefits for students, such as higher high school graduation rates (Krueger & Whitmore, 1998; Cohen, Miller, Stonehill, & Geddes, 2000; Egelson, Harman, Hood, & Achilles, 2002; Finn, Fox, McClellan, Achilles, & Boyd-Zaharias, 2006; Finn, Gerber, & Boyd-Zaharias, 2005; Nye, Hedges, & Konstantopoulos, 2000).

While the research on class sizes in the early elementary grades is substantial, there is little or no research to suggest that small middle or high school class sizes are beneficial to student performance. According to Odden et. al., (2005), most comprehensive school reform models propose class sizes of 25 or less (Stringfield, Ross, & Smith, 1996; Odden A., 1997). The Northwest Association of Accredited Schools (NAAS) sets an accreditation standard of no more than 160 students per teacher's grading period if on a traditional schedule, 140 students if on a trimester schedule, and 180 students if on a block schedule (Northwest Association of Accredited Schools, 2008). How this translates to actual student-to-teacher ratios and class size is unclear.

At least one author found that small classes not only improve student achievement, but also are more cost effective than regular classes with aides (Grissmer, 1999). It is important to note that student-to-teacher ratios are not synonymous with class sizes. The research indicates that it is important to provide an adequate number of teachers to maintain these class sizes, and allow teachers time for professional development, collaboration, and planning. Additional teachers may also be necessary if the school provides tutoring outside of regular school hours or the school year. The actual number of teachers required to do this may vary significantly due to school schedules and regulations.

Special Education Teachers

A number of studies document the positive impact of smaller student-to-teacher ratios and smaller class sizes on the academic outcomes of special education students (Thurlow, Ysseldyke, Wotruba, & Algozzine, 1993; Keith, Fortune, & Keith, 1993; Keith, Keith, Young, & Fortune, 1993). Special education students often require more personal attention than basic education students. Specifically, one study found that special education students were likely to spend more time engaged and teachers were more active and adaptive when student-to-teacher ratios were lower (The Council for Exceptional Children, 1989). A Virginia study concluded that special education students in smaller classes achieved at higher levels in reading, math, and social studies than their peers in larger classes (Keith, 1993). Researchers in New York reported that larger special education classes were associated with less time spent on academics and higher incidences of misbehavior (MAGI Educational Services, 1995).

One research study found that the maximum special education student-to-teacher ratio was typically 15-to-1 (McCrea, 1996). In the report from Virginia (referenced above), teachers believed that manageable class sizes without paraprofessionals were not much smaller than manageable class sizes with paraprofessionals (Keith, Fortune, & Keith, 1993).

Unfortunately, information on the *optimal* student-to-teacher ratio for special education students is relatively sparse. One of the few existing studies compares special education student-to-teacher ratios of 1-to-1, 3-to-1, 6-to-1, 9-to-1, and 12-to-1 and found that academic engagement, task completion, task success, and instruction were both significantly better under lower ratios (Thurlow, Ysseldyke, Wotruba, & Algozzine, 1993). Another study on class size and special education students concluded that although students performed better under lower ratios, there was no optimal student-to-teacher ratio that should be recommended (McCrea, 1996).

ESL Teachers

Research on class size and student-to-teacher ratios for English-as-a-Second-Language (ESL) students is similar in nature to the research for all students, although the research base for ESL students is considerably smaller. That is, the limited research generally suggests that lower class sizes and student-to-teacher ratios are beneficial, but does not reach any conclusions about optimal class sizes or ratios. For example, programs such as *Éxito Para Todos*, the bilingual adaptation of *Success for All* “increases chances of academic success by reducing student-to-teacher ratio”, but does not recommend a particular ratio (Slavin & Madden, 1999).

Another study found that smaller class sizes with less pull-out time positively impact the oral proficiency of ESL students in first grade (Oberg, 1993). Specifically, this study compared the oral proficiency of ESL students in 45-minute classes with six to eight students with the proficiency of ESL students in 90-minute classes with nine to fifteen students (Oberg, 1993). A Texas evaluation of high performing ESL students showed an average ESL student-to-teacher ratio of 24-to-1 (Texas Education Agency and Texas A&M University, Corpus Christi, 2000). In an effort to identify the appropriate student-to-teacher ratio for ELL students, one group of researchers initially recommended providing 0.4 FTE teachers for every 100 ELL students, in addition to tutoring resources (Odden, et al., 2005). Based on input from professional judgment panels, this recommendation was later modified to 1.0 FTE teacher for every 100 ELL students.

School Administrators

APA was unable to locate much research on the impact of student-to-administrator ratios. Because most schools have at least 1 FTE principal, there has not been much research on the differences between schools that have a principal and those that do not. The only study that addressed these ratios was a comparison between California schools that “beat the odds” and other California schools. Schools that “beat the odds” were defined as those that consistently performed at higher levels than predicted by their demographics. This study found that student-to-administrator ratios were lower in elementary schools that beat the odds (Perez, et al., 2007). NAAS also sets a maximum ratio of 550 students per administrator as one of its accreditation standards (Northwest Association of Accredited Schools, 2008).

Clerical Staff

There is also virtually no research on the impact of clerical staff on student achievement. This is not surprising given that clerical staff have little or no direct impact on instruction. Nonetheless, every school needs clerical staff to help manage day-to-day school operations. NAAS recommends one administrative support staff member for each 350 students (Northwest Association of Accredited Schools, 2008).

Instructional Aides

There is very little research on the relationship between instructional aides and academic achievement and what research exists is largely contradictory.

Using data from Tennessee’s Project STAR, one researcher concluded that students in smaller K-3 classes outperformed those in larger classes even when an aide was present in the larger classes (Word, et al., 1990). Another study using STAR data examined the short- and long-term effects of teacher aides on student academic achievement. These researchers found little positive impact of teacher aides on student achievement (Achilles, Finn, Gerber, & Boyd-Zaharias, 2000). According to other researchers, students in regular-sized classes with and without aides show little difference in reading achievement (Slavin, 1994; Gerber, Finn, Achilles, & Boyd-Zaharias, 2001). In some cases, students in classes with aides actually performed more poorly than students in classes without an aide (Finn, Gerber, Farber, & Achilles, 2000). In addition, an analysis of achievement and costs concluded that small class sizes were

more likely to improve achievement than the presence of aides, and also more cost effective than regular sized classes with aides (Grissmer, 1999).

Nonetheless, some research indicates that instructional aides may be helpful in some situations. One study found that the presence of an instructional assistant may influence reading and language achievement in schools with higher socio-economic levels (Lapsley, Daytner, Kelly, & Maxwell, 2002). Another study concluded that early primary school students who were in a class with an aide for a year or more performed higher on the SAT reading test (Finn, Gerber, Farber, & Achilles, 2000). Finally, an evaluation of a class size reduction policy in Indiana found that achievement scores were higher in classrooms with an instructional assistant than in unassisted classrooms (Lapsley, Daytner, Kelly, & Maxwell, 2002).

Library Staff

The literature indicates that a qualified library media specialist, a larger library staff, and a library staffed for more hours may improve student test performance, grades, reading comprehension, research skills and the ability to express ideas effectively (Baumbach, 2002; Baxter & Smalley, 2003; Lance, 1994; Haycock, 1995; Lance, Rodney, & Hamilton-Pennell, 2000; Smith, 2001).

Specifically, the research recommends that each school library have at-least one full-time certified library media specialist and one full-time support staff member (Baumbach, 2002; Smith, 2001). Another study provides evidence that students from high schools with library media teachers display better research skills in college (Smalley, 2004). NAAS recommends the following staffing ratios: one library media specialist for schools with 500 or fewer students, and one library media specialist plus an unspecified number of additional library media personnel at schools with more than 500 students. The NAAS standards do not require a certified library media specialist for schools with less than 250 students.

Nurses

Research on school nurses indicates that lower student-to-nurse ratios are likely to have positive impacts on student well-being (Bradley, 1998; Fryer & Igoe, 1995; Guttu, Engelke, & Swanson, 2004). An evaluation in Missouri found that as student-to-nurse ratios improved, the length of time spent in the health center decreased and more students returned to class after visiting the health center (Igoe, 2002). In a 2003 meta-analysis, researchers concluded that school nursing strategies that are targeted at specific student populations had positive effects on student academic performance (Maughan, 2003). A Seattle study found that students who were able to receive health care at school demonstrated more classroom attentiveness (Barkan, Pfohman, & Bolan, 2004). Furthermore, this study indicated that school health clinics helped reduce absenteeism, the number of dropouts, and helped improve school safety, student performance, substance abuse problems, and pregnancy rates (Bradley, 1998).

Although no specific student-to-nurse ratios can be recommended by reviewing the literature, the federal government advocates a student-to-nurse ratio of 750-to-1 (U.S. Department of Health and

Human Services (2000), *Health People*, 2010). The research on health clinics also indicates that a health clinic at each school with at least one full-time staff member may also be advantageous (Bradley, 1998).

Custodians and Maintenance Workers

There is no research linking custodians and maintenance workers to student achievement. However, these staff members perform essential duties within the school. A set of researchers has developed a formula that they believe takes all custodial duties into account (Odden, et al., 2005). This formula is:

(1 custodian for every 13 teachers + 1 custodian for every 325 students + 1 custodian for every 13 classrooms + 1 custodian for every 18,000 gross square feet) / 4.

One author has also outlined a very detailed formula for estimating the number of necessary maintenance workers. For more information, please see references to the work of Odden, et al., 2005.

Technology Specialist

The research identifies a technology specialist as an integral component of computer and information technology programs (Beglau, 2005; Dexter, Seashore, & Anderson, 2003; Stringfield, Ross, & Smith, 1996; North Central Regional Educational Lab, 2005; Wenglinisky, 2005). A technology specialist typically troubleshoots technology problems, maintains technology, and trains teachers in how to integrate technology into their instruction (North Central Regional Educational Lab, 2005). Studies have found this training to be important to how teachers use technology in their classrooms (Becker, 1994).

Counselors

The literature consistently documents the positive impact on student academic performance and behavior (Gerler, 1985; Prout & DeMartino, 1986; St. Clair, 1989; Lapan, Gysbers, & Petroski, 2001). Specifically, a number of studies conclude that school counseling may decrease inappropriate behavior, improve student-teacher relationships, and improve student ability to stay on task (Baker & Gerler, 2001; Lapan, Gysbers, & Petroski, 2001; Watts & Thomas, 1997). Counselors may also help to improve students' social skills, self-awareness, and other developmental skills (Borders & Drury, 1992; Litrell, Malia, & Vanderwood, 1995; Verduyn, Lord, & Forrest, 1990; Schlossberg, Morris, & Lieberman, 2001). A fairly recent study used regression models to investigate the relationship between student-to-counselor ratios and student discipline. The study found significant substantial decreases in discipline problems as the ratios decreased (Carrell & Carell, 2006). Decreases were especially pronounced among black male students and low-income students (Carrell & Carell, 2006).

Academically, several studies have found that counselors helped students improve their grades (Gerler, 1985; Watts & Thomas, 1997; Lee, 1993). The influence of counselors may continue beyond high school as well. Research has concluded that counselors help students define career plans, increase their aspirations, and reduce drop-out rates (Beardan, Spencer, & Moracco, 1989; Lapan, Gysbers, & Yongmin, 1997; Kaufman, Kiein, & Frase, 1999; Mau, Hitchcock, & Calvert, 1998; Whiston & Sexton, 1998).

NAAS sets its accreditation standard at a ratio of 300 students for each staff member providing guidance and counseling (Northwest Association of Accredited Schools, 2008). The American School Counselor Association recommends a student-to-counselor ratio of 250-to-1. The Carrell & Carrell (2006) study indicated that this ratio was helpful in reducing discipline problems.

Examining Personnel Ratios in Virginia School Divisions

Defining and Measuring Personnel

In order to help us understand how the SOQ personnel ratios work in Virginia, we felt that it was important to examine data for every school division. We had three objectives in mind when we undertook this examination: (1) to understand the relationship between numbers of personnel allotted to each school division by division characteristics, particularly size (enrollment level) and need (the personnel implications of having students with special needs); (2) to understand the relationship between the actual number of personnel employed as reported by school divisions and the number allotted by SOQs; and (3) to understand whatever variation might exist across school divisions in both allotted and actual numbers of employees. The first objective provides information about whether the personnel ratios are working appropriately while the second objective provides information about how well the personnel ratios represent how districts deliver education services; the third objective allows us to delve into the equity of the system.

In order to undertake these examinations for Virginia as a whole, we asked the VDOE to provide us with data about: (1) the numbers and characteristics of students enrolled in school divisions; (2) the number of employees allotted to each school division in every SOQ personnel category for which a personnel ratio exists; and (3) the number of staff actually employed in every personnel category for which a personnel ratio exists. We made a number of decisions about what data we would examine and how it would be organized based on discussions with VDOE staff and mutual agreement about how to proceed as quickly as possible given the time constraints that existed for our work: (1) we would focus on the 2007-08 year because these data become the basis for cost rebenchmarking in the 2010-2012 biennium; (2) data would be organized into 132 school divisions based upon how school divisions are paid and how Virginia's report card data are aggregated; and (3) certain personnel categories would be aggregated, primarily elementary teaching staff and secondary teaching staff.

In order to examine what personnel are allotted in the SOQ and what personnel are actually employed by a school division, the VDOE provided information to us related to estimating positions generated in the SOQ model using comparable cost and FTE factors. The estimated positions generated by the SOQ model (solely for the purposes of this study) and provided to us by the VDOE are what we view as allotted positions. For the actual positions employed, we used personnel information provided to us from the VDOE as reported by school divisions in the Annual School Report for the 2007-2008 school year, which represent the data that will be used to estimate SOQ costs for the 2010-2012 biennial budget in Virginia. The Annual School Report is a multi-faceted reporting tool that is used for federal reporting and other purposes, not solely for the purpose of generating SOQ costs and positions.

Because of the nature of the Annual School Report and the significant burden of reporting that it places on school divisions, it is our understanding that it is not possible to conform the personnel section of this report to a format that is 100 percent compatible to the structure of the SOQ model. Consequently, the ability to correlate the allotted positions to those actually employed is challenging and needs to be considered when examining variations in the different categories of positions.

We determined that the only way we could compare divisions was to translate numbers of employees allotted or actually employed into numbers of employees per 1,000 students. This is the case because there are variations across school divisions in enrollment and student demographic characteristics. Because of the autonomous nature of Virginia school divisions, this means that every division is likely to have a different number of employees, allotted or actual, which makes it impossible to interpret whether the system is working appropriately. While we could have used the ratio of numbers of actual-to-allotted staff to examine the second objective identified above, and never had to look at employees per 1,000 students, it would have been impossible to examine the first objective without doing so.

Using employees per 1,000 students is useful for several reasons. First, it is easy to interpret: for example, if an SOQ ratio were expressed as one teacher per 25 students, that equals 40 teachers per 1,000 students. Additionally, a standard based on every 1,000 students can be used to compare different categories of personnel to one another, is a more comparable measure across school divisions, and is easy to compare over time.

Before we look at employee figures, it is useful to understand some of the differences that exist across the 132 Virginia school divisions. We obtained 2005-2006 data from the National Center for Education Statistics (NCES of the U.S. Department of Education) in order to look at enrollment and demographic characteristics. We found that the average enrollment of Virginia school divisions was about 9,250 students although 11 divisions had fewer than 1,000 students and 13 divisions had more than 20,000 students. While 31.4 percent of all students were eligible for free and reduced price lunch, in 19 divisions fewer than 20 percent of all students were so eligible and in 14 divisions more than 60 percent of all students participated in the free and reduced price lunch program. On average, 14.0 percent of all students had individualized education programs (IEPs), making them eligible to participate in special education programs, although in four divisions fewer than 10 percent of all students were in special education programs and in six divisions, more than 20 percent of all students were in special education programs. Finally, across the Commonwealth, about 7.1 percent of all students were English language learners, although these students were concentrated in the 15 districts in which more than 15 percent of all students were English language learners. In light of these figures, it is likely that no two school divisions face the same cost pressures based on student demographic characteristics.

Given that we want to understand how the allocation of personnel, both allotted and actual, are related to school division size and need, we had to have ways of measuring these factors. Size is relatively easy – division enrollment can be used. In the case of need, we developed a procedure to assign “weights” to students based on three types of need: participation in special education, eligibility for free lunch, and being a student with limited English-proficiency (LEP). Weights are factors (numbers such as .10 or .85)

that estimate the added resources to serve students with different needs relative to students with no special needs (who would be counted, or weighted, at 1.00). The ratio of weighted to unweighted students is an indicator of the relative need of each school division. The weighting factors allow APA to compare the relative levels of need in each district.

For example, if a characteristic contained a weight of .25, indicating that 25 percent more resources were required for that characteristic compared to a student with no special need, then a weight would exist totaling 1.25. If a school division had a total of 2,500 students and 40 percent of those students had that characteristic ($2,500 \times .40 = 1,000$) while 60 percent of the students had no special need ($2,500 \times .60 = 1,500$), then the weighted student count for the division would be 2,750 ($1,000 \times 1.25 = 1,250$) + ($1,500 \times 1.00 = 1,500$.) In this case, the relative need of the division would be 1.10 ($2,750/2,500$), or 10 percent higher than a district containing only students with no special needs or characteristics.

We used three weights in determining the relative need of Virginia's school divisions: (1) an economically disadvantaged student weight of .25; (2) an LEP weight of .40; and (3) a special education weight of 1.0; they are an estimate of the additional resources spent on each type of student. The weights come from research APA has done around the country and have been similarly applied in studies conducted by APA in other states. In this case, as in the other studies, APA is simply creating a convenient measure of need to help the analysis. The weights are applied to the actual student data for each of Virginia's school divisions. The weights are only being used in APA's analysis as a way to examine if the SOQ models take the need of a district into account; they are not meant to be a recommendation of how Virginia should allocate resources. Applying these weights, the range in the ratio of weighted to unweighted students among the school divisions is 1.12 to 1.40.

Using the information provided to APA by VDOE, APA began to analyze the relationships between actual division staffing and staff allocations through the SOQ, and division factors such as size and student need.

Variations in Allotted and Actual Personnel across School Divisions

The figures in Tables 2A and 2B provide some basic statewide information for 23 types of personnel (14 instructional and 9 support categories) in three areas:

1. Personnel actually employed in that category per 1,000 students;
2. Personnel allotted by SOQ ratios per 1,000 students; and
3. The ratio of actual to SOQ allotted figures (actual staffing divided by SOQ allocation).

The basic information provided includes: (1) the statewide average; (2) the standard deviation of the distribution of school divisions; (3) the coefficient of variation; (4) the correlation between numbers of personnel and the size (enrollment) of all school divisions; and (5) the correlation between numbers of personnel and the relative needs of all school divisions. What each of these figures means is explained in further detail below:

1. *The statewide average*, which is the simple average across all school divisions, expressed as personnel per 1,000 students as discussed previously. This figure is not weighted by district enrollment so it cannot be used to estimate statewide costs.
2. *The standard deviation*, which is an indicator of variation. Nearly seventy percent of all data points will be within plus or minus one standard deviation from the mean, with ninety-five percent being within plus or minus two standard deviations. Therefore, a larger standard deviation figure indicates that division figures are more spread out from the mean, while a smaller standard deviation figure means that they are more closely gathered around the mean. However, for the purposes of this study, this figure is not of much use by itself, so instead we use this figure to calculate the coefficient of variation, which is a better indicator of variation because it can be used to compare across SOQs.
3. *The coefficient of variation*, which is the standard deviation divided by the average. This figure indicates the extent to which the figures for divisions differ from one another. Figures above .20 suggest quite a bit of variation because it means that a third of all divisions have figures that might be either more than 20 percent higher than the average or more than 20 percent lower than the average.
4. *Correlation with division size*, which shows if there is a relationship between the numbers of personnel and the size (enrollment) of all school divisions. Figures below .300 are thought of as being a “weak” relationship. It is also worth noting if the correlation is positive or negative. In this case, a positive correlation would indicate that as the size of the division grew, so did the number of personnel they employ per 1,000 students, while a negative figure would indicate that as division size grew, the number of personnel per 1,000 tends to decrease.
5. *Correlation with student need*, which shows if there is a relationship between the numbers of personnel and the relative needs of all school divisions. As mentioned in an earlier section, this relative need factor is the ratio of weighted to unweighted students. Students are assigned a weight based on their special needs (being economically disadvantaged, an English Language Learner, or being in special education) to reflect the additional resources divisions typically employ to meet these student needs. As with the size correlation figures, a relationship below .300 is considered weak, and the sign [+ or -] demonstrates whether the relationship is positive or negative.

To more clearly illustrate how these figures are used, we can use Elementary Teachers, the first personnel category in Table 2A, as an example. There are three rows of information for elementary teachers: (1) the number of elementary teachers that are actually employed in all of the divisions, (2) the number of elementary teachers allocated to divisions based on SOQs, and (3) the ratio of actual teachers to allocated teachers. Looking at the first row, actual elementary teachers employed, the first column of data shows the average number of teachers per 1,000 students, which is 80.62. The second

column of data is the standard deviation, which is 12.78. This means that nearly seventy percent of divisions employ between 67.8 ($80.62 - 12.78$ or one standard deviation) and 93.4 ($80.62 + 12.78$ or one standard deviation) teachers per 1,000 students, and ninety-five percent employ between 55.1 ($80.62 - 15.56$ or two standard deviations) and 106.2 ($80.62 + 15.56$ or two standard deviations) teachers per 1,000 students. The third column of data shows the coefficient of variation, which puts the variation between division figures in a better perspective. In this case, that figure is .16; while the standard deviation may seem to indicate a wide variation from the mean, the coefficient of variation is actually fairly low, so it is not an area for concern. The final two columns of data show the correlation with division size and with student need. The correlation figure for size is $-.199$, which indicates a slight negative relationship between division size and number of teachers per 1,000. This is not unusual, since small schools tend to have lower teacher to student ratios than larger schools. However, since this figure is less than $\pm .300$, it is still a weak relationship. The correlation figure for student need, on the other hand, is above $.300$ at $.331$ so it indicates that there is a moderately positive relationship between student need and number of teachers employed, meaning the higher the relative need is in a school district, the more teachers that they employ.

It is worth noting that a few types of personnel account for a large portion of all the personnel actually employed in school divisions. The total number of people actually employed in the 23 types of personnel we examined was 160,648, based on data from the 2007-2008 Annual School Report as provided by the department. Of these, 124,226 were instructional staff and 36,422 were support staff. Among instructional staff, elementary and secondary teachers account for 75.3 percent of all staff actually employed; adding elementary and secondary teacher aides to this teacher total account for 90.5 percent of all instructional staff (so four of the 14 types of instructional personnel represent 90 percent of all instructional staff). Similarly, school-based clerical and technical clerical personnel account for 75.7 percent of all support staff. The fact is that six types of personnel (elementary and secondary teachers and aides plus school-based and technical clerical workers – or six out of 23 types of personnel) account for 87 percent (or about five out of every six) employees.

Table 2A
 Instructional Staff per 1,000, Comparison between Actual Staffing and SOQ
 Descriptive Statistics

Position	Average	Standard Deviation	Coefficient of Variation	Correlation with Division Size	Correlation with Student Need
Elementary Teachers Actual per 1,000	80.62	12.78	0.16	-0.199	0.331
Elementary Teachers SOQ per 1,000	69.94	7.12	0.10	-0.180	0.188
<i>Elementary Teacher Ratio</i>	<i>1.16</i>	<i>0.18</i>	<i>0.16</i>	<i>-0.097</i>	<i>0.219</i>
Secondary Teachers Actual per 1,000	88.48	17.18	0.19	-0.120	0.289
Secondary Teachers SOQ per 1,000	76.41	9.61	0.13	-0.226	0.229
<i>Secondary Teacher Ratio</i>	<i>1.17</i>	<i>0.22</i>	<i>0.19</i>	<i>0.018</i>	<i>0.154</i>
Elementary Teacher Aides Actual per 1000	23.19	8.75	0.38	-0.211	0.041
Elementary Teacher Aides SOQ per 1000	2.63	1.30	0.49	-0.074	0.002
<i>Elementary Teacher Aides Ratio</i>	<i>10.46</i>	<i>7.34</i>	<i>0.70</i>	<i>-0.114</i>	<i>0.023</i>
Secondary Teacher Aides per 1000 Actual	11.20	6.48	0.58	-0.070	0.069
Secondary Teacher Aides per 1000 SOQ	2.02	1.09	0.54	-0.035	0.136
<i>Secondary Teacher Aides Ratio</i>	<i>6.71</i>	<i>5.98</i>	<i>0.89</i>	<i>-0.064</i>	<i>0.003</i>
Elementary Guidance Actual per 1,000	2.49	0.87	0.35	-0.049	0.218
Elementary Guidance SOQ per 1,000	1.60	0.21	0.13	-0.030	0.010
<i>Elementary Guidance Ratio</i>	<i>1.57</i>	<i>0.55</i>	<i>0.35</i>	<i>-0.048</i>	<i>0.195</i>
Secondary Guidance Actual per 1,000	4.11	1.46	0.35	0.129	0.233
Secondary Guidance SOQ per 1,000	3.93	1.18	0.30	-0.023	-0.235
<i>Secondary Guidance Ratio</i>	<i>1.09</i>	<i>0.40</i>	<i>0.37</i>	<i>0.107</i>	<i>0.284</i>
Elementary Librarian Actual per 1,000	2.18	1.07	0.49	-0.165	0.156
Elementary Librarian SOQ per 1,000	1.70	0.43	0.26	-0.241	0.110
<i>Elementary Librarian Ratio</i>	<i>1.29</i>	<i>0.50</i>	<i>0.39</i>	<i>-0.055</i>	<i>0.120</i>
Secondary Librarian Actual per 1,000	1.67	0.87	0.52	-0.082	0.153
Secondary Librarian SOQ per 1,000	2.52	1.24	0.49	-0.214	-0.145
<i>Secondary Librarian Ratio</i>	<i>0.71</i>	<i>0.34</i>	<i>0.48</i>	<i>0.092</i>	<i>0.145</i>
Elementary Principal Actual per 1,000	2.43	0.95	0.39	-0.275	0.216
Elementary Principal SOQ per 1,000	1.70	0.43	0.26	-0.241	0.110
<i>Elementary Principal Ratio</i>	<i>1.42</i>	<i>0.37</i>	<i>0.26</i>	<i>-0.212</i>	<i>0.221</i>
Secondary Principal Actual per 1,000	1.96	1.23	0.63	-0.280	0.152
Secondary Principal SOQ per 1,000	2.49	2.06	0.83	-0.241	-0.104
<i>Secondary Principal Ratio</i>	<i>0.85</i>	<i>0.30</i>	<i>0.36</i>	<i>0.025</i>	<i>0.234</i>
Elementary Asst. Principal Actual per 1,000	1.41	0.89	0.64	0.128	0.059
Elementary Asst. Principal SOQ per 1,000	0.14	0.20	1.44	0.230	-0.103
<i>Elementary Asst. Principal Ratio</i>	<i>6.69</i>	<i>4.59</i>	<i>0.69</i>	<i>0.008</i>	<i>0.168</i>
Secondary Asst. Principal Actual per 1,000	2.61	0.98	0.37	0.049	0.115
Secondary Asst. Principal SOQ per 1,000	1.14	0.76	0.67	0.295	-0.230
<i>Secondary Asst. Principal Ratio</i>	<i>1.92</i>	<i>0.85</i>	<i>0.44</i>	<i>-0.140</i>	<i>0.299</i>
Elementary Tech Teacher Actual per 1,000	1.09	1.14	1.05	0.070	0.001
Elementary Tech Teacher SOQ per 1,000	1.02	0.06	0.05	0.005	-0.387
<i>Elementary Tech Teacher Ratio</i>	<i>1.07</i>	<i>1.13</i>	<i>1.06</i>	<i>0.067</i>	<i>0.027</i>
Secondary Tech Teacher Actual per 1,000	1.45	1.69	1.16	0.017	0.045
Secondary Tech Teacher SOQ per 1,000	1.07	0.21	0.19	-0.043	-0.259
<i>Secondary Tech Teacher Ratio</i>	<i>1.38</i>	<i>1.60</i>	<i>1.16</i>	<i>0.015</i>	<i>0.059</i>

Table 2B
 Support Staff per 1,000, Comparison between Actual Staffing and SOQ
 Descriptive Statistics

Position	Average	Standard Deviation	Coefficient of Variation	Correlation with Division Size	Correlation with Student Need
Instructional Professional Actual per 1,000	3.02	2.22	0.73	0.013	0.179
Instructional Professional SOQ per 1,000	2.97	0.07	0.02	-0.067	-0.121
<i>Instructional Professional Ratio</i>	<i>1.02</i>	<i>0.75</i>	<i>0.74</i>	<i>0.015</i>	<i>0.181</i>
General O&M Actual per 1,000	0.29	0.25	0.86	0.017	0.193
General O&M SOQ per 1,000	0.35	0.01	0.02	-0.063	-0.155
<i>General O&M Ratio</i>	<i>0.85</i>	<i>0.73</i>	<i>0.86</i>	<i>0.018</i>	<i>0.191</i>
Technical Support Actual per 1,000	1.83	1.06	0.58	0.029	0.019
Technical Support SOQ per 1,000	1.53	0.04	0.02	-0.067	-0.123
<i>Technical Support Ratio</i>	<i>1.20</i>	<i>0.70</i>	<i>0.58</i>	<i>0.031</i>	<i>0.023</i>
School Based Clerical Actual per 1,000	4.88	1.73	0.35	0.108	0.199
School Based Clerical SOQ per 1,000	5.07	0.12	0.02	-0.111	-0.128
<i>School Based Clerical Ratio</i>	<i>0.96</i>	<i>0.34</i>	<i>0.36</i>	<i>0.116</i>	<i>0.203</i>
Technical Clerical Actual per 1,000	14.26	4.40	0.31	0.106	0.337
Technical Clerical SOQ per 1,000	15.16	0.37	0.02	-0.067	-0.124
<i>Technical Clerical Ratio</i>	<i>0.94</i>	<i>0.29</i>	<i>0.31</i>	<i>0.110</i>	<i>0.341</i>
Instructional Technical Actual per 1,000	2.62	1.94	0.74	0.041	0.091
Instructional Technical SOQ per 1,000	2.61	0.06	0.02	-0.068	-0.125
<i>Instructional Technical Clerical Ratio</i>	<i>1.01</i>	<i>0.75</i>	<i>0.74</i>	<i>0.042</i>	<i>0.093</i>
General Administration Actual per 1,000	0.73	0.78	1.07	0.064	0.217
General Administration SOQ per 1,000	0.81	0.02	0.02	-0.071	-0.116
<i>General Administration Ratio</i>	<i>0.89</i>	<i>0.96</i>	<i>1.07</i>	<i>0.064</i>	<i>0.216</i>
Attendance and Health Administration Actual per 1,000	1.17	0.79	0.67	0.040	0.027
Attendance and Health Administration SOQ per 1,000	1.38	0.03	0.02	-0.067	-0.127
<i>Attendance and Health Administration Ratio</i>	<i>0.85</i>	<i>0.57</i>	<i>0.67</i>	<i>0.043</i>	<i>0.031</i>
Assistant Superintendent Actual per 1,000	0.15	0.20	1.32	-0.093	-0.080
Assistant Superintendent SOQ per 1,000	0.24	0.01	0.03	-0.081	-0.102
<i>Assistant Superintendent Ratio</i>	<i>0.64</i>	<i>0.84</i>	<i>1.32</i>	<i>-0.093</i>	<i>-0.080</i>

Our expectations were that we would find: (1) a difference between the actual number of personnel per 1,000 students and the number of personnel allotted by each SOQ ratio (and that such differences would be such that the ratio of actual-to-allotted personnel would be greater than 1.00; not much variation in the number of personnel per 1,000 students allotted by an SOQ ratio; (2) if there were much variation in the number of personnel per 1,000 students allotted by an SOQ ratio, that variation might be associated with district size and/or district need; and (3) if there were much variation in the actual number of personnel per 1,000 students, it would be related to the needs of school divisions. While we had hoped to examine the relationship between numbers of personnel and student performance, we found it very difficult to create a measure of student performance at the school division level that made sense. The state does not have such a measure and there are at least three ways that one might be created when there is agreement on the objective (including achievement test scores, student attendance, and graduation rates): based on absolute levels of student performance, change in student performance, and comparison of actual to expected performance based on student demographic characteristics.

There are a variety of issues worth noting about the figures shown in Tables 2A and 2B (Table 2A shows data for instructional personnel while Table 2B addresses support personnel). First, in 10 of the 14 types of instructional personnel, the average number of personnel actually employed is at least 10 percent *higher* than the average number of personnel allotted by an SOQ, as shown by the “ratio” row for those types of personnel being greater than 1.10 (shown under the “average” column); that is, for those types of personnel, school divisions tend to employ more people than they earn under the SOQ ratio. This includes the four categories of personnel that account for the vast majority of instructional personnel (as mentioned above). Again, this may be because the Annual School Report captures positions that are funded both within and outside of the SOQ and captures positions that are funded from state, federal, and local sources of funds, whether related to the SOQ or not.

At the same time, in four of the nine support personnel categories, the average number of personnel actually employed is at least 10 percent *lower* than the average number of personnel allotted by an SOQ. This can be seen where the “ratio” row for those types of personnel is less than .90 (shown under the “average” column). This is not the case for the two types of personnel that account for a large portion of all support staff (for which the average number employed is very close to the average number allotted). This suggests that school divisions tend to need more instructional staff than are provided under the SOQ ratios and that they are willing to trade off between support staff and instructional staff.

Second, in nine of the 14 types of instructional personnel categories (Table 2A), there is a high level of variation in the number of personnel per 1,000 students allotted by an SOQ (because the coefficient of variation was greater than .20) while at the same time the correlation between the number of personnel allotted by an SOQ and both school division size and school division need is weak (the correlation is between $-.300$ and $+.300$), therefore not explaining the variation that exists. This may be because some of the SOQs are school-based and are specified with “cliffs” under which schools in one size range are eligible to receive one level of personnel while schools in a different size range are eligible to receive a different level of personnel, resulting in dramatically different numbers of personnel per 1,000 students. When considering the coefficient of variation for these nine instructional personnel categories, in four cases the variation in actual personnel per 1,000 students is less than in the variation in the SOQ personnel per 1,000 students (three of which are administrator positions). Then, when looking at the correlation with student need, there are five instances where the correlation between actual personnel per 1,000 students and student need switches from being negative to being positive (although still weak) in comparison to the SOQ personnel per 1,000 students.

Third, the numbers of all types of support staff allotted under the SOQ ratios are very similar across school divisions (with coefficients of variation at or under .03), which reflects the fact that most of those SOQs are defined in terms of personnel per 1,000 students. Unfortunately, there is almost no relationship between numbers of support staff allotted under the SOQ ratios and the needs of school districts (in fact, while the relationships are weak, they are all negative); but the numbers of support staff actually employed are positively related to district needs (even if the relationships are still weak).

The figures in Tables 3 and 4 illustrate the relationships between numbers of personnel and school division size (Table 3) and need (Table 4) for the six instructional and support types of personnel that, taken together, represent over 90 percent of all personnel actually employed by school divisions. To illustrate these relationships, divisions are divided into five groups, or quintiles, so that differences in the averages of these groups could be examined. We use this procedure to see whether patterns exist even though correlations might be low. In Table 4, that meant that divisions were divided into quintiles by their size, with the 1st quintile being the 20 percent of divisions that are the smallest, up to the fifth quintile, which is the 20 percent of divisions that are the largest. The divisions were then similarly divided into quintiles based upon their student need, with the 1st quintile being the divisions that had the lowest need, and the 5th quintile being the divisions with the highest need (need being the weighted to unweighted student ratio described previously). Divisions could just have easily been divided into four groups, or ten groups; in this case, APA chose quintiles because it split the divisions into enough different groups to allow for meaningful comparison without making patterns difficult to see by having too many groups. This is standard practice undertaken in other studies.

Table 3
Instructional and Support Staff per 1,000, Comparison between Actual Staffing and SOQ
By Division Size Quintiles

Position	Division Size				
	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
	1,682 or Less	1,683- 2,627	2,628- 4,586	4,586- 10,598	Greater than 10,598
Elementary Teachers Actual per 1,000	89.57	79.49	81.23	78.86	74.06
Elementary Teachers SOQ per 1,000	76.17	69.89	69.26	67.70	66.79
<i>Elementary Teacher Ratio</i>	<i>1.19</i>	<i>1.14</i>	<i>1.18</i>	<i>1.17</i>	<i>1.11</i>
Secondary Teachers Actual per 1,000	93.83	89.01	87.00	85.29	87.55
Secondary Teachers SOQ per 1,000	83.74	75.65	75.69	75.69	71.60
<i>Secondary Teacher Ratio</i>	<i>1.13</i>	<i>1.18</i>	<i>1.15</i>	<i>1.14</i>	<i>1.22</i>
Elementary Teacher Aides per 1000 Actual	26.15	23.96	24.44	22.17	19.25
Elementary Teacher Aides per 1000 SOQ	3.02	2.45	2.69	2.47	2.55
<i>Elementary Teacher Aides Ratio</i>	<i>12.81</i>	<i>11.76</i>	<i>10.14</i>	<i>9.82</i>	<i>8.55</i>
Secondary Teacher Aides per 1000 Actual	13.33	11.71	11.06	10.35	11.53
Secondary Teacher Aides per 1000 SOQ	2.53	2.07	2.01	1.99	1.94
<i>Secondary Teacher Aides Ratio</i>	<i>6.08</i>	<i>7.37</i>	<i>6.91</i>	<i>7.24</i>	<i>6.87</i>
School Based Clerical Actual per 1,000	4.82	5.54	4.23	4.96	4.83
School Based Clerical SOQ per 1,000	5.06	5.04	5.12	5.06	5.07
<i>School Based Clerical Ratio</i>	<i>0.95</i>	<i>1.10</i>	<i>0.83</i>	<i>0.98</i>	<i>0.95</i>
Technical Clerical Actual per 1,000	15.34	12.88	14.05	13.90	15.19
Technical Clerical SOQ per 1,000	15.32	15.09	15.10	15.18	15.12
<i>Technical Clerical Ratio</i>	<i>1.01</i>	<i>0.85</i>	<i>0.93</i>	<i>0.92</i>	<i>1.00</i>

Table 4
Instructional and Support Staff per 1,000, Comparison between Actual Staffing and SOQ
By Student Need Quintiles

Position	Student Need (Weighted to Unweighted Student Ratio)				
	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
	1.200 or Less	1.201- 1.240	1.241- 1.270	1.271- 1.304	Greater than 1.304
Elementary Teachers Actual per 1,000	74.53	76.13	87.80	81.75	85.46
Elementary Teachers SOQ per 1,000	67.66	69.39	71.40	69.55	72.21
<i>Elementary Teacher Ratio</i>	<i>1.10</i>	<i>1.10</i>	<i>1.24</i>	<i>1.18</i>	<i>1.19</i>
Secondary Teachers Actual per 1,000	85.35	84.59	87.79	87.78	97.77
Secondary Teachers SOQ per 1,000	71.80	76.78	79.81	76.03	78.21
<i>Secondary Teacher Ratio</i>	<i>1.19</i>	<i>1.11</i>	<i>1.10</i>	<i>1.16</i>	<i>1.26</i>
Elementary Teacher Aides per 1000 Actual	21.77	23.01	26.35	22.20	22.94
Elementary Teacher Aides per 1000 SOQ	2.53	3.09	2.29	2.14	2.92
<i>Elementary Teacher Aides Ratio</i>	<i>10.67</i>	<i>9.10</i>	<i>11.63</i>	<i>13.67</i>	<i>8.79</i>
Secondary Teacher Aides per 1000 Actual	10.41	12.33	12.54	10.27	11.94
Secondary Teacher Aides per 1000 SOQ	1.90	2.02	2.16	1.99	2.43
<i>Secondary Teacher Aides Ratio</i>	<i>6.50</i>	<i>7.30</i>	<i>8.23</i>	<i>6.77</i>	<i>5.91</i>
School Based Clerical Actual per 1,000	4.81	4.42	5.46	4.86	4.99
School Based Clerical SOQ per 1,000	5.06	5.06	5.06	5.05	5.12
<i>School Based Clerical Ratio</i>	<i>0.95</i>	<i>0.88</i>	<i>1.08</i>	<i>0.96</i>	<i>0.98</i>
Technical Clerical Actual per 1,000	12.45	13.38	15.21	13.17	17.39
Technical Clerical SOQ per 1,000	15.25	15.14	15.13	15.10	15.17
<i>Technical Clerical Ratio</i>	<i>0.82</i>	<i>0.88</i>	<i>1.01</i>	<i>0.87</i>	<i>1.15</i>

Tables 3 and 4 show the relationships between staffing and division size and need by examining how the average number of employees per 1,000 students (actually employed, SOQ-allotted, and the ratio of actually employed to SOQ-allotted) changes across quintiles of school divisions based on size and need (quintiles are ranked from low to high moving from left to right). The Elementary Teachers personnel category can again be used as an example to demonstrate what is being shown in Tables 3 and 4. Looking at Table 3 and the line for Elementary Teachers allocated by SOQ, it can be seen that teacher allocations vary somewhat by size. For the 1st quintile, which is made up of districts that have 1,682 students or less, the average SOQ allocation is 76.17 teachers per 1,000. This average decreases as division size increases, going from 69.89 in the 2nd quintile, to 69.26 in the 3rd, 67.70 in the 4th, and 66.79 in the 5th quintile.

In regard to Table 3, it is clear that SOQ-allotted teachers are sensitive to division enrollment. This is evidenced by the fact that the number of teachers per 1,000 declines as the size of the divisions grow. This relationship also exists for secondary teacher aides per the SOQ. The relationship between division size and actual number of elementary teachers is somewhat stronger than is true for SOQ-allotted elementary teachers although that is not the case for secondary teachers. Essentially, numbers of

support staff (of the two types shown) are unrelated to division size when looking at the SOQ allocations which remain consistent across quintiles and there is no discernable pattern when looking at actual support staffing. Looking at Table 4, while there is a small relationship between SOQ-allotted elementary and secondary teachers and division needs (that is, the highest need divisions [those in the fifth quintile] earn more teachers than the lowest need divisions [those in the first quintile] but the pattern does not hold true for divisions with moderate levels of need [the three middle quintiles]). The relationship is stronger for actual teachers employed, which, along with the fact that the ratios of actual to SOQ-allotted teachers are higher in the fifth quintile than they are in the first quintile, suggests that school division actual staffing is more sensitive to need than the SOQ ratios are. Again, this may not be unexpected because of the actual staffing as shown in this study is derived from the Annual School Report and covers programs that can fall outside of the SOQ.

Ideas for the Virginia Board of Education's Consideration

On the basis of APA's analyses, a few key points about the Standards of Quality can be highlighted for the Board's consideration.

1. School divisions employ more personnel than the SOQ ratios provide. It appears that the majority of Virginia school divisions employ personnel at a higher level than currently prescribed in the SOQ, validating the concept that the SOQ is intended to be a minimum education foundation program.
 - It is important to remember that the SOQ ratios do not include all the personnel a district would be expected to employ. An example would be elementary aides where the SOQ ratio only includes aides for kindergarten and special education. Most districts employ aides for other purposes. This may be why the SOQ figure is much lower than the actual figure for this category of personnel.
 - The majority of the personnel categories with higher personnel were in the instructional categories. For the time period examined, the average numbers of personnel actually employed were higher than the SOQ ratios. Given that the Annual School Report captures all positions employed within school division not just those related to the SOQ, this is not unexpected.
 - The average number of elementary teachers is 16 percent above the SOQ ratio. Elementary teachers make up 34 percent of all personnel examined.
 - The average number of secondary teachers is 17 percent above the SOQ ratio. Secondary teachers make up 24 percent of all personnel examined.

- The numbers of elementary and secondary teachers actually employed by districts appear to be related to district needs based on examining quintiles of school divisions organized by need.
2. It appears that school divisions are using their support category revenue to employ more instructional personnel. This strategy is permissible because prevailing support dollars may be used for instructional needs.
 3. One personnel category that may need to be examined is nurses assuming that a shift in funding formulas does not detrimentally affect school divisions.
 - The states with which we talked mentioned nurses as a personnel group for which they are considering setting a new standard or revising an existing one.
 - APA believes that a ratio of 750 students per nurse might be appropriate. Currently, school divisions in Virginia provide nursing services but there is no mandated staffing standard.
 4. All SOQ ratios could be expressed in personnel per 1,000 student terms, assuming that such a shift does not detrimentally affect funding or staffing and class sizes at the school and classroom levels. Some factors to consider are:
 - Currently the state uses both student personnel ratios and personnel per 1,000 terms to express SOQ ratios. Using one approach will simplify the SOQ process.
 - Such an approach would avoid the “cliffs” built into some current SOQ ratios. These cliffs are based on break points related to school size that make assumptions about how schools are staffed that may not be true.
 - In APA’s examination of the data the instructional categories that use this cliff style funding had far more variation in personnel per 1,000 students than other categories.
 - The cliffs mean a school with a difference of just one student can be funded very differently. For example, a school with one more student than another school earns an additional half-time principal for that student.

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