JOINT LEGISLATIVE AUDIT AND REVIEW COMMISSION
OF THE VIRGINIA GENERAL ASSEMBLY

TECHNICAL REPORT:

State Funding Formula for Educational Technology

REPORT OF THE
JOINT LEGISLATIVE AUDIT AND REVIEW COMMISSION

TECHNICAL REPORT:
State Funding Formula for Educational Technology

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

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Preface

The 2002 General Assembly passed Senate Joint Resolution 87, which directs the Joint Legislative Audit and Review Commission (JLARC) to develop a State funding formula for educational technology and technology support personnel. This report responds to SJR 87 by providing illustrative funding options for the General Assembly to consider if it wishes to more explicitly support educational technology through the use of a funding formula. The report does not recommend a specific level of technology funding that is justified in schools, as this is a policy choice of the General Assembly. Rather, the report explores how different aspects of educational technology could be addressed through a funding formula.

The report was presented at the September 8, 2003, JLARC meeting. Although a number of JLARC members commented favorably on the quality of staff work that went into the report, several members expressed concern over whether there is a need for the funding options identified in the report. Commission members therefore voted to receive the report and authorize printing, but not to approve the report.

During FY 2002, school divisions reported spending a total of $368.8 million on their educational technology programs. The State has assisted school divisions in funding their technology costs through specified State initiatives and indirectly through the Standards of Quality (SOQ). The report estimates that, based on FY 2002 expenditure data, the State has provided between $84 million and $110 million annually for educational technology through the SOQ. The State has also provided significant funding through State initiatives, primarily the Virginia Public School Authority (VPSA) Technology Initiative. In recent years, the General Assembly has authorized approximately $58 million annually for this program.

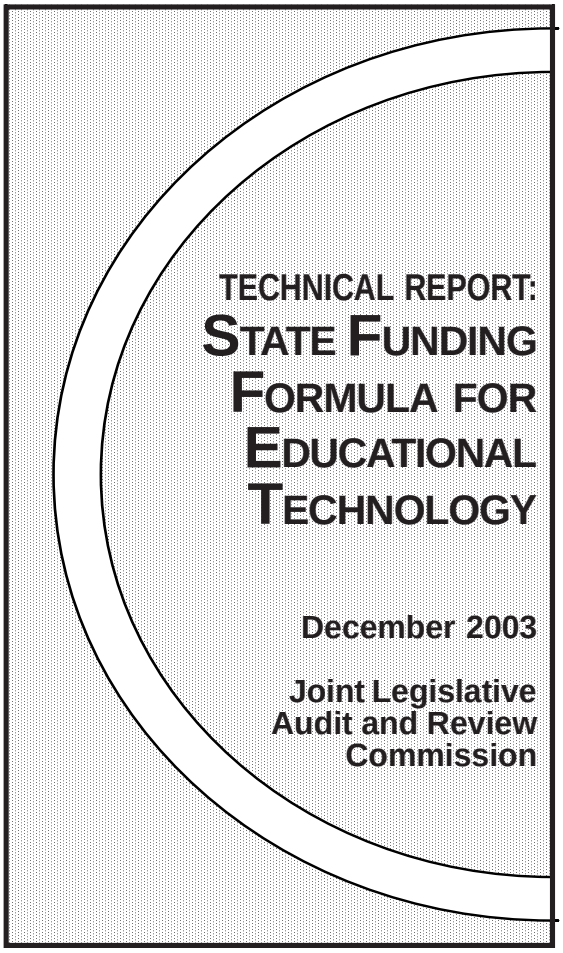
The purpose of this study is to provide funding formula options that would allow the State to more directly and explicitly address educational technology funding. The report, therefore, provides funding formula options across a variety of areas where school divisions make technology-related expenditures. These areas include technology integration specialists, technical support staff, hardware replacement, and other non-personnel costs. The report assumes that any funding that has been provided through the SOQ could be used to help support the technology funding options included in the report. There are no assumptions as to whether funding from existing State initiatives, such as the VPSA Technology Initiative, would be redirected to offset the cost of the funding formula options.

On behalf of the Commission, I wish to express our appreciation for the assistance and cooperation provided during the course of this review by the Virginia Department of Education, the Virginia Society for Technology in Education, and local school divisions.

Philip A. Leone
Director

December 22, 2003

JLARC Report Summary



Educational technology has been an increasing priority of school divisions over the past decade as divisions have sought to improve the use of technology in their schools. However, as divisions have attempted to better integrate technology into the classroom environment, they have been confronted with a number of funding challenges and have increasingly looked to the State to help support these funding needs. In response to these concerns, the 2002 General Assembly passed Senate Joint Resolution 87, which directs JLARC to develop a State funding formula for educational technology and technology support personnel.

This report responds to SJR 87 by providing illustrative funding options for the General Assembly to consider if it wishes to more explicitly support educational technology through the use of a funding formula. The purpose of this report is not to determine the level of technology funding that is justified in school divisions. Rather, its role is to explore how different aspects of educational technology can be addressed through a funding formula. The amount of funding that the State should contribute to school divisions' educational technology programs hinges on a number of policy choices, which is why this report presents funding formula options and does not include specific recommendations for which level of technology funding support should be selected.

There are several key findings and observations that result from this review, which are summarized as follows:

- Significant progress has been made in the Commonwealth in funding technology personnel, in funding non-personnel items such as computers, and in funding other aspects of educational technology such as teacher training
- Nearly all divisions have given substantial access to students to use computers in the school environment.
- The Board of Education has recognized the need to institutionalize technology funding by proposing revisions to the Standards of Quality (SOQ) that would recognize technology in the funding formula for allocating SOQ funds.
- Technology funding will be an ongoing need at the State and local level, particularly personnel costs and the replacement of hardware.

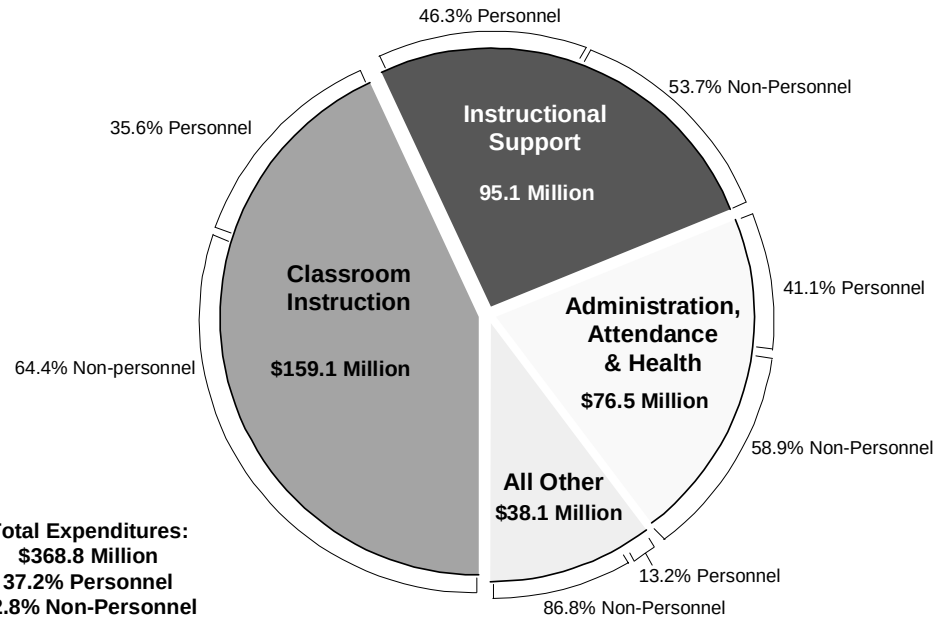
- State involvement in the ongoing support of technology funding could allow more local divisions to replace computers on a timely basis and provide the personnel needed for the effective use and maintenance of the technology. Funding formula options to address these objectives are included in this report.

Funding for Educational Technology

Virginia's school divisions spend a significant amount each year on educational technology. For example, during the 2001-2002 school year school divisions reported spending a total of $368.8 million on technology (see figure). The majority of these expenditures (63 percent) were for non-personnel costs, such as computer equipment and infrastructure. School divisions receive State and federal funding to help cover these various technology costs, although the greatest share of costs is paid by localities.

State Funding for Educational Technology. There are two ways in which the State has assisted school divisions in funding their technology needs – through specified State initiatives and indirectly through the Standards of Quality (SOQ). The SOQ has been the largest source of State funding for educational technology; however, since funding has been provided indirectly, many school divisions may be unaware that they have received State SOQ funds for technology. To the extent that the State has provided technology funding through the SOQ, this funding has been imbedded with other educational costs. JLARC staff estimate that, based on FY 2002 expenditure data, the State's actual cost to meet its share of prevailing SOQ technology costs in that year was between $84 million and $110 million. This range captures the State share of costs reported by school divisions for technology support personnel and non-personnel costs in categories recognized in the SOQ fund-

Total School Division Expenditures for Technology
By Function, FY 2002



Educational Technology Funding Provided by the State

FY 2001 to FY 2004

	FY 2001	FY 2002	FY 2003	FY 2004
VPSA Technology Initiative (Amount Authorized in the Appropriation Act)	$56,910,000	$58,338,000	$58,416,000	$58,598,000
Technology Resource Assistants Initiative	--	$4,973,521	$5,072,127	--
Electronic Classroom	$2,611,658	$2,611,658	$2,531,770	$2,531,770
Administrative Systems	$1,135,345	--	--	--
Southside Virginia Regional Technology Consortium	$215,000	$215,000	$182,750	$100,000
Project ECOLE	$50,000	$50,000	--	--
Virginia Educational Technology Alliance	--	--	$50,000	$50,000
Total State Initiative Funding	**$60,922,003**	**$66,188,179**	**$66,222,647**	**$61,279,770**

<u>Estimated</u> Standards of Quality Funding for Technology	**$84 to $110 million annually** The SOQ funding provided by the State each fiscal year includes an imbedded amount for technology purposes. The cost range shown above is JLARC staff's best estimate of the annual State share for technology costs reported in SOQ cost-eligible categories, based on actual FY 2002 expenditure data, and provides a rough approximation of the State's SOQ funding level over the fiscal years shown above.

ing formula, as implemented by DOE. The main technology area where it appears State SOQ funds may not have been provided to cover some costs is in the area of instructional technology personnel, such as integration specialists.

Beyond the funding provided through the SOQ, the State has also funded several initiatives aimed at educational technology. The Virginia Public School Authority (VPSA) Technology Initiative is the largest such State program. The General Assembly has authorized around $58 million annually in technology notes through the VPSA over the past several years to help divisions improve their infrastructure and increase student access to computers. In addition to the VPSA Technology Initiative, the State has provided educational technology funding through several other smaller initiatives, and school divisions may use the local share of the lottery proceeds and funds provided through the School Construction Grant program for technology purposes.

Other Support for Educational Technology. State appropriations for educational technology in FY 2002 are estimated to have covered about 44 percent of the total technology expenditures made by school divisions. School divisions covered the remaining technology costs through funds they received locally or from the federal government. Most of this remaining share was covered locally. However, the federal government has been an important source of educational technology funding.

In FY 2002 the federal government provided over $25 million to Virginia's public schools for technology. The two most significant federal programs are the E-Rate program and the Educational Technology (Ed Tech) Grant program. Under the E-Rate program, schools receive discounts that can be applied to telecommunications services,

Internet access, and internal connections. The federal government allows a fair amount of flexibility for the use of the Ed Tech funds, although the Virginia DOE reports that it has earmarked the majority of Ed Tech funds for teacher training in technology.

The mandate for this study directs JLARC to "study ways to enhance the use of federal assistance for educational technology … and the implementation of state tax credits for businesses that contribute technology resources to schools." It appears that both the State and school divisions are doing what they can to maximize technology funding from federal sources. Funding for both the E-Rate program and the Ed Tech program are calculated on a funding formula basis. Thus, the Commonwealth and its school divisions are limited in the actions they can take to increase their share of federal funds.

With regard to State tax credits for business, DOE staff indicated that local school divisions, rather than the State, should take the initiative in working with private businesses that may contribute technology resources due to the fact that such opportunities vary greatly from one locality to another. Interviews with staff in the school divisions indicate that there are concerns regarding the use of tax credits to encourage businesses to donate technology resources. In their experience, donated resources have often been too old or have been costly for divisions to maintain. In addition, donated support may not be reliable or effective, and the distribution of donations may create problems of equity among divisions. Furthermore, most school divisions already have education foundations, established in the *Code of Virginia,* through which they can channel donated technology resources. Donations through these education foundations are already tax deductible.

Overview of Educational Technology Funding Options. This report provides funding options for the following categories of educational technology costs:

- Technology personnel, including technology integration specialists and technical support staff;
- Hardware replacement; and
- Other non-personnel costs.

These costs are reflected across several different types of funding options. (A description of the various funding options is included in the exhibit at right.) The most viable and appropriate funding options for each of the cost categories are organized into different combinations to illustrate some ways in which the State could fund educational technology through the use of funding formulas.

Funding Formula Options for Technology Personnel

Virginia's school divisions indicated that technology staffing is one of the areas where increased State funding is most needed. Unlike many other technology cost areas, school divisions are somewhat limited in the source of funds they can use for technology personnel. While divisions are able to utilize funding from a variety of sources for technology equipment and certain infrastructure needs, these sources often do not likewise provide a dependable source of funding for technology staff. Furthermore, some sources restrict the use of funds to non-personnel items. A State funding formula that explicitly provides a reliable and recurrent source of funds for technology staffing may be one of the ways in which the State could most effectively enhance its technology support for school divisions.

Funding for Technology Integration Specialists. The success of a school division's technology program depends largely on having staff available to help teachers integrate technology into the regular

Types of Technology Funding Formula Options

Option Type	Description of Option
Prevailing Cost Option	Bases a funding formula on the typical (or linear weighted average) expenditures made by school divisions.
DOE Advanced Level Staffing Ratios Option *(Personnel Costs Only)*	Bases a funding formula on the advanced level staffing ratios in DOE's *Guidelines for Technology Staffing and Support for Integration of Education Technology into Instructional Programs.*
Board of Education-based Model *(Personnel Costs Only)*	Bases a funding formula on the Board of Education's recent proposed changes to the Standards of Quality to recognize technology support staff positions.
Site-based Model *(Personnel Costs Only)*	Calculates staffing levels at the school level with adjustments for school size.
Expand the High School Technology Resource Assistants Initiative *(Personnel Costs Only)*	Expands the former High School Technology Resource Assistants Initiative to include elementary, middle, and adult education schools.
Industry Standards Option *(Personnel Costs Only)*	Bases a funding formula on the industry standard for providing technology support.
5 to 1 Student-to-computer Ratio/5-Year Replacement Cycle *(Hardware Replacement Costs Only)*	Bases a funding formula on a 5 to 1 student-to-computer ratio and assumes a 5-year hardware replacement cycle.
5 to 1 Student-to-computer Ratio Plus Administrative Computers/5-Year Replacement Cycle *(Hardware Replacement Costs Only)*	Bases a funding formula on a 5 to 1 student-to-computer ratio and recognizes administrative computers. Assumes a 5-year hardware replacement cycle.
3 to 1 Student-to-computer Ratio/5-Year Replacement Cycle *(Hardware Replacement Costs Only)*	Bases a funding formula on a 3 to 1 student-to-computer ratio and assumes a 5-year hardware replacement cycle.
1 to 1 Student-to-computer Ratio/5-Year Replacement Cycle *(Hardware Replacement Costs Only)*	Bases a funding formula on a 1 to 1 student-to-computer ratio and assumes a 5-year hardware replacement cycle.

classroom curricula. This is the primary role of technology integration specialists, who work with teachers and other staff members to integrate technology into the classroom environment. Despite the importance of this position, nearly half of Virginia's school divisions did not report employing integration specialists. Furthermore, the need for this type of personnel was one of the areas of concern most often mentioned by school division personnel. Currently, it is not clear whether the State contributes funding towards technology integration support personnel in many cases. Therefore, providing funds for integration specialists is an area where the State could significantly enhance its support for educational technology.

This report includes four options for funding integration specialists. The total State and local base salary and benefit costs for these options range from a low of $15.2 million for the prevailing cost option to a high of $93.1 million for the option based on the site-based model. Between these options are an option based on the DOE advanced level staffing ratios and the Board of Education-based option, both of which reflect current State guidance and recommendations for integration specialists. Of these four options, the site-based model produces the level of integration specialist staffing that most reflects the needs articulated by Virginia's school divisions. However, both the DOE advanced level staffing ratios option and the Board of Education-based model would be an improvement in shifting the costs for integration specialists into a funding formula that could be shared by the State and localities.

Funding for Technical Support Staff. Technical support is the other area of technology staffing where school divisions indicated increased State support is needed. Technical support staff are concerned with technical responsibilities, such as keeping a school division's networks running and trouble-shooting computer problems. Due to the large range in how school divisions provide technology support, it is difficult to devise a funding formula that is representative of all divisions. For example, in very small divisions, a handful of technology support staff may serve a variety of support roles for the division. In contrast, large divisions often have several levels of technology administration and support, and technology staff in these divisions may serve much more specialized roles. Despite the variations in how technology support needs are met, it appears that there are generally three levels of technology support provided to schools – administrative support, support provided at the division level, and school-based technology support.

This report provides six options for funding technical support staff. The lowest cost option ($49.6 million in base year FY 2002) is to reinstate and expand the High School Technology Resource Assistants Initiative, and the highest cost option ($196.4 million in total State and local base salary and benefit costs) is to provide technology support at the industry level. In between these options are a prevailing cost option, a Board of Education-based option, an option based on the DOE advanced level staffing ratios, and a site-based option that calculates technical support at the school level. Similar to the funding options for integration specialists, the site-based model ($100.8 million) reflects what several school divisions visited for this review have indicated is most appropriate in terms of levels of technical support.

Funding Formula Options for Hardware Replacement

Increased State funding for the replacement of technology equipment was also listed as a primary area of need by school divisions. Currently, the State provides funding to school divisions for the purchase of additional technology to meet the State's goal of a five-to-one student-to-computer ratio. However, funding is not explicitly provided for divisions to replace technology hardware as it becomes outdated. Education technology experts recommend that technology should be replaced every three to five years, but the majority of Virginia's school divisions reported that they are unable to fully fund a replacement cycle for hardware. Furthermore, as school divisions continue to add computers to meet the five-to-one ratio, additional funding will be needed to begin replacing a growing number of computers. Therefore, a funding formula that recognizes the ongoing need to replace hardware may be necessary in order to maintain appropriate ratios and to provide up-to-date technology for students.

Five options are presented for funding the replacement of hardware. The lowest cost option bases funding on prevailing expenditures by school divisions for hardware replacement. The total cost of funding this option is $48.6 million in the base year, which is probably comparable to the level of funding the State currently provides for hardware replacement. The remaining four options are based on specific student-to-computer ratios and identified replacement cycles. Of these four options, the least expensive option ($63.8 million) is based on a five-to-one student-to-computer ratio with a five-year replacement cycle. The most expensive option ($299.3 million) is based on a one-to-one student-to-computer ratio and a five-year replacement cycle. The five-to-one student-to-computer ratio with a five-year replacement cycle reflects the State's current goals for student access to computers and a replacement-cycle that is in the range recommended by educational technology experts and school division staff.

Other Non-Personnel Costs and Teacher Training

In addition to costs associated with technology personnel and hardware replacement, school divisions face other technology non-personnel costs and costs associated with training teachers in the use of technology. These other components are vital in supporting a school division's educational technology program. However, in most cases school divisions did not indicate that they are high priority areas for increased funding from the State.

Other Non-personnel Costs Could Be Funded on a Prevailing Cost Basis. Beyond technology hardware, there are other non-personnel technology costs that school divisions must fund. These costs are related to technology infrastructure, software and supplies, Internet connectivity, and a variety of other non-personnel items. School divisions did indicate that technology infrastructure, such as routers and electrical wiring, can be a high area of need for increased funding. However, infrastructure replacement costs tend to vary from year to year due to the long replacement cycle for some components and the one-time nature of other infrastructure cost items. For other non-personnel cost items, school divisions recognized that they present real costs but did not place them as a high priority for increased State support at this time. The funding formula options for non-personnel costs other than hardware are therefore based on the prevailing expenditures reported by school divisions. The prevailing methodology is used because it is consistent with how these costs likely have been recognized through the SOQ, and in some cases, it is not clear that there is a better way to model these costs.

Funding Integration Specialists May Be the Best Way to Assist with School Divisions' Training Needs. School divisions indicated that teacher training in technology is critical to the success of their technology programs. However, most divisions also acknowledged that existing State and federal funds available for teacher training are sufficient to cover current training needs, at least for traditional forms of technology training such as classes. Further, division staff said that the most effective technology training often occurs when technology staff are available to assist teachers with their immediate needs. Additional State funding to help divisions hire integration specialists may therefore be the most effective way to help divisions better train their teachers. This report addresses school divisions' training needs through the funding formulas provided for technology integration specialists rather than including options for increased funding for traditional technology training.

Illustrative Funding Formula Combinations

There are several combinations of funding options the State could use to help divisions fund their educational technology costs (see table below). The five combinations presented in the report do not include all of the various funding options discussed in the report. Instead, they include only those options that appear to be the most viable and best address the concerns of school divisions. These combinations also largely have the effect of redistributing technology costs currently paid by localities alone into a funding formula where a greater portion of the costs are shared with the State. Providing funds through a State formula would help equalize the funding that is available for educational technology among divisions, which would seem to be an appropriate role for the State. In some cases, however, localities would need to spend significantly more for technology than they reported spending in FY 2002 to pay for their share of the funding combination.

Of the five combinations, the prevailing cost combination is the least expensive and bases funding on a linear weighted average of what divisions are currently spending on technology. When compared to the total technology spending estimated for FY 2002, the prevailing cost combination still leaves a significant share of technology costs to be funded by the localities. The higher aspiration combination is the most expensive combination and would provide a very high level of technology support and student access to computers. This combination may be most illustrative of future costs as schools increase student access to computers. Combinations Two and Three represent recent State policies and recommendations in educational technology, while Combination Four best repre-

Summary of Illustrative Funding Combinations (Estimated Total State and Local Costs)

	FY 2002	FY 2005	FY 2006
Combination 1: Prevailing Costs	$203,628,435	$225,636,256	$234,101,481
Combination 2: DOE Advanced Level Staffing Guidelines; 5:1 Ratio, 5-Year Hardware Replacement Model	$240,588,274	$266,515,578	$276,450,243
Combination 3: Board of Education-based Recommendation; 5:1 Ratio, 5-Year Hardware Replacement Model*	$256,858,949	$285,234,219	$294,939,999
Combination 4: Site-based Model; 5:1 Ratio, 5-Year Hardware Replacement Model	$324,214,847	$359,888,613	$373,691,846
Combination 5: Higher Aspiration Option; 1:1 Ratio, 5-Year Hardware Replacement Model	$559,786,490	$620,027,191	$642,594,771

Total Estimated State and Local Dollars Spent in FY 2002
$368,784,677

*The Board of Education is recommending a 4-year phase-in of the revisions that it is proposing to the SOQ. FY 2005 and FY 2006 costs shown here are the costs for the full implementation of the recommendation.

sents what several visited school divisions stated would be most appropriate in terms of meeting technology support personnel and hardware replacement needs.

As described previously, the State already provides some funding for educational technology through the SOQ and various State initiatives. This report assumes that any funding that has been provided through the SOQ could be used to help support the technology funding formula combinations. The table below shows the estimated net cost increase to the State if it applied SOQ funding towards meeting its share of the cost options. The report makes no assumptions as to whether existing State initiative funding, such as the VPSA Technology Initiative, would be redirected to offset the cost of the combinations.

If the General Assembly decides to adopt a funding formula approach to educational technology, such formulas should be revisited on a regular basis. This is needed because the nature of educational technology in Virginia's schools will change over time, affecting schools' needs for technology support, hardware replacement, and other technology items.

Estimated Net Increase in State Costs of Illustrative Funding Combinations*
(in millions)

	FY 2005 (State Cost)	***Estimated Increase Over FY 2002***	**FY 2006 (State Cost)**	***Estimated Increase Over FY 2002***
Combination 1: Prevailing Costs	$124.9	*$27.8*	129.4	*$32.3*
Combination 2: DOE Advanced Level Staffing Guidelines; 5:1 Ratio, 5-Year Hardware Replacement Model	$148.2	*$51.1*	$153.4	*$56.3*
Combination 3: Board of Education-based Recommendation; 5:1 Ratio, 5-Year Hardware Replacement Model**	$157.8	*$60.7*	$162.9	*$65.8*
Combination 4: Site-based Model; 5:1 Ratio, 5-Year Hardware Replacement Model	$200.5	*$103.4*	$207.7	*$110.6*
Combination 5: Higher Aspiration Option; 1:1 Ratio, 5-Year Hardware Replacement Model	$345.1	*$248.0*	$356.9	*$259.8*

Estimated FY 2002 State Share of Standards of Quality Technology Funding
$97.1 million

*Estimates do not assume any changes in current use of State initiative funding.

**The Board of Education is recommending a 4-year phase-in of the revisions that it is proposing to the SOQ. FY 2005 and FY 2006 costs shown here are the costs for the full implementation of the recommendation.

Educational Technology and the Annual School Report

The Annual School Report (ASR) is the primary source of data for school divisions' educational expenditures. It was also the primary source of data for the technology funding options provided in this report. Starting with FY 2001, DOE added a new section to the ASR specifically for technology. This new section is very helpful for calculating technology funding levels, but there are currently several limitations with the technology data that are collected through this section that may need to be addressed if the data are to be used for a technology funding formula. Because of these limitations, the cost of various funding combinations may change appreciably in the future if divisions change how they report their technology expenditures.

There appear to be three main limitations associated with the technology expenditures reported in the ASR, if the data are to be used for a funding formula. First, the ASR does not currently provide separate categories to allow school divisions to report certain technology expenditures independently, such as the expenditures for technology integration specialists and peripheral hardware equipment. The extent to which this is an issue depends on whether the General Assembly decides to adopt certain funding formula options discussed in this report. For example, if the General Assembly decides to adopt funding formulas for technology integration specialists and peripheral hardware replacement, it may wish to direct DOE to collect more detailed data on these technology cost components. DOE staff have indicated that, should more detailed expenditure data be needed for a funding formula, the ASR could be modified to collect such data.

Second, during analysis of the ASR data and site visits with school divisions, JLARC staff found that some school divisions failed to use the ASR technology section to report the majority of their technology expenditures. In most cases, these expenditures were reported elsewhere in the ASR. However, the

Summary of Potential Actions Regarding the Annual School Report (ASR)

ASR Data Collection:	If the General Assembly decides to adopt a funding formula for educational technology, it may wish to direct DOE to collect more detailed data on certain technology cost components through the Annual School Report (ASR).
Analysis of ASR Data:	If the General Assembly decides to adopt a funding formula for educational technology, it may wish to direct DOE to conduct preliminary analysis, such as outlier analysis, to help identify school divisions that have not reported their technology expenditures in the technology section of the ASR.
Consistency of ASR Data:	If the General Assembly decides to adopt a funding formula for educational technology non-personnel costs, it may wish to work with DOE, and other State agencies as is necessary, to set a consistent capitalization threshold for localities for data reporting purposes. Alternatively, the General Assembly may wish to direct DOE to modify the ASR to distinguish between expenditures for new additions and replacements for non-capitalized hardware and infrastructure.

failure to report technology expenditures in the proper ASR section means that these divisions' costs were not included in the estimates of technology costs. To help remedy this issue, in future years DOE could perform preliminary analysis, such as outlier analysis, to identify divisions that do not appear to be using the technology section of the ASR to report their technology expenditures. In addition, the General Assembly may wish to consider amending Section 22.1-115 of the *Code of Virginia* to include technology as a major classification of funds for school division accounting purposes.

Third, the consistency of the technology expenditures reported in some areas could be improved, particularly regarding the capitalization of hardware and infrastructure. Because localities have different capitalization thresholds, they report expenditures for various hardware and infrastructure items, such as computers, differently. This means that expenditures for the same types of items may be treated differently in a funding formula. If the General Assembly decides to adopt a funding formula for educational technology non-personnel costs, it may wish to work with DOE, and other State agencies as is necessary, to set a consistent capitalization threshold for localities for data reporting purposes. Alternatively, the General Assembly may wish to direct DOE to modify the ASR to distinguish between expenditures for new additions and replacements for non-capitalized hardware and infrastructure.

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I. Introduction

Educational technology has been an increasing priority of school divisions over the past decade. Divisions have sought to increase the use of technology in their schools and to better integrate technology into their education curricula. Part of this effort has been a result of school divisions responding to State and federal policies requiring them to integrate technology into their educational programs. However, divisions are also responding to students' needs to be proficient in the use of technology to successfully compete in today's college and work environments.

As divisions attempt to better integrate technology into the school environment, they are confronted with a number of funding issues. Two of the most challenging issues are staffing and replacing technology equipment. Divisions require technical support staff to help maintain technology equipment, and often a further concern is having technology staff available to assist teachers in integrating technology into the curricula. Replacing technology equipment is also an issue. In recent years, it has been a State priority to increase the availability of technology in local schools, but this technology has a limited life and will likely need to be replaced as it becomes outdated. School divisions have also dealt with other educational technology needs related to infrastructure, software and computer supplies, and Internet connectivity.

Addressing these technology issues has required additional funding, and school divisions have increasingly looked to the State to help support these funding needs. In response to this concern, the 2002 General Assembly passed Senate Joint Resolution 87. SJR 87 directs JLARC to develop a State funding formula for educational technology and technology support personnel. This report responds to SJR 87 by providing illustrative funding options for the General Assembly to consider if it wishes to more explicitly support educational technology through the use of a funding formula.

The purpose of this report is not to determine the level of technology funding that is justified in school divisions. Rather, its role is to explore how different aspects of educational technology can be addressed through a funding formula, particularly one that is consistent with Virginia's Standards of Quality (SOQ) funding methodology. The amount of funding the State should contribute to different aspects of educational technology to go above and beyond the existing State standards and SOQ framework is a policy question for the General Assembly, which is why this report presents funding formula options and does not include specific recommendations for levels of technology funding.

EDUCATIONAL TECHNOLOGY AND STUDENT ACHIEVEMENT

Although school division staff indicate a desire to increase the levels of educational technology in their schools, in part to prepare students for college and the workforce environment, there is no clear consensus on whether technology positively

impacts student achievement while students are at the elementary, middle, or secondary level. Studies linking educational technology with student achievement indicate that there may be instances where technology effectively improves student achievement, but there are also cases where technology is used ineffectively. These studies generally fall on one of two sides of the issue: (1) one side says there is evidence of technology's positive influence on student achievement and interest; and (2) the other side argues that there is no research evidence to support the claims of educational technology proponents.

Studies falling on the "positive evidence" side often quote from reviews of hundreds of studies. Findings by one researcher concluded that:

- On average, students who used computer-based instruction scored higher on standardized tests compared to students in control conditions without computers;
- Students tended to learn more in less time when they received computer-based instruction;
- Students tended to like their classes more when their classes included computer-based instruction; and
- Computers did not have positive effects in every area in which they were studied.

The method of review employed by those on this side of the argument have been criticized as lacking the necessary controls to make solid conclusions possible. However, there appears to be general agreement that drill and tutorial software can help improve basic skills in math computation, and that computer-assisted instruction has improved the performance of physically handicapped and special education pupils.

On the other side of the debate, much of the objection to technology spending in schools arises from the prospect that other programs, such as physical education, music, and art, may need to be cut in order to give technology a higher priority. Further, some critics question studies reporting the benefits of computer-assisted instruction because key factors that also typically play a role in student achievement may be overlooked, such as the instructor's capabilities. For example, one critic pointed out: "Many early studies of computers in elementary educational settings employed highly trained educational researchers rather than ordinary teachers. Their advanced training and experience may have facilitated the learning process, making the effect of the computers alone difficult to ascertain."

In general, research that reports technology has no discernable difference in student achievement are subject to similar problems to those studies that do report positive differences. The more convincing arguments on this side of the debate are the ones that question the educational areas that are vulnerable to being reduced or eliminated in order to devote more time and resources to technology. These

arguments move beyond the issue of technology and student achievement into questions regarding the most appropriate objectives for education and curriculum.

Overall, the research literature lacks a clear consensus on whether technology has a positive effect on student achievement. However, rather than framing the question as a simple "yes" or "no", research can provide more useful information by addressing the more complicated question of "what types of technology, with what types of students, under what conditions, lead to the best results?" Both sides of the debate agree that educational technology is less effective, or maybe even ineffective, when the learning objectives are ambiguous, and the focus of the technology's use is unclear or diffuse. However, there seems to be agreement generally that, even if technology does not have a direct link to student achievement, it is important in preparing students for college and helping them to function more productively in the workforce environment.

STATE GOALS AND REQUIREMENTS FOR EDUCATIONAL TECHNOLOGY

Virginia has shown a historical commitment to educational technology that is demonstrated through the guidelines and policies it has adopted in this area, and through the technology requirements it has placed on local school divisions. State goals and requirements pertaining to educational technology have been adopted both legislatively and administratively and are found in places such as the Standards of Quality, the *Code of Virginia*, the Appropriation Act, the Standards for Accrediting, the Standards of Learning, and in various reports, studies, and technology plans produced by the Virginia Department of Education (DOE). Examples of some of the State's more general educational technology requirements include the following:

- The *Standards of Quality* require local school boards to implement a program of instruction "which emphasizes … proficiency in the use of computers and related technology"

- Section 22.1-199.1 of the *Code of Virginia* states that "the General Assembly finds that educational technology is one of the most important components … in ensuring the delivery of quality public school education throughout the Commonwealth. Therefore, the Board of Education shall strive to incorporate technological studies within the teaching of all disciplines. Further, the General Assembly notes that educational technology can only be successful if teachers and administrators are provided adequate training and assistance."

- The *Standards for Accrediting* require local school administrations to provide "properly equipped laboratories that meet the needs of instruction in the sciences, technology, fine arts, and career and technical programs."

- The *Standards of Learning* contain specific computer/technology standards for grades five, eight, and 12.

Section 22.1-199.1.B. of the *Code of Virginia* also provides more specific guidance with respect to educational technology. In particular, subsection B established the State's educational technology grant program, which was ultimately funded through the Virginia Public School Authority. Since 1996, subsection B has also outlined State priorities for educational technology, such as providing a five-to-one ratio of pupils to network-ready computers. The technology priorities included in subsection B are largely based on the Board of Education's 1996 six-year technology plan.

In addition to the priorities outlined in the Board's technology plan, subsection B includes several other priorities, most of which are dependent on support through the Appropriation Act. For example, subject to appropriation, subsection B states that funds should be available "for providing a technology resource assistant to serve every elementary school in this Commonwealth beginning on July 1, 1998" and that "a technology replacement program shall be, with such funds as may be appropriated for this purpose, implemented to replace obsolete educational hardware and software." The General Assembly did provide funding for technology resource assistants at the high school level in FY 2002 and FY 2003; however, this funding was discontinued in FY 2004. State funding has not been explicitly provided for a replacement program to replace hardware and software.

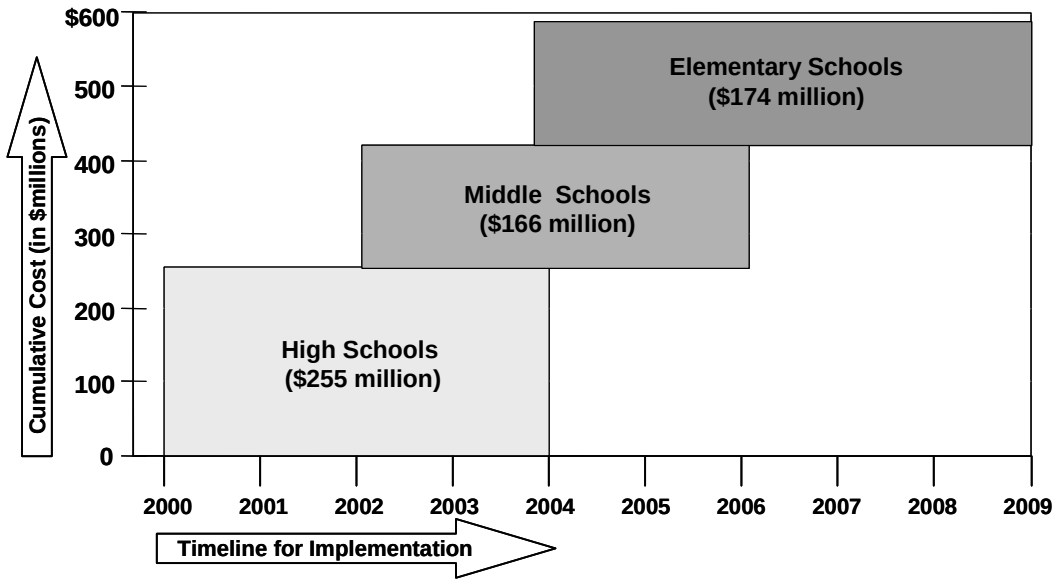
The State's current goals and priorities for educational technology are probably best highlighted in the Web-based Standards of Learning (SOL) Technology Initiative. According to DOE staff, this initiative officially began in FY 2000; however, it was built on previous initiatives to increase the number of computers in schools and to build the appropriate infrastructure to support these computers. The General Assembly has recognized the Web-based SOL Technology Initiative and has provided funding directed at meeting its goals.

The primary goal of the Web-based SOL Technology Initiative is "to have school divisions utilize Web-based systems to improve the standards of learning instructional, remedial, and testing capabilities." In addition, the initiative will prepare schools to administer the State's SOL tests online. The main objectives of the initiative, which are also outlined in the Appropriation Act and are consistent with the priorities in Section 22.1-199.1.B. of the *Code*, are to: (1) provide access to computers at a ratio of one computer for every five students, (2) create Internet-ready local area network capability in every school, and (3) assure adequate high-speed, high-bandwidth capability in every school.

The goals for the Web-based SOL Technology Initiative will be implemented over three phases based on school type, with an estimated completion date set for FY 2009. Figure 1 provides an illustration of the estimated timeline and costs associated with each phase of the initiative. High schools are targeted first and are scheduled to begin testing the SOLs on-line by FY 2004. Middle schools will be next, with on-line testing scheduled for 2006. Elementary schools will make up the final phase of the initiative, with on-line testing scheduled for FY 2009. According to DOE, the estimated total cost of the initiative over the nine years will be $595 million.

Figure 1

Web-Based SOL Technology Initiative: Estimated Costs and Time Line



Source: JLARC staff analysis of data provided by the Department of Education.

STATUS OF EDUCATIONAL TECHNOLOGY IN VIRGINIA

Virginia's school divisions have made improvements in their technology programs in recent years, and the State compares favorably with other states in areas such as Internet connectivity, computer access, and teacher use of and preparedness in technology. *Education Week* tracks states' progress in educational technology through an annual report called *Technology Counts.* The 2003 edition of *Technology Counts* show that Virginia stacks up well against other states and national averages along various measures of technology readiness. For instance, in Virginia 95 percent of schools report access to the Internet, which is comparable to the 94 percent of schools nationally that have Internet access. Virginia is also one of 34 states to report having minimum state standards for teachers that include a technology proficiency component, and Virginia reports that 77 percent of its teachers integrate computer use during class time compared to 69 percent nationally. Further, Virginia was one of only 13 states, including the District of Columbia, to administer state-level tests in a computer-based environment during the 2002-2003 school year. High schools in ninety-two of Virginia's 132 school divisions participated in on-line testing in the spring of 2003.

One of the most frequently cited measures of technology readiness is the ratio of students to computers, and Virginia compares favorably on this measure as

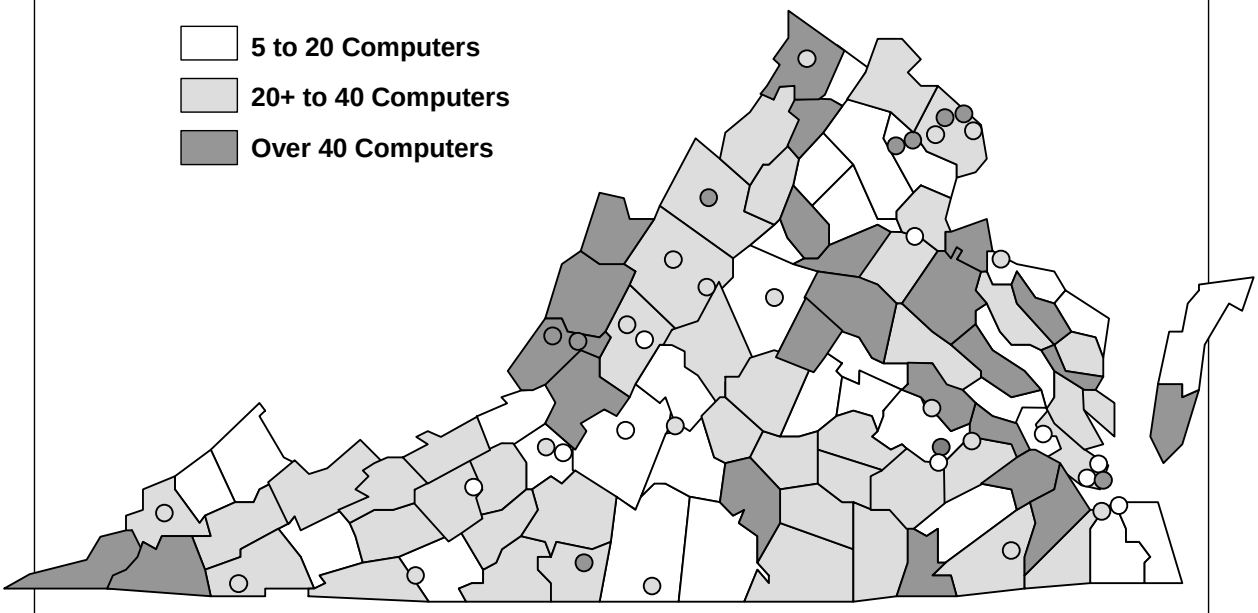
well. *Technology Counts* reports a national ratio of 5.6 students to Internet-connected computers in 2002. Based on the Virginia Department of Education's (DOE) *2002 Capacity-Connectivity Survey of Virginia's School Divisions*, DOE reports a statewide Internet-connected student-to-computer ratio of 3.75.

Figure 2 shows the number of computers per 100 students at the division level. As indicated by Figure 2, student-to-computer ratios vary across the state. The majority of divisions provide over 20 computers per 100 students, which means that these school divisions are meeting the State's goal of providing a five-to-one student-to-computer ratio, at least at the division level.

Such student-to-computer ratios should be taken with caution because the method in which they are calculated can yield very different results. For example, the 3.75 student-to-computer ratio cited by DOE is based on a statewide total count of students to computers as opposed to a school-based average of students to computers. Hence, large divisions with many computers can significantly lower the total ratio of students to computers. Virginia's average ratio of students to computers calculated at the school level is 7.5, which is twice as high as the statewide average. In addition, how a computer is defined, for example the minimum processing speed accepted in the definition, can affect student-to-computer ratios.

Figure 2

Computers per 100 Students, Shown by School Division, 2002



Source: JLARC staff analysis of DOE 2002 Capacity-Connectivity Survey of Virginia Schools.

OVERVIEW OF EDUCATIONAL TECHNOLOGY FUNDING

The cost of an educational technology program consists of a variety of technology-related costs. The total cost of technology, known as the Total Cost of Ownership, includes all of the expenses associated with deploying, maintaining, and troubleshooting a computer in the school environment. Understanding and recognizing the various costs associated with the Total Cost of Ownership is key to ensuring a successful technology program.

Both the Consortium for School Networking (CoSN), a national non-profit association that promotes the use of telecommunications to improve K-12 learning, and the U.S. General Accounting Office (GAO) have attempted to itemize the major Total Cost of Ownership components associated with an educational technology program (Exhibit 1). Although their total cost components vary slightly, they convey the same message, which is that the cost of an educational technology program includes much more than just the cost of the computers.

Exhibit 1

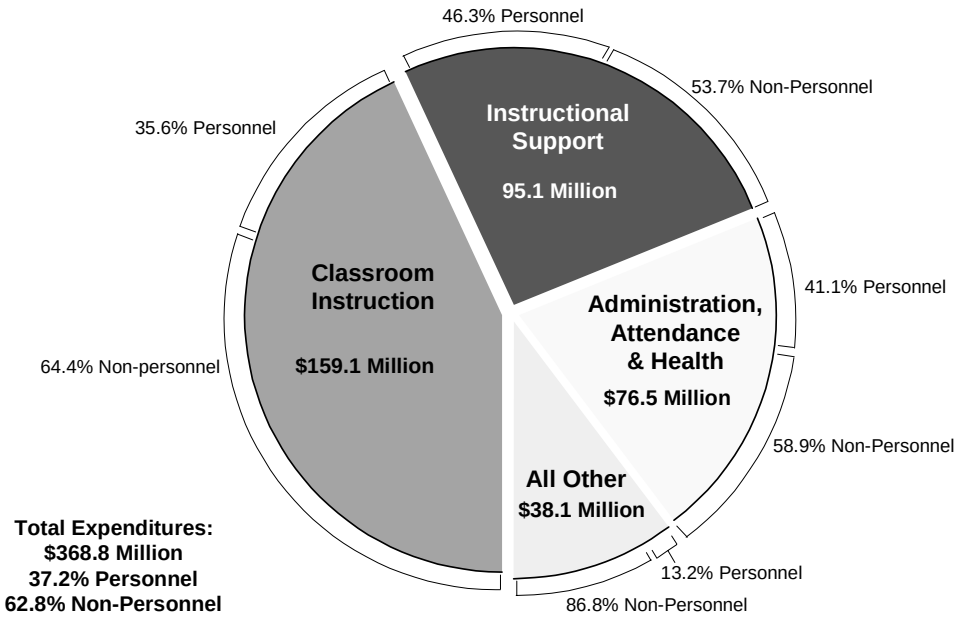
Cost Components of an Educational Technology Program

Consortium for School Networking (COSN) Total Cost of Ownership Checklist	General Accounting Office (GAO) Basic Components of a Computer-Based Education Technology Program
• Hardware • Networking Infrastructure • Professional Development • Support • Connectivity • Software • Replacement Costs • Retrofitting	• Hardware • Infrastructure • Training • Technical Support • Telecommunications Access • Software • Maintenance

Source: *Taking TCO to the Classroom: A School Administrator's Guide to Planning for the Total Cost of New Technology*, Consortium for School Networking, July 2001; *School Technology: Five School Districts' Experiences in Funding Technology Programs*, U.S. General Accounting Office, 1998.

Each year, Virginia's school divisions spend a significant amount on these various technology cost components across a variety of educational functions. During the 2001-2002 school year, school divisions reported spending a total of $368.8 million on technology. Figure 3 shows that the majority of this spending ($254.2 million) occurred in the areas of classroom instruction and instructional support.

Figure 3
Total School Division Expenditures for Technology
By Function, FY 2002



Source: JLARC staff analysis of the 2001-2002 Annual School Report.

Figure 3 also shows that school divisions spent significantly more on non-personnel costs, such as computer hardware equipment and infrastructure, than on technology personnel.

While school divisions as a whole spent a significant amount on technology, the per-pupil amounts spent by different divisions varied greatly. On average, school divisions spent $272 per pupil for all technology-related expenses in FY 2002. However, per pupil amounts ranged from a high of $748 per pupil to less than $150 spent for technology per pupil. Part of this range reflects an inconsistency among divisions in reporting technology data, and in some cases an underreporting of technology expenditures in the technology section of the Annual School Report. Nonetheless, there appears to be a large range in the technology programs provided in different school divisions. Exhibit 2 provides examples of the contrast in educational technology programs that can be found in Virginia's school divisions.

Exhibit 2

Examples of Differences Found in Virginia Between High Technology School Divisions and Low Technology School Divisions

High Technology Divisions – School division administrators have invested time and energy in learning about educational technology and have placed a priority on technology in their division. The school division employs technology integration specialists, in some cases one in every school, to assist teachers in integrating technology into their lessons. Therefore, technology is regularly used in the classroom to enhance instruction and educational activities. The division has technical support staff assigned at both the school-based level and the division level, and support (such as repairing broken equipment and solving network problems) is provided on a timely basis. In addition, technical support staff are well qualified and make appropriate decisions for upgrading infrastructure and hardware. The division has met the State's 5-to-1 student-to-computer goal at the high school level, and is moving toward meeting this goal at the elementary and middle schools. Laptop carts are available for teachers to check out to achieve a 1-to-1 ratio for their classes, and the carts are checked out regularly. The division may even be implementing a 1-to-1 student-to-computer ratio at certain grade levels. The division funds a regular hardware replacement cycle that is between three to five years.

Low Technology Division – School administrators have not invested time to understand their technology programs and have left technology planning largely to division staff. The school division does not employ integration specialists, and students primarily use technology for word processing and drill practice. The division employs technical support staff, but staffing levels are insufficient to cover support needs. In addition, technical support staff are not well trained and may make recommendations for hardware and infrastructure that are not appropriate for the school division. The division has not met the State's 5-to-1 student-to-computer goal at the high school level. Laptop carts may or may not be available, and even if they are available, they are rarely checked out because teachers do not receive adequate support. The division does not fund a regular replacement cycle and hardware is replaced as funds are available. In some cases, computers are not replaced until they are eight years old.

State Funding for Educational Technology

The State provides funding for public education through a variety of means. Most State funding (over three-quarters) is provided indirectly through the Standards of Quality (SOQ). Exhibit 3 provides an overview of some of the key terms and features of the State's SOQ funding approach. In addition to the SOQ, the State also provides funding, although to a much lesser extent, through initiatives and incentive programs which are outside of the SOQ.

Based on FY 2002 data, it appears that the State pays about 44 percent of technology costs (Table 1). State initiative funding (based on amounts included in the appropriation act) paid for about 18 percent of reported school division costs in FY 2002. In addition, State funding for SOQ costs appears to address about 26 percent of the cost. Twenty-six percent is the midpoint of an estimated range from 22 to

Exhibit 3

Overview of Key Terms Regarding Standards of Quality (SOQ) Costs and Funding in Virginia

SOQ – The State's minimum requirements for a high quality program of education in all school divisions across the Commonwealth. The SOQ are required by the Constitution of Virginia (Article VIII), and are to be "determined and prescribed" by the Board of Education, subject to revision only by the General Assembly.

SOQ costs – The estimated cost that is considered necessary to enable all school divisions to provide programs that meet the State's SOQ.

Prevailing cost concept – The State's approach to estimating SOQ costs involves the use of "prevailing" cost levels to represent costs in areas deemed to be legitimate for inclusion as SOQ costs, but for which specific, quantified standards have not been set. The prevailing cost level is the expenditure level (for example, a per-pupil cost amount, or a salary level) around which most school division costs tend to cluster, when sorted from high to low.

Linear weighted average – A measure used by the State to estimate "prevailing costs". The linear weighted average is one way to assess the central tendency of data with skewed values in the distribution. It is an average of division unit costs that includes all values in the calculation, but weights central values more than extreme values. It yields a "moderate" cost level. The measure is also sometimes referred to as the "L-estimator."

Composite index – The measure of local ability to pay that is used in Virginia. The composite index assesses the potential strength of each locality's ability to pay based on the relative size of the following components, on a per-pupil and per-capita basis, compared to the statewide average: real and public service corporation property values, taxable sales, and income as a proxy for the ability to tap "other" revenue sources. Each locality's composite index value indicates the local share of the cost. For example, a composite index of 0.80 indicates that the locality is to pay 80 percent of the cost. A composite index of 0.20 indicates that the locality is to pay 20 percent of the cost.

Aggregate State and local shares – While the State and local share of SOQ costs varies from locality to locality based on the composite index (and hence, measured ability to pay), the composite index itself is calibrated to yield an aggregate (overall, or statewide) State share of 55 percent of the cost. The aggregate local share of the cost is 45 percent. The State has set and applied a 55 percent aggregate share as the basis for the composite index calculations since FY 1993.

Source: JLARC staff summary.

30 percent. A more precise estimate of the SOQ amount is not feasible, due to the potential differences between divisions in where they reported technology expenditures on the Annual School Report (ASR).

Standards of Quality Funding for Educational Technology. The largest source of State funding for educational technology appears to be the Standards of Quality (SOQ). However, since the funding has not been separately distin-

Table 1

Educational Technology Funding Provided by the State
FY 2002

Funding Source	FY 2002 Amount	% of Total Technology Expenditures
Estimated Standards of Quality Funding (State Share)	$97,101,334	26.3%
VPSA Technology Initiative (Amount Authorized in the Appropriation Act)	$58,338,000	15.8%
Technology Resource Assistants Initiative	$4,973,521	1.3%
Electronic Classroom	$2,611,658	0.7%
Southside Virginia Regional Technology Consortium	$215,000	< 1.0%
Project ECOLE	$50,000	< 1.0%
Total Estimated State Funding Available for Educational Technology	**$163,289,513**	**44.3%**
Total Technology Expenditures Reported By School Divisions	$368,784,677	100.0%

Source: State Initiative Funding -- Chapter 814, 2000-2002 Appropriation Act. SOQ Estimated Funding -- JLARC staff analysis of the 2001-2002 Annual School Report.

guished as technology funding, many school divisions may be unaware that they have received State funds for technology purposes through the SOQ. Most SOQ funds for support costs are calculated through funding formulas that are applied to enrollment data and annual expenditure data school divisions report through the Annual School Report ASR. Prior to FY2001, the ASR did not include a separate category to report technology expenditures. Most school divisions still reported their technology expenditures on the ASR prior to FY 2001, but did so under existing ASR categories such as Media Services. Thus, when the Department of Education (DOE) calculated SOQ costs for other educational cost components, some technology costs were included in these other costs

Starting in FY 2001, DOE added a new functional code to the ASR specifically for technology. However, since the SOQ is only re-based every two years, at the time of this report there had not been a biennial budget constructed using the new technology function code. To provide a baseline for this report, JLARC staff estimated how much technology funding would be provided through the SOQ using FY 2002 data and based on the SOQ methodology that was employed through the current 2002-2004 biennium. These estimates are provided in Table 2. (The estimates for salary and benefit costs in Table 2 are based on the fringe benefit rates the State used in FY 2002.)

JLARC staff estimate that the State's share of actual prevailing technology costs in FY 2002, adjusted for State SOQ cost calculation assumptions, would be between $84 million and $110 million. For purposes of this report, an average amount of $97 million is used for the FY 2002 estimate of State SOQ funding.

Table 2

Estimate of Technology Costs Funded Through the Standards of Quality Based on FY 2002 Expenditure Data
(State Share Only)

	Low Estimate	High Estimate
Estimated Salary and Benefit Costs	$12,644,871	$38,505,698
Estimated Non-personnel Costs	$71,526,049	$71,526,049
Estimated Total Technology Costs Funded Through the SOQ	**$84,170,921**	**$110,031,748**

Note: Estimates do not include a deduction for State sales tax revenue.
Source: JLARC staff analysis of 2001-2002 Annual School Report data and technical information provided by the Department of Education regarding the calculation of SOQ costs.

The range in estimates comes from the fact that it is impossible to know exactly where school divisions previously reported their technology data, which makes it very difficult to determine whether these costs were previously included with other SOQ costs. For example, if divisions reported technology support costs under the ASR classroom instruction function, these costs were probably not included with other educational costs since the SOQ personnel costs for classroom instruction are largely calculated using pupil teacher ratios rather than prevailing calculations. However, if technology support costs were reported under other ASR functions, such as instructional support or administration, they very likely were included in the prevailing calculation of other educational costs. The main exception to this appears to be positions reported as instructional technology, as it appears that in many cases these positions may not have been included in previous ASR calculations. Most non-personnel technology expenditures were included in previous calculations of SOQ costs, with the exception of technology costs classified as capital outlay additions. This is consistent with the fact that the SOQ does not fund capital outlay additions in any educational cost areas.

It appears that a significant portion of technology costs were funded indirectly through the SOQ. However, since technology costs were not explicitly recognized, many divisions may not realize that State SOQ funding includes some funds for this purpose.

State Initiative Funding for Educational Technology. Table 3 shows the level of funding the State provided through educational technology initiatives in the current and previous biennia. As indicated in the table, the Virginia Public School Authority (VPSA) Technology Initiative is the largest State initiative for funding educational technology. The VPSA Initiative has helped divisions improve their infrastructure and increase student access to computers. Under this program,

Table 3

Educational Technology Initiative Funding Provided by the State
FY 2001-FY 2004

	FY 2001	FY 2002	FY 2003	FY 2004
VPSA Technology Initiative (Amount Authorized in the Appropriation Act)	$56,910,000	$58,338,000	$58,416,000	$58,598,000
Technology Resource Assistants Initiative	--	$4,973,521	$5,072,127	--
Electronic Classroom	$2,611,658	$2,611,658	$2,531,770	$2,531,770
Administrative Systems	$1,135,345	--	--	--
Southside Virginia Regional Technology Consortium	$215,000	$215,000	$182,750	$100,000
Project ECOLE	$50,000	$50,000	--	--
Virginia Educational Technology Alliance	--	--	$50,000	$50,000
Total State Initiative Funding	**$60,922,003**	**$66,188,179**	**$66,222,647**	**$61,279,770**

Source: *Chapter 814, 2000-2002 Appropriation Act*; *Chapter 1042, 2002-2004 Appropriation Act*.

the VPSA issues five-year technology notes that are authorized by the General Assembly. Local school divisions receive the proceeds from the technology notes in the form of a grant, and the debt service for the notes is paid through the Literary Fund over a period of five years. (The Literary Fund and the VPSA Technology Initiative are discussed in more detail in Appendix B.) School division grant amounts are based on a formula that provides $50,000 per division and $26,000 per school.

The VPSA Technology Initiative is directed at helping school divisions reach the goals of the Web-based SOL Technology Initiative. School divisions may use the funds for a variety of capital purposes including retrofitting and upgrading existing school buildings to use technology, implementing a high-speed local area network, and purchasing computers to help meet the State's goal of a five-to-one student-to-computer ratio. Divisions must also provide a 20 percent match to their grant amount, with the requirement that at least 25 percent of the local match be used for teacher training in the use of technology.

After the VPSA Technology Initiative, the next largest State initiative over the past two biennia has been the Technology Support Payments initiative, also known as the Technology Resource Assistants Initiative. This initiative was funded in FY 2002 and FY 2003; however, FY 2004 funding was reprogrammed for other educational purposes. The purpose of the Technology Support Payments initiative was to assist divisions in providing on-site technology staff to support the Web-based Standards of Learning Technology Initiative. Funding was based on the State share of a $26,000 grant for every high school.

Table 3 shows that the State has also provided funding for several smaller initiatives, including the Electronic Classroom Initiative, which supports the State's distance learning program. In addition to the programs shown on Table 1, educational technology is one of the authorized uses of funds school divisions receive through the local share of the Lottery proceeds and the School Construction Grants program.

Federal Funding for Educational Technology

The federal government is also an important source of educational technology funding for school divisions. The two most significant federal technology programs, the E-Rate program and the Educational Technology Grant Program, provided over $25 million to Virginia's public schools in FY 2002. The E-Rate program assists school divisions with telecommunications services, Internet access, and internal connections. The Educational Technology Grant Program can be used for a variety of educational technology purposes, although the Virginia DOE has earmarked most of these funds for technology-related teacher training. Chapter VI provides a more in-depth discussion of federal funding for educational technology.

CURRENT JLARC REVIEW AND REPORT ORGANIZATION

Senate Joint Resolution 87 from the 2002 General Assembly session directs JLARC to develop a State funding formula for educational technology and technology support personnel. In order to develop funding formula options that are both viable for the State and responsive to the needs of Virginia's school divisions, JLARC staff undertook a variety of research activities during the analysis phase of this project. Research activities included a survey of Virginia's school divisions, site visits with a subset of these divisions, and analysis of the 2000-2001 Annual School Report and the 2001-2002 Annual School Report. JLARC staff also conducted a session at the 2002 Virginia Society for Technology in Education (VSTE) Annual Conference. In addition, JLARC staff contacted educational technology experts within Virginia, in other states, and at national organizations and consortiums.

In response to the study mandate, this report provides State funding formula options across a variety of technology cost areas. School divisions generally designated technology staff and technology equipment replacement as the two highest priority areas where they would like to see increased support from the State. Personnel costs are particularly difficult for school divisions to fund due to the recurrent nature of the costs. Providing increased support for personnel costs, which is discussed in Chapter II, would perhaps be most consistent with the types of educational costs the State currently funds through the SOQ. Hardware replacement was also mentioned as a high priority for State support by school divisions, and Chapter III provides several options for how replacement costs could be explicitly recognized through a funding formula.

Chapters IV and V address other technology cost items, such as infrastructure and training. These chapters discuss how these cost items could be included in a technology funding formula, and issues the State may want to consider in deter-

mining whether to recognize these items in a funding formula. As directed by the study mandate, Chapter VI explores whether Virginia's school divisions could increase their level of federal funding for technology and whether State tax credits could provide a viable source of funding for technology.

Chapter VII illustrates the most viable and promising funding formula options and groups these options into five combinations. These combinations largely have the effect of redistributing technology costs currently paid by localities alone into a funding formula where costs are shared with the State. The combinations range from a prevailing cost combination, which is the least expensive of the combinations, to the most expensive higher aspiration combination. Chapter VII also includes three other combinations based on the technology needs indicated by Virginia's school divisions, and State guidelines and recommendations for educational technology.

Six appendixes are included at the end of the report. Appendix A includes a copy of the study mandate, and Appendix B discusses issues related to the VPSA Technology Initiative and the Literary Fund. Appendix C provides more detail on the illustrative funding formula combinations presented in Chapter VII. In addition to providing the total cost of the combinations, Appendix C provides the State and local shares for each of the combinations. Appendix D includes a copy of the technology section from the Annual School Report, and Appendix E includes the assumptions used by JLARC staff to develop the range of estimates of technology costs funded through the SOQ. Appendix F is the agency response of the Virginia Department of Education to this JLARC report.

II. Funding Formula Options for Technology Personnel

Providing adequate levels of technology support staff is a challenge for many school divisions. This includes both technical staff to support the technology equipment and individuals to help teachers integrate technology into the curriculum. In fact, site visits to several school divisions and a survey of Virginia's divisions indicated that technology staffing is one of the top areas where school personnel feel that increased State funding is needed.

Unlike many other technology cost areas, school divisions are somewhat limited in the source of funds they can use to pay for technology personnel. While divisions are able to utilize funding from a variety of sources for technology equipment and certain infrastructure needs, these sources often do not likewise provide a dependable source of funding for technology staff due to the recurrent nature of these costs. Furthermore, some funding sources, such as the State technology grant program and the federal E-Rate program, restrict the use of funds to non-personnel items. Thus, most division technology staff are funded out of local school division funds or any funds that may be received through the SOQ. A State funding formula that provides a reliable and recurrent source of funds for technology staffing may be one of the ways in which the State could most effectively enhance its technology support for school divisions.

There are two types of technology staffing that could be recognized through a State funding formula – technology integration specialists and technical support staff. The role of technology integration specialists is to work with teachers to help them integrate the use of technology into the regular curricula. In contrast, technical support staff are concerned with more technical responsibilities, such as keeping the school division's networks running and trouble-shooting computer problems. Because these two types of personnel serve very different roles, separate funding formula options have been developed for each.

TECHNOLOGY INTEGRATION SPECIALISTS

The success of a division's technology program depends largely on having staff available to help teachers integrate the use of technology into their regular classroom curricula. This concept was reiterated by school division personnel throughout the course of this study. Integration specialists may be referred to with a variety of titles; however, the primary role of this position is to work with teachers and other staff members to integrate technology into the regular classroom environment. Integration specialists train teachers to use technology, help teachers integrate technology into the curricula, participate in the selection of appropriate software, and are involved in other instruction-related tasks. They are often experienced educators or lead teachers who posses a combination of both academic and technical knowledge. While they may assist in co-teaching a class, integration specialists are typically not the primary teacher in a classroom.

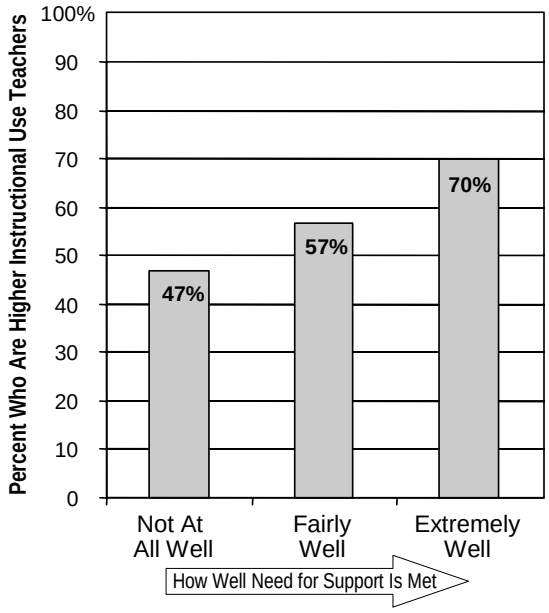
A 2002 study by SRI International, which was prepared for the U.S. Department of Education, illustrates that there is a relationship between the quality of integration support provided to teachers and teachers' use of technology. As shown in Figure 4, SRI International found that 70 percent of teachers made high instructional use of computers when their integration support needs were met 'extremely well'. This compares to only 47 percent when integration support needs were not met at all well.

Although many states and educational organizations have started developing standards for technical support staff, there has not been widespread development of staffing standards for technology integration specialists. Virginia is one of the states, however, that has developed standards and guidelines for technology integration and integration support. The Board of Education's 2003 *Educational Technology Plan for Virginia* includes goals and targets specific to technology integration. One of the goals related to integration is to "improve teaching and learning through the appropriate use of technology." Targets under this goal include that "teachers effectively integrate instructional technology" and that the "Computer/Technology Standards of Learning (SOL) are fully integrated across all curriculum areas." Virginia's Department of Education (DOE) has also recently developed a set of *Guidelines for Technology Staffing and Support for Integration of Educational Technology into Instructional Programs.* These staffing guidelines include recommended staffing ratios for integration specialists.

Figure 4

Instructional Use of Technology:

Use Varies by Quality of Support with Integrating Computer Activities into Curriculum



Source: SRI International, *The Integrated Studies of Educational Technology: Professional Development and Teachers' Use of Technology*, May 2002.

Nearly Half of Virginia's School Divisions Do Not Report Employing Technology Integration Specialists

While evidence suggests that integration specialists lead to improved use of technology by teachers, a JLARC staff survey found that just over half of Virginia's school divisions employ this type of personnel. Furthermore, the need for this type of personnel was one of the areas of concern most often mentioned by school personnel during site visits with school divisions.

Site visits appeared to reveal a relationship between the prevalence of integration personnel and the level of technology integration at the schools. In school divisions that employed integration specialists, the level of technology use in the classroom and the sophistication of that use appeared to be higher among teachers. However, in schools where integration specialists were not available, there seemed to be a lower level of technology integration into the classroom environment. For example, in one school that had recently purchased a cart with wireless laptops, the cart was rarely used by the school's teachers. The division's technology director attributed this to a lack of integration support for the teachers.

A primary benefit of integration specialists is that they are able to provide immediate on-site training and assistance for teachers. Most divisions felt that a separate staff member was needed for this purpose and that existing teachers could not successfully fulfill this role due to their regular teaching obligations. In other words, it is not practical to assume a teacher can leave in the middle of the class she is teaching to provide integration support for another teacher. Thus, providing a stipend to an existing teacher to act as an integration specialist does not appear to be a workable solution, except perhaps for very small divisions. In some cases, however, schools do split an individual staff person's time between performing school librarian duties and acting as an integration specialist.

Where integration specialists were not employed by school divisions, the primary reason given was a lack of funds. These divisions said that they would employ such specialists if the funding were available. Many divisions who already employed integration specialists also said that they would like to employ more such specialists, or at least ensure that specialists' time is spent on integration and not technical support. (Divisions often reported that they did not have enough technical support staff, which consequently resulted in integration specialists spending significant amounts of time on technical support issues to keep computers and networks running rather than on curriculum integration issues.)

Currently, it appears that the State provides limited, if any, funding towards integration support personnel. There are no State-level initiatives for this purpose, and in many cases it does not appear that these positions are covered in the Standards of Quality funding provided by the state. Therefore, providing funds for integration specialists is an area in which the State could significantly enhance its support for educational technology.

The Annual School Report Does Not Collect Detailed Data for Technology Integration Specialists

Starting with the 2000-2001 Annual School Report (ASR), DOE added a new function code specific to technology. However, this new technology function code does not provide a place for school divisions to report data specific to technology integration specialists. Guidance is not given in the ASR instructions on where to report these personnel, but a reasonable assumption would be to report them in the instructional technology category. A limitation with this is that a variety of other types of personnel are likely reported in this category as well, including instructors who teach technology-related courses to students. Therefore, division staffing and salary levels for only integration specialists cannot be determined from the ASR.

In order to estimate the cost amounts for the technology integration specialist funding formula options, JLARC staff relied on integration specialist staffing levels that were collected in a separate JLARC survey. Staff used the average salary levels that were reported in the ASR for the instructional technology category, as this appeared to be the best estimate available. If the General Assembly decides to adopt a funding formula for technology integration specialists, it may wish to request that DOE collect data for integration specialists separately through the ASR. DOE staff indicated that they would make this update to the ASR, if such data is need for a funding formula.

Funding Formula Options for Technology Integration Specialists

This section explores four potential funding formula options the State could use to fund technology integration specialists. As shown in Table 4, the approach with the lowest cost would be to fund integration specialists using the prevailing cost option, and the most expensive approach would be to fund technology integration specialists using an approach similar to the one used to identify and fund SOQ librarian positions. The costs shown in this and other chapters include both State and local costs. The split between State and local costs for these options is shown in the funding combinations included in Appendix C.

There are a couple of assumptions that affect most of the technology integration specialist options. First, the salary level used for the integration specialist position is the prevailing salary level for the instructional technology position reported on the 2001-2002 ASR. The base prevailing salary level for this position (among divisions who reported expenditures for this category) is $38,950. As mentioned above, it is impossible to know precisely what salary level is paid to integration specialists, because the ASR does not collect data for these positions independently. However, several divisions mentioned that integration specialist positions are often filled by master or experienced teachers who have developed an expertise in technology. A salary of $38,950 is slightly higher than the 2001-2002 prevailing base salary for either elementary or secondary teachers, so the salary at this level seemed appropriate for integration specialists. (The instructional fringe benefit rates for FY 2002 were used to develop a total compensation amount.)

Table 4

Summary of Funding Formula Options for Technology Integration Specialists

	FY 2002 Base Salary and Benefit Costs
• Prevailing Cost Option	$15.2 million
• DOE Advanced Level Staffing Ratios	$27.2 million
• Board of Education-based Option	$55.2 million
• Site-based Model	$93.1 million

Note: Cost estimates shown are both State and local costs.

The cost of competing factor used for Planning District 8 (northern Virginia) in all of the integration specialist options is 9.83 percent. This is the same cost of competing factor used in the SOQ methodology for instructional personnel.

Prevailing Cost Option. The prevailing cost option for funding technology integration specialists is the least expensive of the options to the State and bases a funding formula on the typical number of integration technology specialists provided by school divisions. This option uses a linear weighted average approach to calculate the prevailing staffing and salary levels. By using a linear weighted average, divisions reporting either very high or very low staffing and expenditure levels are weighted less than those divisions whose levels fall near the median. The purpose of this approach is to reflect all divisions in the calculation, but not to allow divisions in the extreme to unduly influence the overall calculation.

The prevailing approach is consistent with how many costs are calculated in the SOQ. However, one deviation is made in this option from the Department of Education's implementation of the SOQ methodology. The SOQ methodology used by DOE typically treats divisions that do not report costs as missing data and drops them from the calculation. In other words, DOE does not assume that these divisions actually spent zero in these categories, but rather assumes that they failed to report their expenditures. Hence, the weighted average is not reduced by these divisions. In calculating the prevailing cost option for integration specialists, however, JLARC staff included those divisions that have not reported expenditures for this purpose. This is because it appears that many divisions currently, in fact, do not employ integration specialists. The weighted average is therefore reduced by these divisions.

Table 5 shows the total base number of integration specialists that would be funded under the prevailing cost option and their related salary and benefit costs.

Table 5

Prevailing Cost Option
Estimated Number of Integration Specialists and Related Salary and Benefit Costs

Base Year FY 2002

Total Estimated Number of Integration Specialists	Total Estimated Base FY 2002 Salary and Benefit Costs
315.7	$15,229,324

Note: State and local costs shown.

Under the prevailing cost option, there are .276 integration specialists funded per 1,000 students. Again, while these levels may seem low, they reflect the fact that only 76 divisions reported employing integration specialists on a recent JLARC survey. Using the prevailing cost option for base year FY 2002, a statewide total of 315.7 integration specialists would be funded at a total salary cost of $15.2 million.

Department of Education Advanced Level Staffing Ratios. In 2003, the Virginia Department of Education (DOE) provided to the State Board of Education *Guidelines for Technology Staffing and Support for Integration of Education Technology into Instructional Programs.* This document includes recommended staffing ratios for technology administrators, technical support, and instructional technologists. (The instructional technologists in DOE's staffing guidelines are comparable to the technology integration specialists discussed in this report.)

The recommended staffing ratios in the DOE guidelines are based on the approach used for staffing in the 2002-2003 Texas School Technology and Readiness (STaR) Chart (which draws from a variety of national and statewide technology guidelines) and the Technology Support Index developed by the International Society for Technology in Education (ISTE). Similar to the Texas STaR Chart and the Technology Support Index, DOE proposes different staffing guidelines depending on the level of technological readiness in schools. DOE's recommended staffing levels for instructional technologists are displayed in Table 6.

The funding formula for this option is based on the staffing ratio DOE recommends for the advanced level of technology in schools. While not all schools are at the advanced level yet, this seems to be the most realistic level for what Virginia's schools will reach in the near term. The description of schools at the advanced level is as follows:

> These schools are generally technology rich, have an active and frequently updated technology plan, high availability and use of technology and technology resources, and may have a dedicated

Table 6

DOE Recommended Staffing Ratios for Instructional Technologists

	Number of Instructional Technologists
Beginning Level of Technology in Schools	1 per 160 teachers
Moderate Level of Technology in Schools	1 per 120 teachers
Advanced Level of Technology in Schools	1 per 80 teachers
Integrated Level of Technology in Schools	1 per 40 teachers

Source: Virginia Department of Education, Guidelines for Technology Staffing and Support for Integration of Educational Technology into Instructional Programs.

> high-speed high-bandwidth network. Teachers do on-line research for technology plans and resources to include in instruction and regularly use technology to enhance instruction and student activities. Students regularly use a variety of technology in assignments and often use at least one multimedia method to create products.

As Virginia's schools progress in their technological capabilities, the State could base a funding formula on the recommended staffing ratios for the integrated level of technology capability.

To be consistent with the SOQ, the funding formula for this option applies the recommended staffing ratio to the number of teachers calculated by the SOQ rather than the total number of teachers employed in a school division. This is because the purpose of the funding formula is to provide a base, or floor, for how much integration support is provided. If the SOQ is modified to recognize a greater number of teachers, the related number of integration specialists will increase as well.

Table 7 indicates an estimated 564.2 integration specialists statewide and $27.2 million in total salary and benefit costs in the base year for a funding formula based on the DOE advanced level staffing ratios. This is about twice the cost of the prevailing cost option, but less than 30 percent of the cost of the site-based model.

Board of Education-Based Model. Article VIII, Section 2 of the *Constitution of Virginia* requires the Board of Education to determine and prescribe standards of quality for the public schools in Virginia. The *Constitution* states:

> Standards of quality for the several school divisions shall be determined and prescribed from time to time by the Board of Education, subject to revision only by the General Assembly. The General Assembly shall determine the manner in which funds are to be provided for the cost of maintaining an educational program meeting the prescribed standards of quality ...

Table 7

DOE Advanced-Level Staffing Ratios
Estimated Number of Integration Specialists
and Related Salary and Benefit Costs

Base Year FY 2002

Total Estimated Number of Integration Specialists	Total Estimated Base FY 2002 Salary and Benefit Costs
564.2	$27,209,268

Note: State and local costs shown.

In October 2001, the Board of Education revised its by-laws to require itself to "determine the need for a review of the SOQ from time to time but no less than once every two years", and a Standards of Quality Standing Committee was subsequently created by the Board in November 2001. Several bills passed by the 2002 General Assembly also required regular review of the SOQ by the Board.

The results of the Board's more formalized SOQ-review process were publicized during the summer of 2003, when the Board proposed a number of revisions to the Standards of Quality. These proposed revisions will be forwarded to the General Assembly for consideration during the 2004 Session. Proposed revisions include changes and updates for staffing positions currently included in the SOQ, as well as the inclusion of several new positions in the SOQ. Among the new positions the Board proposes to include are an instructional technology position (whose purpose is to assist teachers with integrating technology into their curriculum) and a technology specialist (whose purpose is to provide technical support to divisions). The Board proposes funding one position per 1,000 students for each.

The Board of Education-based funding formula option for this report uses a ratio of one integration specialist position per 1,000 students. It is calculated at the division level using end-of-year average daily membership (ADM) and uses the prevailing salary ($38,950) calculated for the instructional technology positions in the 2001-2002 ASR.

The JLARC staff methodology differs in several ways from the methodology applied by DOE to calculate the cost of the Board of Education proposal. First, although DOE applies the one per 1,000 ratio at the division level, it is applied separately for elementary and secondary levels. This is because DOE uses the prevailing salary levels for elementary teachers and secondary teachers when calculating the cost of the proposal. JLARC staff did not differentiate between integration specialists at the elementary and secondary level because: (1) the Board's proposal itself does not make such a distinction, and (2) it is not clear that the prevailing elementary and secondary teacher salaries are the most accurate salaries to use for integration specialists. Salary data specific to integration specialist positions are currently

not available, but most division staff indicated that integration specialists are typically former lead or experienced teachers. As a result, the salary level for the instructional technology position, which is slightly higher than the prevailing elementary or secondary teacher salaries, appears appropriate.

A second difference is that the estimates provided by DOE for the Board of Education round the calculated number of positions up to the nearest whole number. JLARC staff did not round the number of calculated positions up to the nearest whole number because: (1) this approach is not specified by the Board of Education's proposal, (2) there are partial positions calculated by the SOQ, such as school librarians and guidance counselors, and (3) from an empirical standpoint, many divisions reported partial positions in their total number of integration specialists.

A third difference is that JLARC staff calculated this option solely based on providing one integration specialist per 1,000 students. While the Board's recommended standard is to fund one integration specialist per 1,000 students, DOE indicates that the Board's intention is for this to be an "add-on" to the number of integration specialists calculated using the prevailing methodology. JLARC staff did not treat this option as an add-on to the prevailing cost option because the staffing and cost estimates for providing one integration specialist per 1,000 students are nearly the same as what would be calculated using the DOE recommended staffing ratios for the integrated level of technology in schools. The integrated level is the highest level of technology staffing included in DOE's recommended staffing ratios. (See Table 6 in the DOE advanced level staffing option.) Therefore, calculating staffing levels at the integrated level, plus the prevailing level, seems excessive for this option.

Table 8 shows that the FY 2002 base year estimates for the Board of Education-based option are 1,143.8 integration specialists and $55.2 million in total salary and benefit costs. These staffing and salary costs are similar to the levels calculated by DOE for the one per 1,000 portion of the Board's recommendation (1,240 integration specialist FTE and $49.6 million in salary and benefit costs for FY 2004). One consideration is that perhaps the State could fund staffing ratios at the advanced level first as a way of phasing in funding until it is appropriate to fund in-

Table 8

Board of Education-Based Option
Estimated Number of Integration Specialists and Related Salary and Benefit Costs

Base Year FY 2002

Total Estimated Number of Integration Specialists	Total Estimated Base FY 2002 Salary and Benefit Costs
1,143.8	$55,178,709

Note: State and local costs shown.

tegration specialists at a ratio of one per 1,000 students, which is very similar to the integrated level of staffing.

Site-Based Model. The site-based model most closely reflects what school divisions visited by JLARC staff indicated they would like to see for technology integration support in their schools. In site visits with school divisions, division staff often indicated that the most effective way to provide integration support is to have an integration specialist dedicated to each school. A specialist based at a specific school becomes acquainted with the demographics of the teaching population and is able to develop a better rapport with teachers. Additionally, teachers are more comfortable using technology because they know an integration specialist is readily available.

A formula based on providing one integration specialist per school is appealing in its simplicity, but is somewhat problematic due to the vast range in school sizes. Schools that are very small may not need a full-time integration specialist. In these cases, perhaps an existing instructional staff person, such as the gifted teacher, could serve in this role on a part-time basis. Similarly, in very large schools, one integration specialist may not be enough to support all of the teachers in the school. To deal with the inequities that could be caused by variances in school size, staff at several divisions suggested modeling the integration specialist formula after the SOQ formula for calculating school librarians. The SOQ librarian formula calculates the number of librarians at the school level based on student enrollment. Table 9 shows the number of librarians that are calculated for a given school under the SOQ funding methodology.

Applying a model similar to the SOQ librarian methodology to calculate integration specialists is slightly more expensive, about $4 million more in base salary and benefit costs, than a formula that simply allocates one integration specialist to every school. However, such a formula reflects the differences in need between large and small schools, and therefore would be a more accurate and realistic approach to funding integration specialists. As shown in Table 10, using the site-based model to calculate integration specialists for base year FY 2002 would result in 1,934 integration specialists statewide at a total salary and benefit cost of $93.1 million.

Table 9

SOQ Methodology for Calculating School Librarians

School Enrollment	Number of Librarian FTEs Calculated Under the SOQ
0-299 students	.5 FTE
300-999 students	1 FTE
1000+ students	2 FTEs

Source: Section 22.1-253.13:3, *Code of Virginia.*

Table 10

Site-Based Model
Estimated Number of Integration Specialists
and Related Salary and Benefit Costs

Base Year FY 2002

Total Estimated Number of Integration Specialists	Total Estimated Base FY 2002 Salary and Benefit Costs
1,934.0	$93,067,137

Note: State and local costs shown.

Summary of Technology Integration Specialist Funding Formula Options. The base salary and benefit costs for the technology integration specialist funding formula options range from a low of $15.2 million for the prevailing cost option to a high of $93.1 million for the site-based model. Since a number of divisions indicated that they are currently unable to hire an adequate number of integration specialist due to funding constraints, it does not appear that the prevailing cost option would meet divisions' needs for integration specialists. Providing integration specialists using the site-based model would yield the level of integration staffing that is most desired by school divisions, but this is also the most expensive option for funding integration support. This option may be more realistic if the State decides that it prefers to focus its support on personnel needs rather than non-personnel needs, such as hardware replacement. While funding integration specialists using the DOE advanced level staffing ratios or the Board of Education-based option would not provide the level of support desired by some divisions, it would be substantially more economical for the State and would be a large improvement over the level of funding currently provided by the State, which may be only a negligible amount of funding at best.

TECHNICAL SUPPORT STAFF

Of the various technology costs faced by school divisions, one of the most difficult components for divisions to fund is technical support staff. In a U.S. General Accounting Office (GAO) study of *Five School Districts' Experiences in Funding Technology Programs*, GAO found that "program components that were hardest to fund … were those heavily dependent on staff positions (maintenance, training, and technical support). Staffing was difficult to fund because some funding sources could not be used for staffing and because some sources were not well suited for this purpose."

This finding was echoed by Virginia's school divisions during the course of this project, and for the same reasons. While one-time grants or windfalls can be

used to cover hardware or infrastructure needs, they cannot be used for recurring staffing needs. Furthermore, certain funding sources, such as the State Technology Grants or the Federal E-Rate funds, are not available to cover personnel costs. During site visits with Virginia's school divisions, most divisions reported paying for technology support staff solely out of local funds. In fact, as Chapter I discussed, some funds have been provided for technology support staff through the Standards of Quality. However, these funds were imbedded in other SOQ cost components, so school divisions likely did not realize that State funds were available for this purpose. Throughout the course of this study, school division staff indicated that support for personnel costs is one of the areas where they most need State assistance.

There Is a Wide Range in the Level of Technology Support and How Technology Support Is Provided in Virginia's Schools

There is a large range in both the level of technology support provided in Virginia's school divisions and the manner in which support is provided to schools. During the 2001-2002 school year, Virginia's school divisions provided an average of 1.5 technology support staff personnel for every 1,000 students. The highest level of support reported was six support staff personnel for every 1,000 students. In contrast, several divisions did not report any technology support staff, although in at least some cases, this is a result of divisions misreporting their data. Still, there does appear to be a wide variance in the levels of technology support provided by different divisions.

In addition to the range in level of support provided, there are also significant differences in how school divisions meet their technology support needs. These differences are primarily due to a division's size and location. In very small divisions, a handful of technology support staff may serve a variety of support roles for the division. In contrast, large divisions often have several levels of technology administration and support. In these divisions, technology support staff may serve much more specialized roles.

Divisions also vary in their approach to meeting their schools support needs, and more importantly, what works well in one division may not work for another division. Some more urban school divisions outsource most of their technology support needs and have relatively few support staff in-house. In other divisions, particularly rural divisions, the option to outsource may not be available so divisions hire their own support staff. Divisions also vary in their use of a help desk. Some divisions use a help desk to actually dispense assistance to users while others use a help desk to track and organize work requests. Still other divisions do not make use of this tool because they do not have enough personnel to staff a help desk. Similarly, the use of students to provide technology support ranges from situations where students provide basic trouble shooting, to divisions where students help in tasks such as unloading hardware, to still other divisions where student support is not used at all.

Regardless of the level of technology support provided or how this support is provided, many divisions indicated that technology support staffing is one of the

top technology-related areas where State support is most needed. Unlike the case with integration specialists, in most divisions State funding for technology support positions would serve to reimburse divisions for costs that they are already incurring. Increased State support may also help divisions raise their level of technical support. Some divisions further indicated that increased State support would allow them to free up funds for other technology-related purposes, such as hardware or infrastructure.

As discussed in Chapter I, the State does provide some funding for technology support staff through the SOQ. However, it has not been clear how much funding has been provided by the State for this purpose. At the very least, it would be helpful for the State to explicitly recognize technology support in its funding formula for calculating SOQ per pupil amounts. Even if a separate amount is not identified for technology support staff in the Appropriation Act, divisions could be made aware of the State's methodology of calculating funds for this purpose. However, the State may also want to consider devising a funding formula that attempts to more realistically meet the technology support needs of schools.

Divisions Did Not Consistently Report Their Technology Support Staff Expenditures and Full-Time Equivalents (FTEs) on the 2001-2002 Annual School Report

The Annual School Report (ASR) is the best source of data for school divisions' technology support expenditures and staffing levels, which are captured as Full Time Equivalents (FTE). Unfortunately, it appears that school divisions did not consistently report their technology support expenditures and FTEs on the 2001-2002 ASR, the base year of data used for this study. The issue is two-fold. First, divisions did not consistently report technology support expenditures and FTEs in the same staffing categories. Second, some divisions failed entirely to report their technology support staff expenditures and FTEs in the technology section of the ASR.

Although DOE included a new technology function code starting with the 2000-2001 ASR, the department did not include any descriptions for the new cost codes included in the technology function code. For the 2001-2002 ASR, the technology function code includes the following position types:

- Technology, Administrative,
- Technology, Instructional,
- Technology, Technical Development,
- Technology, Technical Support, and
- Technology, Clerical.

Without position descriptions provided by DOE, school divisions assumed their own descriptions. This resulted in school divisions categorizing the same types of positions differently on the ASR. This was particularly true for the technical develop-

ment positions and the technical support positions. The instructions for the 2002-2003 ASR include position descriptions for the technical development and technical support positions, which should lead to a greater level of consistency among school divisions in reporting technology support staff.

A second limitation of the technology data, which affects more than just the technology support positions, is that some divisions simply did not use the new technology section in the ASR to report their technology expenditures. Rather, they continued to report these expenditures in ASR categories that they had used prior to the addition of the new technology section. In these cases, the technology costs are reflected in other parts of the ASR (they are not dropped completely). However, the ASR technology data does not give a full reflection of the technology expenditures made by these divisions. To help with this issue, the General Assembly may want to consider amending Section 22.1-115 of the *Code of Virginia* to include technology as a major classification of funds for school division accounting purposes. In addition, if the General Assembly decides to adopt a funding formula approach for educational technology, it may wish to direct DOE to conduct preliminary analysis, such as outlier analysis, to help identify school divisions that have not reported their technology expenditures in the technology section of the ASR.

Funding Formula Options for Technical Support Staff

This section discusses several potential funding formula options the State could utilize to fund technical support staff. As shown in Table 11, the least expensive approach would be to expand the State's prior High School Technology Resource Assistants Initiative, while the most expensive approach would be to fund support staff at the industry level of providing technical support.

Throughout the course of this study, school division staff have indicated that technology support staffing is one of the areas where increased State support is most needed in the area of educational technology. However, because of the large range in how divisions provide technology support, it is difficult to devise a funding model that is representative of all divisions. While a formulaic approach can be used to fund technology support, it may not represent how technology support is actually provided in a given division.

Despite the variations in how technology support needs are met, it appears that there are generally three levels of technology support provided to schools – administrative support, support provided at the division level, and school-based technology support. These three levels of support are described in Exhibit 4 and are the basis for many of the support staff funding formula options in this report. As mentioned previously, in large school divisions these three levels of support may be well defined. However, in smaller divisions, the same technology support staff members may serve all levels of support.

In addition to the three levels of technology support that are reflected in the funding formula options, there are several assumptions that are consistently used

Table 11

Summary of Funding Formula Options for Technical Support Staff

	Estimated FY 2002 Base Salary and Benefit Costs
• Prevailing Cost Option	$73.2 million
• DOE Advanced Level Staffing Ratios	$83.0 million
• Board of Education-based Option	$71.3 million
• Site-based Model	$100.8 million
• High School Technology Resource Assistants Initiative	$49.6 million
• Industry Standards Option	$196.4 million

Exhibit 4

Levels of Technology Support

Administrative Level. Support provided at the administrative level includes technology staff responsible for administering and managing the technology program. Their responsibilities usually include developing and implementing technology plans, designing policies, managing training programs, and supervising employees. Administrative staff may include technology directors, coordinators, and supervisors. In small school divisions, the superintendent may serve as the division's technology director. The administrative technology positions from the ASR most closely align with this level of technology staffing.

Division Level. Technology support staff at the division level may include systems analysts and engineers who are responsible for systems design, technical development, modification of programs or applications, and telecommunications and network support that is required at the division level. This level of support is most closely aligned with the technical development positions in the ASR.

School Level. The third level of technology support is provided at the school level and is responsible for on-site computer and network support. These support staff provide software and hardware support, and network support and maintenance at the school level. They are generally not responsible for the development and implementation of new applications and programs. The technical support positions in the ASR seem most closely aligned with the school level of support.

with the options. First, instructional technology staff are not reflected in any of the technology support options. This is because most divisions did not include technical support positions in the instructional technology category of the ASR. The instructional technology category typically included positions related to instruction and curriculum integration.

For options based on the number of computers requiring support, the number of computers needed is calculated using a 5:1 student to computer ratio. A 5:1 ratio was used because it is consistent with the State's current goal for student access to computers. No attempt was made to calculate options based on the actual number of computers available in the school divisions. This is because of discrepancies in how well divisions are able to track their inventory of computers, and due to the definitional issues that arise in trying to determine what qualifies as a computer.

The cost of competing factor used for Planning District 8 (northern Virginia) in the options is 9.83 percent. This is the cost of competing factor used for instructional staff in the SOQ, as opposed to the support staff factor of 20.92 percent. The lower cost of competing factor was used because it is much closer to the 9.32 percent differential found for technical salaries in the 1996 *JLARC Technical Report: The Cost of Competing in Standards of Quality Funding*.

The calculation of prevailing staffing levels for the prevailing cost option, or prevailing subgroups in other options, includes all divisions, even those reporting zero expenditures. This is because these divisions likely reported their technology support expenditures elsewhere in the ASR, which means these expenditures may be picked up in the calculation of other cost components. When a prevailing staffing or salary level is used for a specific position type, only those divisions reporting data for that position type are included in the calculation. This is because, in these cases, the purpose of the calculation is to determine the prevailing number of positions and corresponding prevailing salary among those divisions reporting a type of position.

A final issue is that the cost of the technology support options is likely to increase over time as divisions more accurately report data for technology support staff on the Annual School Report. This is particularly true for those divisions who have failed to report technology support expenditures in the technology section of the ASR.

Prevailing Cost Option. The prevailing cost option for technology support staff is based on the level of technology support that is currently provided by school divisions. In contrast to the prevailing cost option for integration specialists, the prevailing cost option for technology support staff is not the least expensive of the support staff options. This reflects the fact that most, if not all, divisions already have some form of technology support in place. This is not necessarily the case with integration specialists.

The prevailing cost option combines all technology support positions, and calculates the prevailing number of positions per student and the prevailing salary level for these combined positions. Similar to the prevailing cost option for integra-

tion specialists, this option uses a linear weighted average to calculate the prevailing staffing and salary levels. Table 12 shows the total base number of technology support staff positions that would be funded under the prevailing cost option and their related salary and benefit costs. Under the prevailing cost option, there are 1.5 technology support staff per 1,000 students. An estimated 1,664.3 technology support staff would be funded in FY 2002 using the prevailing cost option at a total estimated salary and benefit cost of $73.2 million.

Table 12

Prevailing Cost Option
Estimated Number of Technology Support Staff
and Related Salary and Benefit Costs

Base Year FY 2002

Total Estimated Number of Technology Support Staff	Total Estimated Base FY 2002 Salary and Benefit Costs
1,664.3	$73,172,020

Note: State and local costs shown.

Department of Education Advanced Level Staffing Ratios. As mentioned in the previous section of this report dealing with integration specialists, in 2003 the Virginia DOE provided to the State Board of Education *Guidelines for Technology Staffing and Support for Integration of Education Technology into Instructional Programs*. This document includes recommended staffing ratios for both technology administrators and technical support staff based on the level of technological readiness in schools (Table 13).

The staffing ratios in the DOE guidelines for technical support staff are modeled, in part, on the Technology Support Index (TSI) developed by the International Society for Technology in Education (ISTE). In addition to other technology support issues addressed by the TSI, the TSI provides ranges of suggested staffing levels based on the level of technology capability in schools. The TSI stages of school technological capability are categorized into four levels, emergent through exemplary, and appear to provide the basis for the four levels of technological readiness included in the DOE staffing guidelines.

The DOE staffing guidelines take into consideration the staffing ranges recommended in the TSI, along with several other guidelines for technology staffing. DOE chose staffing ratios that were in the lower end of the proposed ranges in an attempt to reflect other computerized devices in schools that require support, such as cell phones and digital cameras. In doing so, the funding formula based on the DOE guidelines is the only option that attempts to make an explicit adjustment for these other emerging technologies that are being used by schools.

Table 13

DOE Recommended Staffing Ratios for Technology Administrators and Technical Support

	Technology Administrators	Technical Support
Beginning Level of Technology in Schools	1 per division and 1 per 1200 teachers	Computer-to-Technical Support, 260:1
Moderate Level of Technology in Schools	1 per division and 1 per 600 teachers	Computer-to-Technical Support, 200:1
Advanced Level of Technology in Schools	1 per division and 1 per 450 teachers	Computer-to-Technical Support, 140:1
Integrated Level of Technology in Schools	1 per division and 1 per 300 teachers	Computer-to-Technical Support, 80:1

Source: Virginia Department of Education, *Guidelines for Technology Staffing and Support for Integration of Educational Technology Into Instructional Programs*.

The technology support option based on DOE's suggested staffing ratios uses the ratios proposed for the advanced level of technology in schools. As mentioned previously, while not all of Virginia's schools are at this level yet, this seems to be the most realistic level for what Virginia's schools will reach in the near term. As Virginia's schools progress in their technological capabilities, in the future the State may want to consider basing a funding formula on the staffing ratios recommended for the integrated level.

The current option applies the staffing ratio for technology administrators to the number of teachers calculated by the SOQ funding formula. The number of technical support staff calculated for this option is based on a ratio of one computer for every five students. Because the DOE staffing ratios do not differentiate between types of support staff, a combined prevailing salary level for both the technical development positions and the technical support positions from the ASR is used.

Table 14 indicates that the DOE advanced-level staffing ratios option would fund an estimated 1,866.3 technology support staff statewide in base year FY 2002 at a total salary and benefit cost of $83.0 million. This option is mid-range in cost compared to the other technology support options. It is also very close to the estimated total salary cost and staffing levels that result from a recommendation made by a Virginia-based educational technology group, the Virginia Society for Technology in Education (VSTE). (VSTE is Virginia's affiliate of the International Society of Technology in Education, and is made up of educators and school administrators from across the state. In November 2002, VSTE presented technology support staffing recommendations to the Board of Education.) If the DOE staffing ratios that are recommended at the integrated level are used, the costs are substantially higher – around $133 million in total base year salary and benefit costs.

Table 14

DOE Advanced-Level Staffing Ratios
Estimated Number of Technology Support Staff
and Related Salary and Benefit Costs

Base FY 2002

Total Estimated Number of Technology Support Staff	Total Estimated Base FY 2002 Salary and Benefit Costs
1,866.3	$83,006,468

Note: State and local costs shown.

Board of Education-Based Option. As mentioned previously in this chapter, during the summer of 2003 the Board of Education proposed a number of revisions to the Standards of Quality. Among these proposed changes is the inclusion of a technology specialist position in the SOQ to provide technical support to schools. The Board proposed providing one technology specialist position per 1,000 students.

In the Department of Education's estimate of costs for the Board's proposal, DOE calculates one technical support staff position per 1,000 students. For the other types of technology support staffing, such as administrative technology personnel, DOE calculates a prevailing level and includes this prevailing level in the overall estimate for the proposal. The Board's proposal does not indicate that there should be one technical support staff position per 1,000 students, plus a prevailing level of other types of technology support positions. However, DOE indicates that this is the Board's intention. JLARC staff have recognized this intention as well for purposes of estimating a Board of Education-based option.

There are several points where the JLARC staff methodology differs from the methodology used by DOE to calculate the costs associated with the Board's proposal. First, DOE rounds the calculated number of FTE positions up to the nearest whole number. JLARC staff did not do this because: (1) from an empirical standpoint, many divisions reported partial positions in their total number of technology support staff, and (2) various other support positions calculated on a prevailing basis in the SOQ are not rounded up to the nearest whole FTE.

Second, DOE includes instructional technology positions in the calculation of prevailing 'other technology support'. JLARC staff did not include technology instructional positions because, based on information from school divisions, these positions are typically instructional in nature -- either integration specialists or technology instructors. Either way, it does not seem appropriate that they should be included in a calculation of technical support staff.

According to JLARC staff estimates, the Board of Education-based option would fund 1,619.26 total technology support staff statewide in base year FY 2002 at a total salary and benefits cost of $71.3 million (Table 15). This option is comparable in cost and staffing levels to the prevailing cost option, but is significantly less expensive than the site-based model or the DOE Advanced Level Staffing Guidelines Option. It is also significantly less than DOE's estimate of total salary and benefit costs for the Board of Education proposal (approximately $130 million), which is probably largely due to the fact that the JLARC estimate does not include instructional technology positions.

Table 15

Board of Education-Based Option
Estimated Number of Technology Support Staff
and Related Salary and Benefit Costs

Base Year FY 2002

Total Estimated Number of Technology Support Staff	Total Estimated Base FY 2002 Salary and Benefit Costs
1,619.26	$71,307,699

Note: State and local costs shown.

Site-based Model. Site visits with school divisions revealed that many division staff suggest that it is ideal to have technology support staff assigned at the building level. If support staff is based at a particular school, the time spent traveling between schools is reduced so there is more time on task for support personnel, resulting in less downtime for school computers. Additionally, site-based support staff help reduce the amount of time that integration specialists spend fixing technical problems – a common complaint of school division staff.

While technology support staff assigned at the building level may be ideal for many schools, school division staff acknowledged that smaller schools may not require a full-time technology support person and very large schools may require more than one support person. Also, in school divisions that cover a small geographic area, the time spent traveling between schools may be less of a concern. Taking these factors into consideration, several school divisions suggested modeling a technology support staff formula after the SOQ formula for calculating librarians. As indicated in the comparable model for integration specialists, the SOQ funding formula calculates the number of librarians based on school enrollment. Schools with 0-299 students receive .5 librarian FTEs, schools with 300-999 students receive one librarian FTE, and schools with 1,000 students or more receive two librarian FTEs.

The site-based model is applied only to the technical support positions in this option, because these types of positions are most likely to deal with issues at the

building level. All other support positions -- administrative, technical development, and technology clerical – are calculated on a prevailing basis.

Using the site-based model, an estimated 2,378 technology support staff positions statewide would be provided in base year FY 2002 at a total salary cost of $100.8 million (Table 16). This model is slightly more expensive, about $4 million more, than using the simpler approach of providing one technical support position at each school building. However, the site-based model more precisely represents individual school's needs.

Table 16

Site-Based Model
Estimated Number of Technology Support Staff and Related Salary and Benefit Costs

Base Year FY 2002

Total Estimated Number of Technology Support Staff	Total Estimated Base FY 2002 Salary and Benefit Costs
2,377.8	$100,775,170

Note: State and local costs shown.

Expand the High School Technology Resource Assistants Initiative. During FY 2002 and FY 2003, the State provided approximately $5 million annually for the High School Technology Resource Assistants Initiative. (In FY 2004, this initiative was discontinued and funding was transferred to pay for other education-related initiatives.) The High School Technology Resource Assistants Initiative was provided to assist local school divisions in providing on-site support for the Web-based Standards of Learning Technology Initiative. Divisions could directly employ technology resource assistants to provide support or contract for on-site technology support services. The incentive payments for the initiative were based on the State share of a grant of $26,000 for every high school.

The study mandate for this report directs JLARC to "examine the possibility of expanding the high school technology resource assistant initiative to include elementary, middle, and adult education schools." Based on school fall membership data and adult education enrollment data, less than one quarter of Virginia's schools are classified as high schools. Expanding the High School Technology Resource Assistants Initiative to include elementary, middle, and adult education schools would increase the total cost of the initiative from an estimated $8.5 million per year (the State's share is approximately 55 percent of the total cost) to over $49 million per year (Table 17). This option assumes that every elementary, middle, adult, and high school would receive a grant amount of $26,000, with the exception of situations where adult education enrollment level is very low. The cost of this option could be

Table 17

Expand the High School Technology Resource Assistants Initiative Estimated Total Costs

Base FY 2002

Total Estimated Number of Technology Support Staff	Total Estimated Cost
Not Applicable	$49,621,000

Note: State and local costs shown.

reduced if all schools with an enrollment below a certain level, for example 100 students, were receive an adjusted grant amount of less than $26,000.

Expanding the High School Technology Resource Assistants Initiative is the least expensive of the technology support options. A benefit of this option is that it is very easy to predict the future cost of the option, since it is based on a flat amount per school. The cost of the option will not change appreciably unless the General Assembly decides to increase the grant amount. However, several of the other options may be preferable since they reflect the needs articulated by school division staff and are more closely related to the number of computers, enrollment levels, and staffing levels actually supported by the school divisions.

Industry Standards Option. The industry standard for providing technology support ranges from one support person per 50 computers to one support person per 100 computers depending on the type of business. Most educational leaders agree that it is not practical to assume that schools could provide the level of support that is consistent with the standard for the private sector. However, for illustrative purposes, an industry standards option has been included in this report.

The industry standards option is based on a ratio of one technology support person for every 50 computers. (A ratio of one computer for every five students was used to calculate the total number of computers.) The salary level used is the prevailing salary ($35,147) for all technology support personnel, since this option does not specify a particular type of support personnel. This salary level is probably less, however, than what is provided in the private sector for technology support personnel.

Table 18 shows that the industry standards option by far yields the greatest number of technology support staff statewide (4,575.3) in the base year at the greatest total salary and benefit cost ($196.4 million). Such an option is probably not realistic for the State to consider, but it does provide a basis of comparison for the other technology support options.

Table 18

Industry Standards Option
Estimated Number of Technology Support Staff
and Related Salary and Benefit Costs

Base FY 2002

Total Estimated Number of Technology Support Staff	Total Estimated Base FY 2002 Salary and Benefit Costs
4,575.3	$196,413,587

Note: State and local costs shown.

Summary of Technology Support Staff Funding Formula Options. The base FY 2002 salary benefit costs for the technology support staff funding formula options range from a low of $49.6 million to a high of $196.4 million. However, if the industry standards option is not considered, the range in costs among the various options becomes smaller.

The least costly option is to simply reinstate and expand the High School Technology Resource Assistants Initiative ($49.6 million), although this is a somewhat arbitrary way to fund technology support. The prevailing cost option ($73.2 million) reflects actual division expenditures, but does not make a judgment about whether the levels of support provided by divisions is adequate or appropriate. In contrast, the Board of Education-based option ($71.3 million), the DOE advanced level staffing ratios ($83.0 million), and the site-based model ($100.8 million) attempt to provide some guidance as to a level of technology support that should be provided in schools. This is particularly true for the site-based model, which is based on what school division staff indicated as ideal, and the DOE advanced level staffing ratios, which is based on research by the International Society for Technology in Education (ISTE) and others.

These options, with perhaps the exception of the industry standards option, seem to be in line with the technology support goals in other states. It is difficult to compare staffing goals directly, as it is unclear whether some of the state goals are only for technical support staff or whether they include other types of technology support staff, such as administrative support. However, there are a number of states that have developed technology staffing goals for their schools. For example, Massachusetts established a goal of one technical FTE per 100 to 200 computers. Maryland established a ratio of one technical support person for every 300 computers. Oregon established a goal of one technical support staff for every 100 to 250 users. California has proposed a goal of one technical support person per 300 computers in newer schools and up to one support person per 50 computers in older schools. North Carolina's staffing ratios include one technology administrator per district, one technology coordinator for every ten schools, and one technology support

person per approximately each 100 computers. Similar to the Virginia DOE, several states have also based their staffing goals on the ISTE Technology Support Index.

The Virginia General Assembly may wish to consider adopting a funding formula for technology support personnel. Although some State funds may have been provided implicitly through the SOQ, many divisions are unaware of this. Therefore, there is some benefit to the State more explicitly providing funds for educational technology. Unlike the case with the integration specialists, a State funding formula for technology support staff would largely reimburse divisions for costs that they are already incurring. However, in some cases this may allow divisions to provide improved levels of support, and in other divisions this may free up funds to be used for other technology needs.

III. Funding Formula Options for Hardware Replacement

The mandate for this study specifically requests JLARC staff to examine the integration of technology replacement into a funding formula for educational technology. Currently, the State provides funding to school divisions for the purchase of technology hardware to meet the Web-based SOL Technology Initiative hardware goal of having a five-to-one student-to-computer ratio in all classrooms. However, it does not have an explicit funding program to replace existing computers.

Computer replacement was listed as one of the primary areas of funding need behind personnel during JLARC staff interviews. In addition, on a JLARC staff survey of all school divisions, the majority of divisions reported that they are unable to fully fund a regular replacement cycle of their computers. Education technology experts recommend that technology should be replaced every three to five years. As school divisions continue to add computers to meet the five-to-one ratio, additional funding is needed to begin replacing the growing number of computers as they age. Therefore, a funding formula that recognizes the ongoing need to replace hardware may be necessary in order to maintain the appropriate ratios and to provide up-to-date technology to students.

The following chapter discusses the issues concerning hardware additions and replacement. The first section discusses how well school divisions are providing additional hardware to meet current goals set by the State. The second section describes the need for additional funding to replace aging hardware and the difficulty in determining current hardware costs. It also provides funding formula options for the State to more explicitly address the need for hardware replacement.

HARDWARE ADDITION GOALS HAVE AN IMPACT ON REPLACEMENT COSTS

Recent additions of hardware in school divisions have been primarily for the purchase of computers to meet the State's five-to-one student-to-computer goal. Based on a recent DOE survey, school divisions are working towards meeting the State's goals. However, the method of purchasing computers varies, as do the types of computers purchased and the way in which they are added. Also, school divisions purchase other peripheral equipment that is included in the cost of hardware, such as printers, keyboards, and monitors. Although the amount of these purchases is less, school divisions indicated that peripheral equipment is essential to supporting computers.

School Divisions Are Working Towards Meeting the SOL Technology Goal of Providing a Five-to-One Student-to-Computer Ratio

Since 1996, the Board of Education's six-year technology plans have called for a five-to-one student-to-computer ratio. This goal has also been reflected in the *Code of Virginia* (§22.1-199.1) since 1996, and in Appropriation Act language since 1999. The State's Web-based SOL Technology Initiative outlines a specific hardware goal of providing a five-to-one student-to-computer (networked multimedia and Internet connected) ratio in all classrooms. The first phase of the initiative, which focuses on high schools, began in 2000 and is expected to be completed by 2004. Schools receive funding from the State for this initiative from notes issued by the Virginia Public School Authority (VPSA). The General Assembly reimburses the VPSA from the State's Literary Fund. (The VPSA Technology Initiative and the Literary Fund are discussed in more detail in Appendix B). In FY 2004, DOE plans to begin the second phase of the initiative, which is to provide a five-to-one ratio in middle schools. Elementary schools will begin in FY 2006 and are estimated to complete the initiative in FY 2009.

JLARC staff analysis of the 2002 DOE Capacity-Connectivity Survey indicates significant progress in meeting the State's goal of a five-to-one student-to-computer ratio. Sixty percent of all schools have met the five-to-one student to Internet-connected computer goal (Table 19). However, it appears that 63 high schools (22 percent) had not met the ratio when the survey was completed, despite the expected completion of the high school phase in FY 2004.

Currently, the State's average school ratio is 7.5 students per computer. However, the average for high schools is much lower at 4.31 students per computer. These figures differ from the DOE calculated statewide student- to-computer ratio of 3.75. The DOE figure is based on a statewide total count of students to computers instead of a school average of students to computer. Figure 5 provides an illustration of the differences in calculating a school average ratio versus a total student-to-computer ratio.

Table 19

Status of Schools with Regard to Meeting the Five-to-One Student-to-Computer Ratio by School Type, FY 2002

School Type	Average School Ratio*	Percent of Schools Meeting 5:1 Ratio	Number of Schools Above the 5:1 Ratio
High School	4.31	78%	63
Combined	6.26	65%	15
Middle	5.76	64%	105
Elementary	8.74	55%	527
Total	**7.5**	**60%**	**710**

*Average school ratio is the average of each school's student-to-computer ratio.

Source: JLARC staff analysis of DOE 2002 Capacity-Connectivity Survey of Virginia Schools.

Figure 5

Example of School Average Ratio Versus Total Students-to-Computer Ratio

	Students	Computers	School Average
School A	5,000	2,500	2.0
School B	5,000	1,000	5.0
Total	**10,000**	**3,500**	
Total Students to Computer Ratio(10,000/3,500)			2.86
School Average Students to Computer Ratio ((2.0+5.0)/2)			3.50

Source: JLARC staff analysis.

Although school divisions are purchasing additional hardware to meet the State's Standards of Learning (SOL) technology initiative, there is considerable variation concerning: (1) how school divisions are purchasing computers, (2) the types of computer configurations in school divisions, and (3) the use of peripheral and other specialized equipment.

Computer Purchases Account for the Majority of Hardware Expenditures

Hardware purchases are the largest non-personnel technology expenditure for school divisions. In FY 2002, school divisions reported average hardware expenditures of $101.29 per pupil. Hardware expenditures accounted for 49 percent of total non-personnel technology expenditures in the same year. According to a DOE description of categorized expenditures, hardware includes purchases for computers, peripheral equipment, and other specialized technology (Exhibit 5). JLARC staff estimate that computer purchases account for the majority of hardware expenditures (approximately 75 to 90 percent of total hardware costs).

Exhibit 5

Categories and Descriptions of Hardware Expenditures

Category	Examples
Computers	Desktops, laptops, handheld computers (such as personal digital assistants), and mainframe computers
Peripheral Equipment	Monitors, keyboards, printers, scanners, cameras, disk drives, modems, speakers, etc
Specialized equipment	Fax-back and voice-mail resources, videoconferencing and other distance education tools, and cable-based receivers

Source: Virginia Department of Education, 2001-2002 Annual School Report, Attachment D.

Interviews with school division staff indicate that there are varying methods of purchasing computers. Computers may be purchased at the division or school level through a State contract, a buying consortium, or individually. For example, some school divisions use the State contract because they find it to be more cost effective. However, this is not always the case. In other situations, school divisions purchase individually because they are large and have similar purchasing power as a State contract due to their size. Despite the variation in computer purchasing, JLARC staff analysis of computer costs reported by school divisions indicates that costs do not vary based on a division's method of purchasing, the size of the division, or where it is located.

Another alternative to purchasing is to lease/purchase computers. Lease purchasing allows a school to lease a computer for a specific time period and provides the option of purchasing the computer at the end. School divisions reported advantages and disadvantages to outright purchasing of computers versus a lease/purchase approach. Some divisions felt that purchasing computers is the best approach, as funding is limited and may not be available the following year. In addition, divisions felt that by purchasing the computers, older computers can be passed down to lower grades to prolong the life of the computer. Some divisions also reported purchasing computers because State funding provided through the VPSA Technology Initiative does not allow the lease of computers. Alternatively, one division visited by JLARC staff has a four-year lease/purchase agreement for its laptop computers. It felt the major benefits to this approach are that all of the computers are the same age and type and the cost of the computers is spread out over four years.

The Types of Computers Purchased and the Way in Which They Are Added Varies by School

Many school divisions are also providing a variety of types of computers and computer configurations to meet the State's five-to-one goal and to increase access for students. Some school divisions are increasing the number of desktop computers available in computer labs, libraries, and in the classroom. A number of elementary schools are using portable basic word processing units for students to practice their typing and writing skills. In other cases, divisions are also adding portable laptop carts to their computer inventory.

Portable laptop carts contain 20 to 25 laptop computers that can be transported to classrooms to provide a one-to-one computer-to-student ratio as needed. Although portable laptops are more expensive and fragile than desktop computers, they save time, classroom space, and may reduce the number of computers needed. The carts eliminate lost class time of walking to a computer lab and can replace the need for additional class space for a lab. Some school divisions found the carts allowed the school to maintain valuable classroom space as their school population continues to grow. Laptop computers also allow older schools to provide technology without the high cost of retrofitting as required for desktop computers. For example, some school divisions have older schools that are not equipped to support multiple computers in a classroom because of a lack of appropriate electrical wiring, such as

classrooms equipped with only two outlets. By purchasing wireless laptop carts, schools can reduce the need for additional outlets and the need to upgrade wiring.

Computer Peripherals and Other Specialized Equipment Are Essential to Supporting Technology

DOE also classifies peripheral and other specialized equipment as hardware. Although the State DOE has not released specific guidelines on other hardware, such as printers, projectors, and other items, school divisions have emphasized the importance of peripheral equipment and other specialized equipment to support technology use. For example, some school divisions stated that computer projection devices allow teachers to easily project computer exercises to students without having to go to a computer lab to demonstrate an exercise individually. Peripheral equipment costs are typically much lower than computer expenditures, but can range from as low as five percent to as high as forty percent of total hardware costs for school divisions.

HARDWARE REPLACEMENT

Although State funding is allocated to schools for hardware through the release of VPSA technology notes, the funding is targeted towards the purchase of additional computers to meet the five-to-one goal rather than the replacement of aging computers. DOE's technology plan discusses the need to replace computers on a continual basis, but many school divisions indicate that they are unable to fully fund the replacement of older computers. Additional funding may therefore be needed to continue the State's effort of maintaining a five-to-one student-to-computer ratio.

To address these concerns, there are several options the State may wish to consider to explicitly fund the replacement of hardware. These options include funding based on: (1) the prevailing costs of hardware, (2) a five-to-one student-to-computer ratio with a five-year replacement cycle, (3) a five-to-one student-to-computer ratio and recognizing administrative computers with a five-year replacement cycle, (4) a three-to-one student-to-computer ratio with a five-year replacement cycle, and (5) one-to-one student-to-computer ratio with a five-year replacement cycle.

Most Schools Do Not Have Adequate Funding to Replace Hardware

The State currently provides funding support for the addition of computers to meet its five-to-one student-to-computer ratio, but it does not explicitly provide ongoing funding for the replacement of computers. (As discussed in Chapter I, funds for computer replacement have likely been provided through the SOQ. However, these funds were imbedded with other education costs, so divisions most likely used the SOQ funds for other purposes.) In a JLARC survey of school divisions, less than 25 percent of divisions reported the ability to fully fund regular computer replacement. Instead, computers are replaced based on funding availability. In some cases, schools are just beginning to replace computers that are over eight years old.

Computer replacement is important to provide students with training on technology that is consistent with the technology used in the workplace. A report by the Consortium for School Networking (CoSN) recommends that schools should plan to replace computers every three to five years. The Virginia Technology Plan also discusses the goal of upgrading and/or replacing network computers on a three-year cycle.

CoSN also recommends that schools should consider replacing all computers in the same time period to maintain uniformity. Lack of uniformity can increase costs and decrease efficiency in repairing computers as staff have to be familiar with various ages of the computers. One challenge to this uniform purchase approach is that most school divisions do not have the ability to set aside money annually for future purchases. If the money is not spent in one year, the division will likely lose the funds. Therefore, many experts recommend that schools should purchase computers with as much processing power and memory as they can afford, which may result in higher computer costs.

ASR Reporting of Hardware Is Not Consistent Across Divisions

In FY 2001, the State DOE introduced a new technology section in the Annual School Report (ASR). This section is intended to capture all technology related expenditures by school divisions. Exhibit 6 provides the cost codes related to hardware in this section. Initial analysis indicates that many school divisions are not fully reporting hardware costs in the technology section. Consequently, expenditures for hardware are not reported consistently across school divisions.

The lack of reporting is partially due to the recent addition of the technology section to the ASR in FY 2001. Prior to the introduction of the technology section, school divisions reported technology costs in the area for which the technology was purchased. For example, computers purchased for a school library were reported in the media section. Based on analysis of ASR and computer ratio data, it appears that several school divisions have not fully transitioned to reporting their costs in the new technology section and continue to report costs in other sections of

Exhibit 6

Cost Codes Related to Hardware on the Technology Section of the Annual School Report, FY 2001-2002

Materials and Supplies	
6050	Non-Capitalized Technology Hardware
Capital Outlay Replacements	
8110	Technology Hardware
Capital Outlay Additions	
8210	Technology Hardware

Source: Virginia Department of Education, 2001-2002 Annual School Report and school division responses to questions about hardware expenditures on JLARC site visits.

the ASR. For example, 19 school divisions reported no expenditures for hardware replacements and 27 divisions had no expenditures in the hardware additions section, despite the increases in their computer-to-student ratios in the same year. To help with this issue, the General Assembly may wish to consider amending Section 22.1-115 of the *Code of Virginia* to include technology as a major classification of funds for school division accounting purposes. In addition, if the General Assembly decides to adopt a funding formula approach for educational technology, it may wish to direct DOE to conduct preliminary analysis, such as outlier analysis, to help identify school divisions that have not reported their technology expenditures in the technology section of the ASR.

Another related issue may be confusion over the extent to which expenditures should be reported in the new technology section. Interviews with the JLARC staff in 11 school divisions visited indicated that division staff were unsure of what should be reported in the technology section. For example, staff in one school division expressed uncertainty regarding whether special education computers should be recorded in the special education portion or in the new technology section of the ASR. This occurred despite ASR instructions that indicate "all technology-related expenditures should be reported under [the technology] function." Perhaps one way to help address this issue would be to include further clarification in the ASR instructions, particularly for areas such as special education and media services where divisions seem prone to confusion. For example, the ASR could state that "all technology-related expenditures, including those for special education and media services, should be reported under [the technology] function."

JLARC staff also determined that data may be recorded inconsistently across school divisions regarding the capitalization of hardware. Hardware costs may be reported in two different areas depending on a school division's capitalization threshold. The ASR guidelines assume a capitalization threshold is $5,000--meaning that any material expenditure valued over $5,000 should be placed in the capitalization category. (DOE staff point out that there is currently no statewide policy governing capitalization thresholds for localities.) Following this, most computer purchases, which are generally less than $5,000, should be placed in the non-capitalized-hardware code of the ASR. However, many school divisions have lower thresholds ranging from $500 to $2,500, and in these cases, the ASR guidelines indicate that school divisions should use their local capitalization threshold for determining where to report expenditures. Consequently, school divisions with a lower threshold may place computer purchases in the capital outlay additions or replacement categories, while other school divisions place computer purchases in the non-capitalized hardware category. If the General Assembly decides to adopt a funding formula for hardware replacement, it may wish to work with DOE, and other State agencies as is necessary, to set a consistent capitalization threshold for localities for data reporting purposes. An alternative method for enhancing data consistency for use in a funding formula could be to distinguish between expenditures for new additions and replacements for non-capitalized hardware and infrastructure on the ASR.

Funding Formula Options for Hardware Replacement

If hardware replacement is an area which the State wishes to address more explicitly and to support, there are several funding formula options that the General Assembly may wish to consider. The options focus on providing school divisions with the appropriate financial support to replace computers -- an area of need expressed by school divisions as they continue to add computers to meet the State's recommended five-to-one student-to-computer ratio. Table 20 provides a summary of the identified options based on cost. The funding options range from as little as $48.6 million to as high as $299.3 million in total State and local costs. The first option provides a formula based on prevailing hardware expenditures and is the least expensive option at $48.6 million annually based on FY 2002 expenditure data. The final and most aggressive option provides a one-to-one student-to-computer ratio for all students at a cost of $299.33 million annually.

There are four primary assumptions used in calculating the costs of these options: (1) the cost of peripherals is approximately ten percent of total prevailing hardware costs; (2) the current replacement cost of a computer is approximately

Table 20

Summary of Funding Formula Options for Technology Hardware Replacement

Base Year FY 2002

	Estimated Cost
• Prevailing Cost Option	$48.6 million
• 5 to 1 Student-to-computer Ratio/5-Year Replacement Cycle	$63.8 million
• 5 to 1 Student-to-computer Ratio plus Administrative Computers/5-Year Replacement Cycle	$66.1 million
• 3 to 1 Student-to-computer Ratio/5-Year Replacement Cycle	$103.0 million
• 1 to 1 Student-to-computer Ratio/5-Year Replacement Cycle	$299.3 million

Note: (1) All options, with the exception of the prevailing option, include an add-on cost of peripherals. This amount is based on the assumption that peripherals account for approximately ten percent of hardware costs. (2) Cost estimates shown are both State and local costs.

$1,287; (3) computers are replaced on a five-year cycle, (4) the total number of students is 1,143,829 (based on 2002 end-of-year average daily membership).

The peripheral assumption is based on a survey of several school divisions with varying hardware expenditures and computer ratios. These school divisions reported that the costs of peripherals ranged between 5 and 40 percent of total hardware costs. The range accounts for school divisions spending preferences and the annual fluctuation in peripheral costs. Peripheral costs can be high in some years as schools replace items, such as monitors or printers. Based on these interviews, JLARC staff determined that, on average, peripherals account for ten percent of total hardware costs. The peripheral add-on amount of $4.8 million annually, is determined based on ten percent of the prevailing total hardware costs. (DOE staff indicated that if the General Assembly adopts a funding formula that requires a separate calculation for peripheral expenditures, the ASR could be modified to collect this data.)

The second assumption is that the average computer, including desktops and laptops, is $1,287. This amount is based on a spring 2003 JLARC staff survey of school divisions that requested the average cost they are paying for computers and laptops for their schools. JLARC staff used a linear weighted average of these reported costs to determine the typical cost.

These two assumptions are used for the calculation of each of the funding options, with the exception of the prevailing funding option, which is based on hardware expenditures per pupil. Therefore, if the State wishes to provide technology funding other than the prevailing option, it should consider collecting data to determine average computer costs and the costs associated with peripherals annually. These data may be collected through: (1) DOE's current capacity-connectivity survey, or (2) by providing an additional cost category in the ASR that captures computers costs separately from peripheral costs.

The third assumption of a five-year replacement cycle for computers is based on several factors: a range of cycles provided during school division interviews; the average cycle of school divisions reporting the ability to fund the replacement of computers; and recommendations provided by DOE and the Consortium for School Networking (CoSN). During interviews with school administrators, cycles ranging from three to five years were provided as an ideal goal. A similar range was provided in a JLARC survey where the average replacement cycle reported by school divisions that had the ability to fully fund the replacement of computers was 4.48 years. In addition, the BOE technology plan describes a goal of replacing computers every three years, while CoSN suggests three to five years. A five-year replacement cycled is provided because it is a less expensive approach and assumes that funding increases would be prioritized to reduce the student-to-computer ratios before reducing a computer replacement cycle.

The hardware replacement funding formula options include (1) the prevailing costs, (2) a five-to-one student-to-computer ratio with a five-year replacement cycle, (3) a five-to-one student-to-computer ratio plus administrative computers with a five-year replacement cycle, (4) a three-to-one student-to-computer ratio with a

five-year replacement cycle, and (5) a one-to-one student-to-computer ratio with a five-year replacement cycle.

Prevailing Cost Option. The prevailing cost option is the least expensive of the options and bases a State funding formula on the prevailing hardware expenditures reported in the ASR non-capitalized hardware and capital outlay replacement-hardware categories. It does not include the expenditures for the capital outlay additions-hardware category, as the State's SOQ costs framework typically does not recognize the addition of capital in calculating its costs.

Most likely, the prevailing costs reported for technology hardware will rise in the coming years. As divisions lower student-to-computer ratios, more computers will need to be replaced. Also, as divisions who may have underreported their expenditures on the technology section of the ASR fully report these expenditures, technology expenditures should rise. (However, it is also expected that costs in other educational areas where the hardware expenditures were previously reported will decrease.) Conversely, it is also possible that the purchase price of new computers will continue to fall somewhat. For base year FY 2002, the total estimated cost of the prevailing option is $48,608,293.

Five-to-one Student-to-Computer Ratio with a Five-Year Replacement Cycle. This option follows the current State goal of having a five-to-one student-to-computer ratio, and the option includes the replacement of computers on a five-year cycle. For example, based on the use of a five-year replacement assumption, schools purchasing computers with the initiative funding that began FY 2000 would need to begin replacing those computers in FY 2005. Based on this formula, 45,753 computers would need to be replaced in the base year. Including the annual peripheral add-on, the total cost State and local cost of the option is estimated at $63.8 million (Table 21).

Table 21

Five-to-One Student-to-Computer Funding Option With a Five-Year Replacement Estimated Computers Replaced Annually and Total Costs

Base Year FY 2002

Estimated Total Computers Replaced Annually	Estimated Total Base FY 2002 Hardware Replacement Costs
45,753	$63,753,740

Note: (1) Total hardware costs include an annual $4.8 million peripheral add-on.
(2) Cost estimates shown are both State and local costs.
(3) Number of computers does not include administrative computers.

Five-to-One Student-to-Computer Ratio and Recognizing Administrative Computers with a Five-Year Replacement Cycle. This option provides an administrative add-on to the previous option. An administrative add-on is not provided in other options because it appears that the State is primarily interested in providing funding in the area of instructional computers. Estimates for the administrative computer add-on are based on the assumption of a one-to-one ratio of administrative staff per computer. JLARC staff estimate that 9,231 administrative staff were recognized in the SOQ in FY 2002. To meet a five-year replacement cycle for these computers, an additional 1,846 computers ($2.4 million) would to be replaced each year and added to the annual estimates provided in the previous option. Total State and local costs for this option are estimated at $66.1 million annually (Table 22).

Table 22

Five-to-One Student-to-Computer Ratio Plus Administrative Computers with a Five-Year Replacement Estimated Computers Replaced Annually and Total Costs

Base Year FY 2002

Estimated Total Computers Replaced Annually	Estimated Total Base FY 2002 Hardware Replacement Costs
47,599	$66,129,799

Note: (1) Total hardware costs include an annual $4.8 million peripheral add-on.
(2) Cost estimates shown are both State and local costs.

Three-to-One Student-to-Computer Ratio with a Five-Year Replacement Cycle. This option is a more aggressive option as it reduces the number of students per computer. Although the General Assembly currently supports the five-to-one ratio, DOE also outlines long-term goals in its technology plan of having a one-to-one ratio in grades three through twelve and a three-to one-ratio in grades one and two. A three-to-one option illustrates an intermediate goal if the General Assembly wishes to begin moving towards the DOE long-term goal. This option would increase the estimated number of computers funded to 76,255. The total estimated State and local costs for this option is $103.0 million (Table 23).

Table 23

Three-to-One Student-to-Computer Ratio with a Five-Year Replacement Estimated Computers Replaced Annually and Total Costs

Base Year FY 2002

Estimated Total Computers Replaced Annually	Estimated Total Base FY 2002 Hardware Replacement Costs
76,255	$103,015,681

Note: (1) Total hardware costs include an annual $4.8 million peripheral add-on.
(2) Cost estimates shown are both State and local costs.
(3) Number of computers does not include administrative computers.

One to One Student-to-Computer Ratio with a Five-Year Replacement Cycle. This option is provided to illustrate the costs of future goals outlined in DOE's technology plan of having a one-to-one ratio in grades three through twelve and a three-to-one ratio in grades one and two and reflects some school division goals of having a one-to-one ratio for all students. In addition, based on site visits to school divisions, some schools are actively working towards this goal, particularly at the high school level. This option would increase the estimated number of computers to 228,765 with a total estimated State and local cost of $299.32 million from the base year (Table 24). However, since the State has not reached its initial five-to-one goal described in the Web-based SOL Technology Initiative, this option may not be a consideration until after FY 2009--the expected completion date of the current initiative.

Table 24

One-to-One Student-to-Computer Ratio with a Five-Year Replacement Estimated Computers Replaced Annually and Total Costs

Base Year FY 2002

Estimate Total Computers Replaced Annually	Estimated Total Base FY 2002 Hardware Replacement Costs
228,765	$299,325,384

Note: (1) Total hardware costs include an annual $4.8 million peripheral add-on.
(2) Cost estimates shown are both State and local costs.
(3) Number of computers does not include administrative computers.

Summary of the Hardware Replacement Funding Formula Options. Of the funding formula options presented for hardware, the lowest cost option ($48.6 million) bases funding on prevailing expenditures made by school divisions for hardware replacement. The remaining four options are based on specific student-to-computer ratios and identified replacement cycles.

Of these four options, the least expensive option($63.8 million) is based on a five-to-one student-to-computer ratio with a five-year replacement cycle. This option reflects the State's current goals for student access to computers and a replacement cycle that is in the range recommended by technology experts and school division staff. Recognizing the replacement of administrative computers would increase the cost of this option by about $2.4 million. However, it appears the State's current priority is focused on instructional hardware.

Assuming a one-to-one student-to-computer ratio for replacement purposes ($299.3 million) is the highest cost option and reflects the direction that some of Virginia's school divisions are moving in. However, most school divisions do not currently provide this level of access. Assuming a three-to-one computer ratio for hardware replacement yields a more moderate cost ($103.0 million) and reflects an intermediary step if the State decided to adopt the policy of one-to-one student-to-computer ratio.

IV. Funding Formula Options for Other Non-Personnel Costs

Although school divisions indicated that the primary areas of need for additional State funding were technology personnel and computer replacement, ongoing support of other technology items is also required. These other items, such as infrastructure, software and supplies, and Internet connectivity, are vital in supporting a school division's educational technology program and are typically included in the total cost of ownership for educational technology.

The funding formula options for these other non-personnel costs are based on the prevailing expenditures reported by school divisions. The prevailing methodology is used because it is consistent with how these costs have been recognized previously through the Standards of Quality, and in some cases, it is not clear that there is a better way to model these costs. Table 25 provides the estimated total FY 2002 costs for the various funding formula options recognizing other non-personnel costs.

Table 25

Funding Formula Options for Other Non-Personnel Costs

Base Year FY 2002

	FY 2002 Estimated Costs
• Infrastructure Option	$3.9 million
• Software and Supplies Option	$24.6 million
• Connectivity Option	$8.9 million
• Other Non-Personnel Option	$29.2 million
Total State and Local Costs for All Non-Personnel Options	$66.6 million

Note: Includes State and local costs.

TECHNOLOGY INFRASTRUCTURE

The 1996 Acts of Assembly stated that the priorities in State education technology funding for the 1996-1998 biennium should be given to several areas of technology including infrastructure for the "retrofitting and upgrading existing school buildings to efficiently use education technology." The *Code* section was later amended to continue the priority scheme laid out in 1996, by stating that the priority areas are for "the 1996 biennium and thereafter." The State Web-based SOL Technology Initiative also specifically outlines the need for adequate infrastructure in its goals to create an Internet-ready local area network capability in every school

and to ensure adequate high-speed, high-bandwidth capability in each school. During JLARC interviews with school division administrators, infrastructure was listed as a high area of need. Appropriate infrastructure is critical to supporting technology, and lack of infrastructure, such as inadequate electrical capacity, inhibits the ability to use technology.

Infrastructure costs tend to vary based on a variety of factors. For example, older schools require more infrastructure upgrades than newer schools. In addition, cable-based networks have higher recurring infrastructure costs, while wireless networks have high start-up costs. Therefore a funding formula option for replacing infrastructure based on divisions' prevailing infrastructure expenditures may be appropriate.

Schools Divisions Indicate That Infrastructure Is an Important Component in Meeting the State's SOL Online Testing Initiative

Meeting the State's goals of providing adequate network capability requires appropriate infrastructure in schools. Infrastructure refers to the equipment required to establish connections: (1) between computers, (2) to a division's network, (3) and to the Internet. It also includes building improvements to support technology, such as increased electrical capacity or better ventilation systems.

During interviews with JLARC staff, school divisions indicated that (1) infrastructure and (2) computer costs are two of the highest priority areas in meeting the goals of the State's Web-based SOL Technology Initiative. Infrastructure improvements are particularly important in older schools that are less equipped to support the high electrical demands of computers. For example, some school divisions stated that classrooms in their older schools only have two electrical outlets. Unfortunately, how well school divisions are meeting the State's infrastructure goal is unknown. In FY 2000, DOE collected data on the electrical capacity of schools, the availability of computer ports in classrooms, and the connection speed among schools. However, this data has not been collected in recent years. DOE may wish to consider collecting data again to determine the status of school divisions in meeting the State's goals.

Infrastructure Costs and the Expenditures Reported by Virginia School Divisions

Costs to upgrade infrastructure can be expensive. For example, one school division stated that it would cost approximately $740,000 to provide electrical upgrades in its schools to support needed technology. However, infrastructure costs also tend to fluctuate over time because expenditures are primarily for one-time nonrecurring costs, such as installation of new cabling, or for equipment that has a long replacement cycle of seven years of more.

In FY 2002, school divisions reported spending $14.6 illion on infrastructure, which makes up about six percent of total non-personnel technology expenditures. Of this total, $9.1 million was spent on infrastructure replacement.

Infrastructure upgrades are one of the allowed uses of the State funding available through the VPSA Technology Initiative. In addition, some federal funding is available for infrastructure through the E-Rate program. However, these funds are limited primarily to high poverty schools. This limitation effectively excludes the majority of schools in Virginia.

A potential limitation of the infrastructure expenditure data reported through the technology section of the Annual School Report (ASR) is suggested by the fact that less than sixty-five percent of school divisions reported expenditures on infrastructure in FY 2002. Although there is limited data available on whether school divisions have increased their infrastructure expenditures in recent years, it appears that divisions may be underreporting these expenditures. This may be a result of under-reporting on the technology section of the ASR generally. To help with this issue, the General Assembly may want to consider amending Section 22.1-115 of the *Code of Virginia* to include technology as a major classification of funds for school division accounting purposes. In addition, the General Assembly may wish to direct DOE to conduct preliminary analysis, such as outlier analysis, to help identify school divisions that have not reported infrastructure expenditures they have made in the technology section of the ASR.

A further issue may be confusion among divisions over where to report infrastructure expenditures, particularly with regard to the addition versus the replacement of infrastructure. The ASR includes a description for what constitutes infrastructure. However, there is limited guidance on how school divisions should distinguish between the addition of and replacement of infrastructure. Distinguishing between the two infrastructure categories is important as capital replacements rather than capital additions are typically recognized in the SOQ funding formula. Further clarification or examples in the ASR for how infrastructure additions and replacement expenditures should be categorized may therefore be helpful. For example, the ASR instructions could indicate that any expenditures on technology infrastructure for new schools or structures should be classified as the addition of infrastructure. However, in cases where the technology infrastructure in an existing school is being upgraded or replaced, such expenditures should be classified as infrastructure replacements.

Funding Formula Option and Related Costs for Infrastructure

Because funding is already provided for infrastructure additions and upgrades through the VPSA technology notes, and because capital additions are not typically recognized in the SOQ, the funding formula for infrastructure only addresses recurring replacement costs. A prevailing approach is taken because infrastructure needs are difficult to model due to their year-to-year fluctuating nature, and it is not clear that a different approach would yield a more accurate cost. Therefore, this option is based on school divisions' prevailing expenditures for non-capitalized infrastructure and infrastructure replacements.

Although less than 65 percent school divisions reported expenditures for infrastructure in FY 2002, this option includes all divisions in the prevailing calcula-

tion. This is because divisions who did not report any technology infrastructure expenditures likely either had no or minimal expenditures, or reported these expenditures elsewhere in the ASR, which means they will probably be included in the calculation of other SOQ costs. The total base-year FY 2002 cost for this option is $3,861,378.

SOFTWARE AND SUPPLY COSTS

Software and technology supplies play a critical role in supporting technology use. School divisions did not indicate software and supply costs as a primary need for increased funding, but these costs can be significant. In FY 2002, the category of "software and supplies" was one of the highest categories of non-personnel technology expenditures. These costs may increase as more software is needed to integrate technology into classroom instruction and as additional supplies are needed to support increasing numbers of computers.

Although School Divisions Did Not Indicate that Increased State Funding for Software Is a Priority, These Costs Can Be Significant

Software is a critical component that can enhance and increase computer effectiveness. It can be useful in a variety of areas, such as assisting teachers with the integration of technology in the classroom, providing school divisions with anti-virus protection, and giving students an alternative to traditional textbook materials. For example, students can use math software programs rather than traditional textbook lessons and paper quizzes, or teachers can utilize science software programs to simulate experiments previously unavailable due to the high costs for equipment or to the risk certain chemicals may pose to students.

Software costs vary depending on the type of program. Some software is provided free of charge, other software programs are provided with a one-time purchasing fee, and still other programs require a yearly licensing fee. In addition, some software programs come pre-installed in hardware and are included in hardware costs. Software expenditures are described in DOE's Annual School Report (ASR) as:

> expenditures for videodiscs and computer programs used in the classroom for instructional purposes, operating system software (i.e. standalone software, not software that is pre-installed and included in hardware costs), application software, and on-line or downloadable software and content.

Total software expenditures in FY 2002 were $17.4 million, which was eight percent of total non-personnel technology expenditures. For that same year, school divisions reporting software expenditures spent an average of $16.38 per pupil. Although school divisions discussed the importance of software in interviews with JLARC staff, they did not indicate that software was a high priority for increased State funding. This may be because the costs are relatively small compared

to other non-personnel cost components and because the VPSA Technology Initiative allows funding for some software. In addition, school divisions may prioritize software funding over other technology costs because of the recurring nature of some software costs. For example, divisions may fund annual licensing fees for anti-virus software programs instead of funding the replacement of computers.

Purchases of Technology Supplies May Increase as More Schools Implement the SOL Online Testing Initiative

Purchases of technology supplies are primarily related to expenditures for toner, paper, and other non-capitalized supplies. Similar to software, many school divisions did not discuss material and supplies as an area of need for increased State funding. However, one school division noted that technology supply needs are increasing as schools begin to administer SOL tests online, yet no additional State funding has been allocated for these costs. Online testing requires more technology-related supplies, such as paper and toner, to print out and review course materials, sample tests, and test results.

In FY 2002, total expenditures for materials and supplies were $23.3 million, or 10 percent of total non-personal technology expenditures. Average expenditures per pupil for school divisions reporting material and supply costs were $16.28. Similar to software, these costs probably have been funded indirectly through the SOQ as a subset of other educational costs.

Funding Formula Option and Related Costs for Software and Supply Purchases

The funding formula option for software and supplies is based on the prevailing expenditures reported by school divisions for these items. The prevailing approach is used because there is no clear guidance on a better way to model these costs, and previous funding for these costs was most likely provided on a prevailing basis through the SOQ. For base-year FY 2002, the total State and local cost of the prevailing option for software and supplies is $24,602,217.

TECHNOLOGY CONNECTIVITY COSTS

Technology connectivity is a third area of non-personnel costs needed to support a school division's educational technology program, and again, most divisions did not give a high priority to increased State assistance in this area. This is probably because connectivity costs make up a relatively small portion of the overall technology budget and because most divisions receive some support for their connectivity needs through the federal government. Federal funds do not cover all of divisions' connectivity costs, which is why there may still be a role for the State to provide a minimal level of funding for connectivity.

Although Connectivity Is an Important Technology Cost, School Divisions Already Receive Some Support for These Costs

Technology connectivity refers to the on-going telecommunications services that are required to allow computers to communicate within a school division and to access the Internet. There are generally three levels of connectivity services: (1) those that allow computers to communicate within a school (the local area network), (2) those that allow schools' computer systems to communicate within a division (the wide area network), and (3) the services that are necessary for a school division to connect to and access the Internet. All of these levels of service are part of a school division's total connectivity costs.

Connectivity Costs Are a Legitimate But Small Portion of Educational Technology Costs. Technology connectivity is part of the overall cost of an educational technology program, and a fast connection to the Internet is becoming more important as school divisions begin administering the State SOL tests on-line and continue increasing the use of the Internet in the classroom environment. In FY 2002, school divisions reported spending a total of $10.3 million on technology connectivity costs, which is only four percent of the total non-personnel expenditures for technology. On a per pupil basis, school divisions reporting connectivity expenditures spent an average of $14.34.

Despite the importance of having adequate connectivity services, school divisions did not place connectivity as a high priority area for increased State funding. This is likely because connectivity costs do not make up a large portion of the overall technology budget. In addition, divisions already receive some support for connectivity costs through the federal government.

Federal E-Rate Funds Help Subsidize Connectivity Costs. Under the federal E-Rate program, schools receive discounts that can be applied to both telecommunications services and Internet access. E-Rate discount rates depend on the poverty level among the students of the school and school location (rural divisions receive greater discounts), and can be as high as 90 percent. According to Department of Education staff, the average E-Rate discount for Virginia's school divisions is between 61 and 62 percent. Therefore, most school divisions are left to fund slightly under half of their connectivity costs. Many school divisions emphasized that they would have a significant funding problem if the E-Rate program were discontinued.

Funding Formula Option for Connectivity Costs

Although connectivity is an important cost of a school division's educational technology program, the General Assembly may wish to consider how and whether to provide State support for connectivity. One argument for not providing funding for connectivity is that school divisions are already getting an average of 60 percent of their connectivity costs reimbursed through the E-Rate program. However, this discount amount is a division-wide average; some divisions are receiving much less

of a discount on their connectivity costs while some divisions are receiving a larger discount.

For these reasons, a funding formula option is included that provides a minimal amount of funding for connectivity based on the prevailing level of technology expenditures reported by school divisions. This is consistent with the State's historical practice of funding telecommunications costs through the SOQ, which probably also included connectivity costs in previous years. Similar to the prevailing option for infrastructure costs, this option includes all divisions in the prevailing calculation, even those not reporting connectivity expenditures. This is because divisions who did not report expenditures for connectivity likely reported these expenditures elsewhere in the ASR, which means they will probably be included in the calculation of other SOQ costs. For base year FY 2002, the total State and local cost for the prevailing connectivity option is $8,952,437. A future option the State could consider for reducing the cost of this option is to fund connectivity costs net of school division's E-Rate discounts.

OTHER TECHNOLOGY COSTS

In addition to the various personnel and non-personnel technology cost components that have been discussed in this report, there are a variety of other technology-related expenditures that school divisions reported in the 2001-2002 Annual School Report. School division reported spending $53 million on other technology costs, which include:

- Disability insurance
- Unemployment insurance
- Workers compensation
- Other benefits
- Purchased services
- Internal services
- Leases and rentals
- Travel
- Miscellaneous
- Other uses of funds

This report does not recommend any policies for changing how these costs have been treated previously in the SOQ, which has been to fund them on a prevailing basis. The base year FY 2002 prevailing amount for these other non-personnel costs is $29,202,766.

V. Funding Formula Options for Teacher Training

Adequate teacher training is widely acknowledged as one of the key components needed for successful integration of technology into the classroom. Guidelines for technology-related teacher training are set forth in the *Code of Virginia* and the State's appropriation act. In addition, educational technology experts, as well as the U.S. Department of Education, recommend that anywhere between 20 percent and 30 percent of an educational technology budget should be devoted to training for educational staff.

Virginia's school divisions agree that teacher training in the area of technology is critical to the success of their technology programs. However, most divisions indicated that existing funds available for more traditional forms of teacher training are sufficient to cover current training needs, and school division staff therefore did not designate teacher training as a high priority area for increased State support. It also appears that a State-run on-line technology training and assessment program is not necessary at this time. School division staff said that the most effective technology training often occurs when technology staff are available to assist teachers with immediate needs. In light of this, additional State funding to help divisions hire integration specialists may be the most effective way to help divisions better train their teachers.

EDUCATIONAL TECHNOLOGY EXPERTS INDICATE THAT TEACHER TRAINING IS CRITICAL TO ENSURING A SUCCESSFUL TECHNOLOGY PROGRAM

According to educational technology experts, technology training for teachers is critical to the success of a school's technology program. Training must be provided to and required of all teachers if technology is to be integrated across the curriculum. A report produced by McKinsey and Company in the mid-1990's emphasized the importance of providing technology training across all educational disciplines by emphasizing that:

> The greatest benefit from connecting schools to the information superhighway is derived when the technology is fully integrated into the curriculum. Integration into the curriculum requires that teachers be able to use the technology effectively in whatever subject they are instructing.

In addition, the Total Cost of Ownership models that have been developed for educational technology recognize teacher training as a legitimate technology cost. The total cost models developed by the Consortium for School Networking (CoSN) and the General Accounting Office (GAO) both include professional development for teachers as one of their total cost components. (These models are summarized in Exhibit 1 in Chapter I.) COSN goes on to further suggest that:

> The budget item that arguably is most critical to a school district's ability to achieve its technology goals is staff development. If teachers and other staff members do not understand how to use new technologies and incorporate them into the classroom, a district's technological investment will not achieve its desired results.

Most education technology experts recommend that between 20 and 30 percent of the technology budget should be dedicated to teacher training. Federal guidance regarding technology-related teacher training has also recommended this level of funding. In 1995, the U.S. Office of Technology Assessment suggested that at least 30 percent of schools' technology funds should be spent on training. More recent guidance for the federal Ed Tech grant program, which was authorized as part of the 2001 No Child Left Behind Act, requires that schools use at least 25 percent of their grant proceeds "to provide ongoing, sustained, and intensive, high-quality professional development."

It appears that this 20-30 percent recommended by experts covers more than just traditional technology training for teachers, such as classes. Educational experts have suggested that school divisions should provide technology training to teachers through a variety of means, including formalized training classes, one-on-one assistance, and on-line applications. In addition, training topics range from basic "how-to" training to help teachers learn basic computer skills and how to use particular software packages, to integration training, which is geared to how to incorporate technology into a teacher's existing lesson plans or projects.

FUNDING FOR TRADITIONAL AND ON-LINE FORMS OF TECHNOLOGY TRAINING APPEARS ADEQUATE

In recent years, the State has provided increased guidance to its divisions regarding technology-related teacher training. Virginia's school divisions indicate that training their teachers in how to use technology is a high priority. However, they also said that the current federal, State, and local funding provided for traditional technology training is adequate, although more one-on-one, site-based training would be helpful. On-line teacher training and assessment programs are also useful. However, a statewide on-line program does not seem necessary at this time.

The State Has Provided Increased Guidance Regarding Technology Training for Teachers

In recent years, the State has provided increased guidance to its school divisions regarding technology training for teachers through the *Code of Virginia*, the Standards of Learning, and funding guidelines in the Appropriation Act. The *Code of Virginia* includes several requirements regarding technology training for teachers. The Standards of Quality (Section 22.1-253.13:5, *Code of Virginia)* provide that "each local school board should provide … a program of professional development in educational technology for all instructional personnel which is designed to facilitate integration of computer skills and related technology into the curricula." In 1997,

the General Assembly amended Section 22.1-199.1.B. of the *Code* to indicate that "the General Assembly notes that education technology can only be successful if teachers and administrators are provided adequate training and assistance." In 1998, the State's Technology Standards for Instructional Personnel (TSIPs) became effective, and in 1999 the section of the *Code* governing teacher licensure (Section 22.1-298) was subsequently amended to require that "on and after July 1, 2003, persons seeking initial licensure or license renewal as teachers demonstrate proficiency in the use of educational technology for instruction."

Additional guidance for technology-related teacher training has also been provided through the Appropriation Act and the Standards of Learning. Since FY 1995, the Appropriation Act has specified that "localities are required to provide a match [for funds received through VPSA technology grants] equal to 20 percent of the grant amount. At least 25 percent of the local match shall be used for teacher training in the use of technology." The Computer/Technology Standards of Learning further emphasize the importance of providing technology training to teachers across all disciplines:

> Computer/Technology skills are essential components of every student's education. In order to maximize opportunities for students to acquire necessary skills for academic success, the teaching of these skills should be the shared responsibility of teachers of all disciplines.

Divisions Did Not Indicate That Increased State Funding for Traditional Technology Training Is a High Priority

During site visits and interviews with Virginia's school divisions, division personnel emphasized the importance of technology training for their teachers. Unfortunately it is difficult to discern how much school divisions actually spend on technology training for their teachers due to limitations with the data. However, funding for traditional technology training, such as technology training courses, was rarely given by division personnel as a high priority area for increased levels of State support. Divisions indicated that the current levels of federal, State, and local funds that are available for traditional forms of technology training are adequate, as long as these sources remain intact. School division staff further suggested that the most useful form of training is often site-based and is provided on an as-needed basis. Thus, ensuring that teachers have access to technology integration specialists may be the best way the State can help ensure that teachers are adequately trained in technology.

Divisions' Expenditures on Technology Training Are Unclear. It is difficult to determine how much is actually spent for technology training by Virginia's school divisions. Technology training is not broken out as a separate category in the Annual School Report (ASR), and it is not clear that school divisions track technology training separate from other types of training. Because of this, it is im-

possible to determine from the ASR exactly how much divisions spent on technology training for their teachers.

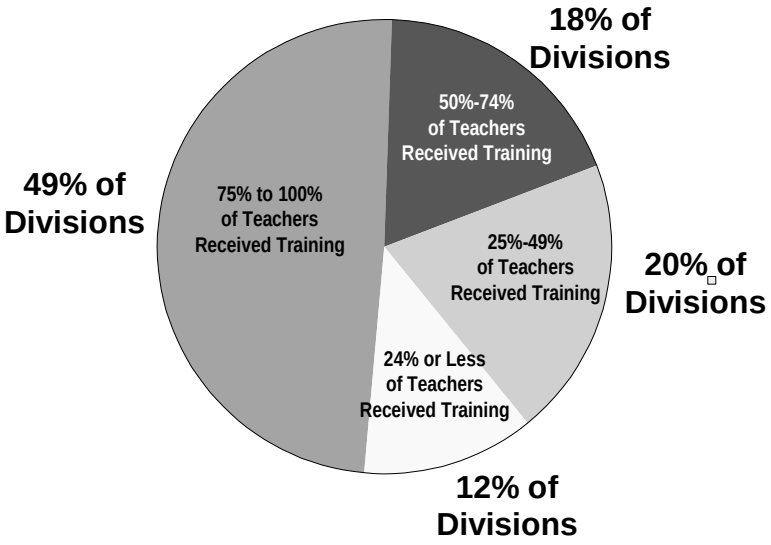
Teacher training is generally reported under the instructional support section of the ASR. The instructional support section includes a subcategory for improvement of instruction, which largely consists of training activities. The technology section of the ASR includes an instructional support category. However, it does not provide any subcategories. Therefore, expenditures for all activities related to instructional support are included in this category, and it is very difficult to determine what portion of these expenditures are devoted to teacher training. A further issue is that, in some cases, technology training may have been reported with other training costs in the instructional portion of the ASR. DOE may therefore want to consider providing explicit instructions for where to report technology training expenditures or developing a new ASR code dedicated to technology training, if a technology training formula were adopted.

JLARC staff attempted to gain additional information about technology training expenditures through a survey of school divisions. However, survey responses varied widely. For example, divisions reported spending from just slightly over $5 per teacher for technology training to over $1,000 per teacher. The wide variations in the training amounts reported by divisions may be due to a combination of different levels of training provided by divisions, as well as different abilities to track training and varying definitions of what constitutes technology training.

As shown in Figure 6, there was less of a discrepancy when divisions were simply asked what percent of their teachers received technology training during the

Figure 6

Percent of Teachers Receiving Technology Training During 2001-2002 School Year



Source: JLARC staff survey of Virginia's school divisions.

2001-2002 school year. The majority of divisions (67%) reported that at least half of their teachers received technology training during the 2001-2002 school year, and only 12 percent of divisions reported that less than 25 percent of their teachers received technology training. Differing definitions for what constitutes technology training could still account for some of the variation in these percentages.

Current Funding for Traditional Technology Training Is Adequate, but School Division Staff Indicate that More Informal, Site-based Training Is Needed. Despite the differences in training levels reported across the Commonwealth, divisions generally felt that the existing funds for traditional technology training are adequate. There are three primary sources of funding for technology training – federal funding, State funding, and funding provided through local initiative.

The main source of federal funding for technology training is the federal Educational Technology (Ed Tech) grant program. During FY 2004, Virginia will receive over $10 million in Ed Tech funding. As mentioned previously, the federal government requires that school divisions use at least 25 percent of their Ed Tech proceeds for technology-related professional development. However, beyond this requirement, states have a fair amount of discretion over how the grant proceeds are used, as long as they are used for technology-related purposes. The Virginia DOE has indicated that it plans to dedicate most of the grant proceeds to professional development. This is consistent with how Virginia has used federal funding for educational technology in the past.

The State also provides funding for technology training through a couple of sources. First, as mentioned previously, technology training is not broken out separately in the ASR. Therefore, to the extent that local school divisions include these costs with other instructional or technology expenditures, the State may be indirectly providing funds for technology training through its calculation of costs for other educational components. The second way that the State ensures funding for technology training is to require that school divisions use a portion of their Web-based SOL Technology Initiative funding for this purpose. This is done through the local match for the VPSA technology grant program. Starting with the 1995 Appropriation Act, the State began including language requiring divisions to use at least twenty-five percent of their local match for teacher training in the use of technology.

In addition to the federal and State funds available for technology, local school divisions report using their own funds to provide technology training for teachers. Several divisions even mentioned that technology training for teachers has been a priority in their division in recent years.

School division staff indicated that the funding provided through existing sources for technology training is generally adequate, particularly for more traditional and formalized training such as classes and workshops. Assuming these existing funding streams remain intact, school divisions did not specify that increased State funds are a high priority, especially for traditional types of technology training. Furthermore, many school division staff indicated that technology training is most effective when it is provided on-site and on an as-needed basis. According to

this, the most useful training for teachers may be that which can be provided by a technology integration specialist. The State may be able to have a greater impact in training teachers by providing funds for integration specialists rather than by providing increased funding targeted at traditional forms of technology training. This report therefore addresses school divisions' training needs by including technology integration specialists in the funding combinations presented in Chapter VII as opposed to including increased funding for traditional technology training.

Some School Divisions and School Consortiums Make Use of Online Teacher Training and Assessment Tools to Provide Teachers with Additional Training Resources

A separate technology training tool reviewed for this report is online teacher training and assessment programs. Online teacher training and assessment programs allow teachers to determine their level of technology proficiency and link teachers to training opportunities based on their proficiency level. These programs can be administered at a local, regional, or state level. Currently, there is no State-level online teacher training and assessment program. However, several school divisions and regional consortiums have implemented or plan to implement an online training and assessment program. Federal and local funding is available for teacher assessment and training through the federal No Child Left Behind competitive grant program and through the local match requirement of the VPSA Technology Initiative. There are various types of online teacher training and assessment programs used in Virginia and in other states, and different types of funding available for these programs.

Implementation of Online Teacher Training and Assessment Programs. Online teacher assessment and training programs allow teachers to identify training needs and connects them to the appropriate training. The assessment component of the program typically includes a series of technology related questions that helps to develop a technology use profile for the teacher. The training component then identifies professional development opportunities through online courses, conferences, and local higher education facilities based on the teacher's level of proficiency. For example, one program provides an on-line assessment where teachers are ranked on a scale of one to seven based on their level of proficiency in three areas: current instructional practices, personal computer use, and level of technology implementation. The program provides the teacher with goals within the specific categories. These goals then link them to various training opportunities.

Online teacher training assessment and training programs can be implemented at a local, regional, or state level. Several states, including Arizona, Indiana, and California have implemented statewide programs. This allows administrators to aggregate assessment data at the school, division, region, and state level to help school administrators identify additional training needs. Although Virginia has not implemented a statewide online teacher training and assessment program, it appears that several of Virginia's school divisions and regional consortiums make use of these programs.

According to a JLARC survey of schools divisions, more than 30 percent of school divisions have implemented various components of an online teacher training and assessment program. Some of these programs were developed to assist schools in meeting the recent Technology Standards for Instructional Personnel (TSIP) technology certification requirements. For example, one school division provided an online assessment program for teachers and waived their technology training requirements if their results were above a specific score. Another school purchased an online training program, which provided teachers with the appropriate technology training to meet the training requirement. This provided greater flexibility to teachers as they could take the course online at a convenient time and location.

In addition, four of the eight regional consortiums in Virginia that were created to apply for federal No Child Left Behind (NCLB) funding indicated that they have implemented or plan to implement an online teacher training and assessment program. This is partially due to the need for school divisions to assess the level of teacher proficiency in the area of technology in order to receive the NCLB funding. As a result, these regions decided to use an online assessment program to fulfill this component of the grant.

Although implementation of an online teacher training and assessment program has occurred primarily at the local and regional level in Virginia, several school division administrators and regional consortiums indicated that they would support a State-run online program if they could provide input into the program design. However, since it appears that many divisions and consortiums have already implemented or plan to implement online teacher training and assessment programs, a State run online program seems unnecessary.

Estimated Costs and Funding for Online Teacher Training and Assessment Programs. The costs to implement an online training and assessment vary depending on the type and the number of users of the program. The costs are typically for licensing fees and a portion of staff person salary to support the program. Costs may range from as low as $5,000 annually in licensing fees (the staff support time was unknown) for a small school division to as high as $100,000 to $200,000 in licensing fees for a statewide program.

Online training and assessment programs may be funded through several sources. With the implementation of No Child Left Behind (NCLB), regional consortiums are requesting funds through the competitive grants program. These grants have a teacher assessment component and support an online teacher training and assessment program. In addition, the VPSA Technology Initiative requires a local match that includes teacher training in the area of technology. School divisions have the option to use the local match funds to support an online system. Because existing funding sources are already available to support online systems, it does not appear that this should be a high priority area for increased State support.

VI. Federal and Private Sector Support for Educational Technology

The mandate for this study directs JLARC to "study ways to enhance the use of federal assistance for educational technology…and the implementation of state tax credits for businesses that contribute technology resources to schools." It appears that both the State and school divisions are doing what they can to maximize funding from federal sources. The two major sources of federal funding for educational technology are primarily calculated on a funding formula basis. Thus, the Commonwealth and its school divisions are limited in the actions they can take to increase their share of federal funds. Further, education technology staff in school divisions indicate that additional State tax credits to businesses donating technology resources are neither necessary nor desirable.

FEDERAL SUPPORT FOR EDUCATIONAL TECHNOLOGY

The federal government has been and continues to be a significant source of educational technology funding for school divisions. In fact, the Appropriations Act states that "local school divisions shall maximize the use of available federal funds, including E-Rate Funds, and to the extent possible, use such funds to supplement the [SOL Technology] program and meet the goals of this program." The two most significant federal technology programs, the E-Rate program and the Educational Technology Grant Program, provided over $25 million to Virginia's public schools in 2002 (Table 26, next page). In addition to these two programs, there are a variety of smaller federal programs that have provided technology funding to schools. However, these smaller programs typically fund very targeted projects on a one-time basis and are not routinely a source of recurrent federal technology funding.

Virginia's School Divisions Appear to Be Maximizing Their E-Rate Funds to the Extent Possible

The federal E-Rate program provides discounts to assist public and private schools and libraries in obtaining telecommunications and Internet access. The program was authorized by Congress as part of the Telecommunications Act of 1996, and is administered by the Schools and Libraries Division of the Universal Service Administrative Company under the direction of the Federal Communications Commission. In recent years, the E-Rate program has provided in excess of $2 billion dollars to eligible U.S. schools and libraries for telecommunications and Internet costs.

Under the E-Rate program, schools and libraries receive E-Rate discounts that can be applied to telecommunications services, Internet access, and internal connections. Eligible services range from basic local and long-distance phone services and Internet access services, to the acquisition and installation of equip-

Table 26

Major Federal Programs Providing Support for Educational Technology
FY 2001 - FY2004 Allocations*
(In Millions)

	FY 2001	FY 2002	FY 2003	FY2004
E-Rate Disbursements**	$14.2	$15.8	$7.6	$15.0
Educational Technology Grants***	--	$10.4	$9.9	$10.2
Technology Literacy Challenge Fund	$6.8	--	--	--
Technology Innovative Challenge Grants	$2.9	--	--	--
Total Funding for Major Federal Programs Providing Support for Educational Technology	**$21.0**	**$26.2**	**$17.5**	**$25.2**

*All federal funds, other than E-Rate, are shown for the federal fiscal year, which differs slightly from the state fiscal year. Amounts shown are also the allocated or appropriated amount for that year. In many cases, due to lags in the grant process, local school divisions may not receive their grant amounts until the following fiscal year.

**At the time of this report, school divisions were still receiving E-rate reimbursements for FY 2003. DOE staff expect the total E-rate disbursement amount for FY 2004 to be comparable to the amounts received in FY 2001 and FY 2002. The FY 2004 E-Rate disbursement amount is an estimate based on an average of the amounts received in FY 2001 and FY 2002.

*** Educational Technology Grant amount for FY 2004 is a U.S. Department of Education estimate.

Source: E-Rate funding levels were provided by the VA Department of Education and are based on data from the Schools and Libraries Division of the Universal Service Administration Company. All other funding levels are taken from the U.S. Department of Education state-by-state budget summaries.

ment to provide network wiring within school and library buildings. Items such as computer hardware and software, staff training, and electrical upgrades are not eligible for E-Rate funds.

Schools and libraries receive E-Rate discounts ranging from 20 percent to 90 percent of the cost of eligible services depending on their level of poverty and location of schools (rural schools receive larger discounts). Level of poverty is based upon the percentage of students participating in the National School Lunch Program. The discount amounts are paid directly to the companies that provide the services, and these companies in turn provide either rebates or discounted bills to the schools. The Schools and Libraries Division prioritizes applications for funding based on the level of discount (high discounts are given higher priority) and the type of service requested. For example, applications requesting internal connections (connections to classrooms and workstations) typically have only been funded for applicants with discount rates of 80 percent or more due to limited E-Rate funding compared to total requests.

Several Factors Prevent Virginia from Obtaining Significantly More Funding through the E-Rate Program. There are several factors outside of the

control of Virginia's school divisions that prevent them from obtaining significantly more in E-Rate funding. The Virginia Department of Education (DOE) reports that almost all divisions (97 percent in FY 2003) apply for E-Rate funds each year (although not all of these applications are accepted by the Schools and Libraries Division). However, factors such as the relative wealth of Virginia's residents and the lack of a statewide network for Virginia's school divisions prevent divisions from significantly increasing their E-Rate funds. DOE also reports that Internet connections in Virginia are relatively less expensive than in many other states.

The relative wealth of Virginia's residents prevents divisions from receiving the highest discount rates. School divisions can receive E-Rate discounts as high as 90 percent if at least 75 percent of their students participate in the federal school lunch program. However, most of Virginia's school divisions do not qualify for a 90 percent discount rate. According to DOE, the average discount rate of a Virginia school division is between 61 and 62 percent. Because of this, Virginia receives less in E-Rate discounts on a per pupil basis than states with higher percentages of children in poverty. This becomes particularly important when E-Rate discounts are approved for internal connections, which is where over 50 percent of E-Rate discounts go. Due to limited E-Rate funds relative to the number of requests, discounts are only given to schools with high poverty levels and discount rates of 80 percent or over. Thus, many of Virginia's divisions miss out on the largest share of E-Rate funding.

DOE officials also claim that the lack of a statewide network for Internet connectivity leads to reduced levels of E-Rate funding. Unlike some other states, Virginia does not have a statewide network. Rather, each division in Virginia has its own network, and divisions utilize different telecommunications and Internet service providers. States that have implemented a statewide network and have consolidated telecommunications services for their school divisions are able to make a consolidated E-Rate application on behalf of all of their school divisions. By submitting one consolidated application, the states may receive larger E-Rate commitments. In contrast, Virginia's school divisions must apply individually for the E-Rate program.

Virginia Assists Its Divisions in Securing E-Rate Funds. Although several factors may prevent Virginia's school divisions from securing large increases in their E-Rate allocations, it does appear that the State provides support for them to ensure they maximize their program funds to the extent possible. DOE staff provide assistance to divisions throughout the program application and appeal process. This helps to reduce the number of rejections of applications by the School and Library Division. Furthermore, DOE staff also track which divisions have applied for E-Rate funds, and staff encourage those divisions that have not submitted applications to do so. Based on the realization that certain impediments exist to Virginia obtaining more E-Rate funds, and the fact that DOE staff are actively providing support to divisions in securing E-Rate funding, it appears that Virginia is doing what it can to maximize E-Rate allocations, short of changing participation rates in the federal National School Lunch Program.

Educational Technology Funds Are Provided on a Formula Basis, and States Are Therefore Limited in How Much They Can Affect Their Funding Levels

The other major federal technology program is the Enhancing Education Though Technology Program (the Ed Tech program). The primary goal of the Ed Tech program is to improve student academic achievement through the use of technology in schools. The Ed Tech program was established in the No Child Left Behind Act of 2001, which reauthorized the federal Elementary and Secondary Education Act of 1965 (ESEA). The Ed Tech program consolidated the prior federal Technology Literacy Challenge Fund (TLCF) and the Technology Innovative Challenge Grant Program into a single grant program.

The majority of Ed Tech funds are disbursed to local school divisions, although a small portion of the funds may be used at the state level. Up to five percent of the grant allocation may be used by the state to carry out state-level educational technology activities and to assist local efforts in carrying out the Ed Tech program. Of the remaining 95 percent, half must be distributed to local school divisions using a formula based on their proportion of disadvantaged students, and the remaining 50 percent must be distributed to divisions on a competitive basis.

There is a fair amount of flexibility in the use of Ed Tech funds, although divisions must use at least 25 percent of their allocation to provide technology-related professional development. The Virginia Department of Education reports that it has earmarked the majority of Ed Tech funds for professional development, which is consistent with how Virginia has used federal technology funds in the past.

Virginia was allocated $10.4 million in Ed Tech funds in FY 2002 and $9.9 million in FY 2003, and this level is expected to continue for FY 2004. The U.S. Department of Education awards Ed Tech funds to states on a formula basis; the amount a state receives in a given year is based on the proportion of funds it receives under Part A of Title I for that year, which is based on the number of disadvantaged students in the state. (No state receives less than one-half of one percent of the funds available for the program.) Because the funds are allocated exclusively by formula, there is very little states can do to change their Ed Tech allocations, other than to ensure that they apply for the grant.

Other Federal Educational Technology Programs Exist, But They Typically Do Not Provide Funds on a Consistent, Recurring Basis

The two major sources of federal technology funding for schools are the E-Rate program and the Ed Tech program. However, there are a variety of other sources of federal funding which are available for educational technology on a limited basis. For example, federal Title I funds for at-risk students may be used for technology in limited circumstances, and Perkins funds can be used for equipment related to some vocational programs. The U.S. Department of Education also administers several smaller competitive grant programs that provide assistance for schools, such as the Star Schools program, which supports projects that utilize dis-

tance learning. These smaller programs are often not limited to schools; other entities, such as public broadcasting services or community centers, are eligible to apply as well. Such programs also typically fund targeted projects and therefore are not a source of recurring technology funds for general educational purposes. In addition to the U.S. Department of Education, other federal agencies provide a limited number of grants for specific educational technology programs. Virginia has benefited from these programs in the past, and while these sources may not be result in recurring sources of funding, the Commonwealth should continue to pursue funding from these various federal programs when it is available.

STATE TAX CREDITS FOR BUSINESSES DONATING EDUCATIONAL TECHNOLOGY RESOURCES

SJR 87 also directs JLARC to study the implementation of State tax credits to businesses that contribute technology resources. Department of Education (DOE) staff indicated that the local school divisions, rather than the State DOE, should take the initiative in working with private businesses that may contribute technology resources. Because businesses vary greatly from one locality to another, the nature of the contributions to educational technology would vary greatly from one school division to another as well.

Interviews with education technology staff in school divisions indicate that additional State tax credits encouraging businesses to donate technology resources may not be so desirable. The three most commonly discussed reasons are: (1) donated hardware may be old or too costly for the division to maintain (because, for example, it may be obsolete or incompatible with the division's current hardware); (2) donated support may not be reliable or effective; and (3) the distribution of donations may create problems of equity.

Problems with Donated Hardware

School divisions indicated that businesses tend not to donate hardware and equipment until it is old and on the way to becoming out-of-date. If donated equipment is too old for effective use in the schools (for example, a donated computer having a processor that is too slow for an internet connection), it may actually be of no help to the school division. Further, equipment that is older may need to be replaced sooner, so that the donation would only serve to postpone the procurement of what is really needed by the school division. Even if the cost of the hardware itself is zero to the school division, there is also an associated total cost of ownership, which includes support technician hours to install, maintain, and repair the equipment. Donated equipment, especially if it is older or incompatible with hardware the school or school division is already using, may require much higher amounts of technical support time, which can ultimately make it prohibitively costly to the school division. Furthermore, there is a cost of disposing the equipment if it does not work.

Problems with Donated Support

School division staff have indicated that there may be reliability problems with technical support time that is donated. For example, when a problem at a school arises, the school division may need the technical person to give that problem highest priority to solve it sooner. If the technical person's time is donated, the school division's problem may be competing with other problems calling for that person's attention, so that the problem would continue for an unacceptably longer period of time. Another problem is that donated technical support may not provide the best solutions and may end up actually costing the school division more in the long run. For example, staff at one school division told of an instance where donated electrical wiring work eventually had to be re-done in a manner that cost the school division much more than if it had not been donated in the first place.

Equity Problems

Having the State support private sector donations of educational technology resources through tax credits would ultimately benefit some localities more than others, because some localities have businesses that others do not. The localities with these businesses may also tend to be more affluent than the ones without them. Therefore, a State subsidy in the form of tax credits may be going to the wealthier localities while the poorer localities would receive none. But even if the question of equity between school divisions is set aside, a similar problem arises *within* school divisions. Some parts of a school division may have businesses wanting to donate educational technology resources to nearby schools, while other parts of the same school division may have none. Some division staff have indicated that allowing similar schools (such as elementary schools) in the same division to have different levels of access to technology would be difficult to justify and to maintain.

Staff in a few school divisions indicated that specific State tax credits may encourage some desired specific donations from businesses in their localities. For example, staff in one school division hope to develop a partnership with local businesses for building their own fiber optic network, and indicated that State tax credits may help. However, each specific type of desired donation was mentioned by only one school division. Therefore, to change the State tax code to benefit only one school division at a time could result in adding a considerable complication to the State tax code for relatively limited benefits.

Finally, most school divisions already have education foundations through which they can channel donated education technology resources, and several do so already. These education foundations are established in Section 22.1-212.2:2 of the *Code of Virginia*. Donations made to these education foundations are already tax deductible.

VII. Illustrative Funding Formula Combinations and Related Issues

This chapter provides illustrative combinations of the various options for funding educational technology that were discussed previously in this report. The least expensive combination is the prevailing cost combination, which bases funding on a weighted average of what divisions are currently spending on technology. When compared to the total technology spending estimated for FY 2002, the prevailing cost combination still leaves a significant share of technology costs to be funded by the localities. The higher aspiration combination is the most expensive combination and would provide a very high level of technology support and student access to computers. It would also result in a total funding level that is over 1.5 times the total amount estimated for FY 2002. There are also three other funding combinations with total costs that fall between the costs of the prevailing and the higher aspiration combinations.

If the General Assembly decides to adopt a funding formula approach to technology, there are several actions it may wish to direct the Department of Education to take to improve the reporting school divisions' reporting of technology data. In addition, any such formulas adopted by the General Assembly should be revisited on a regular basis. This is needed because the nature of educational technology in Virginia's schools will change over time, which will affect schools' needs for technology support and other technology items.

ILLUSTRATIVE FUNDING FORMULA COMBINATIONS AND EXISTING STATE TECHNOLOGY FUNDING

There are several combinations of funding options that the State could use to help school divisions fund their educational technology costs. The combinations presented in this chapter do not include all of the various funding options discussed in the previous chapters. Instead, they include only those options that appear to be the most viable and best address the concerns of school divisions.

As described in Chapter I, the State already provides some funding for educational technology through the SOQ and various State initiatives. It is assumed that any funding that has been provided through the SOQ could be used to help support the technology funding formula combinations. However, there are no assumptions as to whether existing State initiative funding, such as the VPSA Technology Initiative, would be redirected to offset the cost of the funding formulas.

Illustrative Combinations of Funding Formula Options

Five combinations of options for funding educational technology are presented in this section. These combinations largely have the effect of redistributing some technology costs currently paid by localities alone into a funding formula where costs are shared with the State. Providing funds through a State formula

would help to equalize the funding that is available for educational technology among divisions, which would seem to be an appropriate role for the State. In some cases, however, localities would need to spend significantly more for technology than they reported spending in FY 2002 to pay for their share of the funding combination.

Throughout the five combinations, technology staffing and hardware replacement assumptions vary; however, several of the other technology cost components are held constant. Chapter IV discussed that the best approach to funding infrastructure, software and supplies, and connectivity costs is on a prevailing basis. Therefore, the prevailing amounts for these cost components are used for all of the funding combinations. Likewise, all other technology costs that are not itemized in the funding combinations, such as disability insurance and travel costs, are calculated on a prevailing basis. This is consistent with how they have probably been funded previously in the SOQ.

The total costs for the option combinations are presented for 2002, and projected for the 2004-2006 biennium. Consistent with the February 2002 JLARC *Review of Elementary and Secondary School Funding*, historical rates of salary increases for school division personnel and inflation factors for non-personnel costs are recognized through FY 2006. DOE projections of pupil membership levels are also used. At the time of this report, updated fringe benefit rates were not available for the 2004-2006 biennium, so FY 2002 rates are used for this purpose. Appendix C includes additional detail for each of the funding combinations, including the distribution of costs between the State and the localities.

Combination One. Combination One funds educational technology based on the prevailing (linear weighted average) technology expenditures made by Virginia's school divisions during the 2001-2002 school year, and it is the least expensive of the funding combinations. Costs are not based on staffing ratios or guidelines, and this combination does not assume any particular computer replacement cycle.

The prevailing cost combination is an improvement over the State's current approach to funding educational technology, since at the very least, the State would provide an explicit and identified amount for technology. However, this combination does not attempt to provide a Statewide standard for technology staffing levels or computer replacement in schools, and it still leaves a significant portion of the total technology costs for localities to cover themselves.

Combination 1
Prevailing Costs
(Estimated Total State and Local Costs)

	FY 2002	FY 2005	FY 2006
Technology Integration Personnel *(Prevailing Costs)*	$15,229,324	$17,059,424	$17,829,642
Technical Support Personnel *(Prevailing Costs)*	$73,172,020	$81,333,144	$84,741,145
Hardware Replacement *(Prevailing Costs)*	$48,608,293	$53,677,480	$55,485,931
Infrastructure, Connectivity, and Software *(Prevailing Costs)*	$37,416,032	$41,318,018	$42,710,066
Other Ed. Technology Costs *(Prevailing Costs)*	$29,202,766	$32,248,220	$33,334,597
Estimated Total Ed. Technology Costs	**$203,628,435**	**$225,636,256**	**$234,101,481**
Total Estimated State and Local Dollars Spent in FY 2002	**$368,784,677**	--	--

Combination Two. Combinations Two and Three reflect State guidelines and recommendations for technology staffing and are mid-level in terms of cost. Combination Two funds technology integration staff and technical support staff using the advanced level staffing guidelines suggested in DOE's recent *Guidelines for Technology Staffing and Support for Integration of Education Technology into Instructional Programs.*

The hardware replacement option used in this combination is based on a five-to-one student-to-computer ratio and assumes a five-year replacement cycle. A five-to-one student-to-computer ratio is consistent with the State's current computer access goals and is the level of access that most school divisions are trying to reach. In terms of equipment replacement, most divisions suggested that a three to five year replacement cycle for hardware and equipment is adequate. This is also the replacement timeframe recommended by education technology experts. A five-year replacement cycle would therefore appear to meet schools' needs for refreshing their technology.

Combination Two is the second least expensive combination for funding educational technology. However, compared to the prevailing cost combination it redistributes significantly more of the total technology costs (approximately $40 million more annually) into a funding formula to be shared by the State and localities. It also bases technology staffing levels and equipment replacement on guidelines that have been suggested by DOE rather than a simple weighted average.

Combination 2
DOE Advanced-Level Staffing Guidelines
5:1 Ratio, 5-Year Hardware Replacement Model
(Estimated Total State and Local Costs)

	FY 2002	FY 2005	FY 2006
Technology Integration Personnel *(DOE Advanced Level Staffing Guidelines)*	$27,209,268	$30,572.420	$31,892,109
Technical Support Personnel *(DOE Advanced Level Staffing Guidelines)*	$83,006,468	$91,974,528	$95,739,047
Hardware Replacement *(5:1 Ratio, 5-Year Replacement)*	$63,753,740	$70,402,393	$72,774,324
Infrastructure, Connectivity, and Software *(Prevailing Costs)*	$37,416,032	$41,318,018	$42,710,066
Other Ed. Technology Costs *(Prevailing Costs)*	$29,202,766	$32,248,220	$33,334,697
Estimated Total Ed. Technology Costs	**$240,588,274**	**$266,515,578**	**$276,450,243**
Total Estimated State and Local Dollars Spent in FY 2002	**$368,784,677**	--	--

Combination Three. Combination Three is also based on State-level recommendations, but costs slightly more than Combination Two. The difference in cost between the combinations is due to the fact that Combination Three funds technology staff based on recent recommendations made by the State Board of Education. The Board of Education recommends one position per thousand students for technology integration specialists and one position per thousand students for technical support staff. (The Board of Education is recommending a 4-year phase-in of the revisions that it is proposing to the SOQ. Costs shown here are the costs for the full implementation of the recommendation.) This staffing model yields slightly more total staffing than the DOE advanced level staffing guidelines, which explains the increase in cost. Similar to Combination Two, Combination Three assumes a five-to-one student-to-computer ratio and a five-year replacement cycle.

Combination Three falls in the middle of the five funding combinations in terms of total technology costs. Because it costs approximately $20 million more annually than Combination Two, it goes further in redistributing technology costs through a State funding formula.

Combination 3
Board of Education-Based Recommendation
5:1 Ratio, 5-Year Hardware Replacement Model
(Estimated Total State and Local Costs)

	FY 2002	FY 2005	FY 2006
Technology Integration Personnel *(Board of Education-based Rec.)*	$55,178,709	$61,945,549	$62,640,305
Technical Support Personnel *(Board of Education-based Rec.)*	$71,307,699	$79,320,040	$83,480,607
Hardware Replacement *(5:1 Ratio, 5-Year Replacement)*	$63,753,740	$70,402,392	$72,774,324
Infrastructure, Connectivity, and Software *(Prevailing Costs)*	$37,416,032	$41,318,018	$42,710,066
Other Ed. Technology Costs *(Prevailing Costs)*	$29,202,766	$32,248,220	$33,334,697
Estimated Total Ed. Technology Costs	**$256,858,949**	**$285,234,219**	**$294,939,999**
Total Estimated State and Local Dollars Spent in FY 2002	**$368,784,677**	--	--

Combination Four. Combination Four is the best representation of what Virginia's school divisions indicated is desirable in terms of technology staffing and equipment replacement. During site visits, many school division staff suggested that having both integration personnel and technical support personnel assigned at the building level is desirable. The staffing levels in this combination are calculated using the site-based model, which assigns one staff person to each building, unless enrollment levels are very high or very low. The hardware replacement option used in this combination is based on a five-to-one student-to-computer ratio and assumes a five-year replacement cycle.

Combination Four is the second most expensive combination and costs approximately $75 million more annually than the Board of Education-based options. Because of this, Combination Four goes much further in distributing the total costs of educational technology more equally between the State and local school divisions. It also models costs based on what school divisions indicated is desirable in terms of personnel staffing and technology replacement and would provide funding to bring all school divisions up to these levels.

Combination 4
Site-Based Model
5:1 Ratio, 5-Year Hardware Replacement Model
(Estimated Total State and Local Costs)

	FY 2002	FY 2005	FY 2006
Technology Integration Personnel *(Site-based model)*	$93,067,137	$104,130,223	$108,482,956
Technical Support Personnel *(Site-based model)*	$100,775,170	$111,789,760	$116,389,803
Hardware Replacement *(5:1 Ratio, 5-Year Replacement)*	$63,753,740	$70,402,392	$72,774,324
Infrastructure, Connectivity, and Software *(Prevailing Costs)*	$37,416,032	$41,318,018	$42,710,066
Other Ed. Technology Costs *(Prevailing Costs)*	$29,202,766	$32,248,220	$33,334,697
Estimated Total Ed. Technology Costs	**$324,214,847**	**$359,888,613**	**$373,691,846**
Total Estimated State and Local Dollars Spent in FY 2002	**$368,784,677**	--	--

Combination Five. Combination Five is considered a higher aspiration combination. It funds technology staffing at the most desirable level indicated by school divisions, the site-based model, and assumes a one-to-one student-to-computer ratio. A one-to-one ratio is a future goal outlined in DOE's technology plan, and it represents the approach that some school divisions in the State are in the process of adopting.

Combination Five is by far the most expensive of the combinations, costing over $620 million annually in FY 2005 and FY 2006 (over $260 million more than was spent in FY 2002). Because it is so expensive, it would require a significant increase in technology spending by both the State and localities.

Combination Five may be more useful as an illustration of what future technology staffing and replacement costs could look like as schools continue to improve their access to technology. Although several school divisions are attempting to move to a one-to-one ratio student-to-computer ratio, this does not reflect the current or near-term environment found in most of Virginia's school divisions.

Combination 5
Higher Aspiration Option
1:1 Ratio, 5-Year Hardware Replacement Model
(Estimated Total State and Local Costs)

	FY 2002	FY 2005	FY 2006
Technology Integration Personnel *(Site-based model)*	$93,067,137	$104,130,223	$108,482,956
Technical Support Personnel *(Site-based model)*	$100,775,170	$111,789,760	$116,389,803
Hardware Replacement *(1:1 Ratio, 5-Year Replacement)*	$299,325,384	$330,540,970	$341,677,249
Infrastructure, Connectivity, and Software *(Prevailing Costs)*	$37,416,032	$41,318,018	$42,710,066
Other Ed. Technology Costs *(Prevailing Costs)*	$29,202,766	$32,248,220	$33,334,697
Estimated Total Ed. Technology Costs	**$559,786,490**	**$620,027,191**	**$642,594,771**
Total Estimated State and Local Dollars Spent in FY 2002	**$368,784,677**	--	--

Summary of Existing State Funds Provided for Technology

The estimates for the illustrative funding combinations include the total State and local costs associated with those combinations. As discussed in Chapter I, the State already provides some support for educational technology. Some State funds, particularly those provided through the Standards of Quality, could be used to help pay for a technology funding formula. However, it is up to the discretion of the General Assembly as to whether other State initiative funding should be redirected to help support a funding formula.

SOQ Funding for Technology. The primary source of State funds for educational technology to date appears to have been the Standards of Quality. Because technology costs have not been explicitly identified in the ASR until recently (the ASR is the main source of data for the SOQ cost calculations), it is impossible to know exactly how much has actually been provided through the SOQ for this purpose. Because of this, most school divisions are also unaware that they have received funds through the SOQ for technology.

Based on FY 2002 expenditure data, JLARC staff estimate that between $84 million and $110 million has been provided by the State for technology through the SOQ. (The JLARC staff estimate of SOQ technology funding is discussed more fully in Chapter I.) For purposes of this report, the mid-point of this range, $97.1 million, is used as the estimate of State SOQ funding for technology in FY 2002. Many of the cost components included in the funding combinations above have

probably received some funding through the SOQ, with the possible exception of the technology integration specialists.

Existing SOQ funds for technology could help to cover any technology funding formulas adopted by the General Assembly. In fact, even if the General Assembly does not adopt a technology funding formula, DOE will have to alter the way in which it calculates SOQ costs so as to ensure that technology costs are not simply dropped as a result of a restructuring of the Annual School Report. Table 27 shows the estimated net cost increase to the State if it applied SOQ funding towards meeting its share of the illustrative funding combinations.

Table 27

Estimated Net Increase in State Costs of Illustrative Funding Combinations*
(in millions)

	FY 2005 (State Cost)	*Estimated Increase Over FY 2002*	FY 2006 (State Cost)	*Estimated Increase Over FY 2002*
Combination 1: Prevailing Costs	$124.9	*$27.8*	129.4	*$32.3*
Combination 2: DOE Advanced Level Staffing Guidelines; 5:1 Ratio, 5-Year Hardware Replacement Model	$148.2	*$51.1*	$153.4	*$56.3*
Combination 3: Board of Education-based Recommendation; 5:1 Ratio, 5-Year Hardware Replacement Model**	$157.8	*$60.7*	$162.9	*$65.8*
Combination 4: Site-based Model; 5:1 Ratio, 5-Year Hardware Replacement Model	$200.5	*$103.4*	$207.7	*$110.6*
Combination 5: Higher Aspiration Option; 1:1 Ratio, 5-Year Hardware Replacement Model	$345.1	*$248.0*	$356.9	*$259.8*

Estimated FY 2002 State Share of Standards of Quality Technology Funding
$97.1 million

*Estimates do not assume any changes in current use of State initiative funding.
**The Board of Education is recommending a 4-year phase-in of the revisions that it is proposing to the SOQ. FY 2005 and FY 2006 costs shown here are the costs for the full implementation of the recommendation.

VPSA Technology Initiative. The second largest source of State funding for technology has been the VPSA Technology Initiative. In recent years, the State has provided around $58 million through VPSA technology notes to local school divisions. These funds have primarily been used to fund technology infrastructure and to help divisions reach the State's goal of a five-to-one student-to-computer ratio.

This report does not make assumptions about whether the VPSA funds would be redirected to help pay for a technology funding formula. These funds could be rolled into a funding formula; however, JLARC staff did not assume this because funding is still needed to meet the State's goals associated with the Web-based SOL Technology Initiative, such as providing a five-to-one student-to-computer ratio for all grades by 2009. It is up to the General Assembly whether the VPSA funds should be maintained separately, at least until the goals of the Web-based SOL Technology Initiative are met, or whether they could be substituted by or used to help fund a broader technology funding formula.

Other State Funding Available for Technology. In addition to the SOQ and VPSA funds, there are several other sources of State funding that are available for educational technology. These include the funds provided for the State's electronic classroom initiative, and funds available through the school construction grant program and the local share of the lottery. Funding for the electronic classroom initiative (approximately $2.5 million annually) could be rolled into a funding formula, although these funds are specifically provided to support the State's distance learning program. While technology is an authorized use of the school construction funds and the local share of the lottery funds, these sources can also be used for many other purposes. JLARC staff therefore did not make any assumptions about their use with regards to a technology funding formula.

ENHANCING TECHNOLOGY DATA AND ROUTINELY UPDATING TECHNOLOGY FUNDING FORMULAS OVER TIME

If the General Assembly decides to adopt a funding formula for educational technology, there are several actions that it may wish to direct DOE to take to enhance the technology data currently collected through the Annual School Report (ASR). In addition, regular reviews and updates of the funding formulas will be very important due to the changing nature of educational technology.

For several of the funding formula options included in this report, such as the options for integration specialists, detailed data are not currently collected through the ASR. In these cases, JLARC staff collected data separately or made informed estimates of expenditures in these areas. If the General Assembly decides to adopt funding formulas in these areas, it may wish to direct DOE to collect more detailed data on these cost items through the ASR. DOE staff have indicated that, should this data be necessary for purposes of a funding formula, it could be collected through the ASR.

In a related issue, JLARC staff identified several instances where school divisions did not appear to have reported their full technology expenditures on the technology section of the ASR. In most cases, divisions reported these expenditures elsewhere on the ASR, so they were not completely excluded. However, if a funding formula approach to educational technology is used, accurate reporting of technology data will be important in developing accurate cost estimates. To help with this issue, the General Assembly may wish to consider amending Section 22.1-115 of the *Code of Virginia* to include technology as a major classification of funds for school

division accounting purposes. In addition, if the General Assembly decides to adopt a funding formula approach for educational technology, it may wish to direct DOE to conduct preliminary analysis, such as outlier analysis, to help identify school divisions that have not reported their technology expenditures in the technology section of the ASR.

In addition to having accurate data for calculating technology costs, regular reviews and updates of any funding formulas adopted by the General Assembly will be very important due to the changing nature of educational technology. Many aspects of a school division's technology program can and will change over time. For example, while the State's current goal for computer access is a five-to-one student-to-computer ratio, most experts agree that schools will eventually move to a one-to-one ratio. As student-to-computer ratios change, this will impact their need for support staff and may impact hardware replacement cycles. Many school divisions are also moving to a wireless network, which could affect their on-going infrastructure and connectivity needs. Similarly, teachers' familiarity with computers will change over time, which may affect the need for integration specialists. There are probably many other upcoming changes in the world of educational technology that are impossible to anticipate, but will affect schools' technology support and equipment needs.

Because of the rate at which the technology changes, funding formulas that may be appropriate now may not be appropriate even five years from now. Therefore, it is critical that the State review any funding formulas that the General Assembly adopts on a regular basis. The State Board of Education has recently amended its by-laws to require itself to review the SOQ at least every two years. If the State decides to adopt a technology funding formula, perhaps a review of this formula could be incorporated into the Board's biennial schedule for reviewing the SOQ.

Recommendation (1). **If the General Assembly decides to adopt a funding formula for educational technology, it may wish to direct DOE to collect more detailed data on certain technology cost components through the Annual School Report.**

Recommendation (2). **If the General Assembly decides to adopt a funding formula for educational technology, it may wish to direct DOE to conduct preliminary analysis, such as outlier analysis, to help identify school divisions that have not reported their technology expenditures in the technology section of the ASR.**

Appendixes

Appendix A

Senate Joint Resolution N0. 87

Directing the Joint Legislative Audit and Review Commission to recommend a state funding formula for educational technology and technology support personnel.

Agreed to by the Senate, February 12, 2002
Agreed to by the House of Delegates, March 5, 2002

WHEREAS, studies have been reported in recent years that indicate that technology improves academic achievement and decreases student discipline problems and school dropouts; and

WHEREAS, the Standards of Quality require that technological proficiency be emphasized in the instructional program and the Standards of Learning (SOL) require that students demonstrate technological competency; and

WHEREAS, the imposition of state mandates has not been followed by the provision of state funding to support such mandates in recent years; and

WHEREAS, localities are funding the majority of the costs for implementation of the Standards of Learning and numerous mandates that have been added to the Standards of Quality, other state law, or the Board of Education's regulations for accreditation of schools; and

WHEREAS, a formula for the funding of technology initiatives should be developed and integrated as a component of the basic aid funding formula for the public schools; and

WHEREAS, this technology funding formula should subsume the funding and implementation of the technology replacement program that was approved by the General Assembly in 1998 but not funded; and

WHEREAS, in addition, state assistance should be provided for required teacher training, particularly in view of the Standards of Learning technology initiative to automate SOL testing online; and

WHEREAS, with the completion of the study of education funding in Virginia, the Joint Legislative Audit and Review Commission is in a unique position of understanding and knowledge and has the considerable expertise necessary to develop an educational technology funding formula; now, therefore, be it

RESOLVED by the Senate, the House of Delegates concurring, That the Joint Legislative Audit and Review Commission be directed to recommend a state funding formula for educational technology and technology support personnel. In conducting this study, the Joint Legislative Audit and Review Commission shall (i) seek to place few restrictions on local school divisions except that they adhere to their locally developed technology plans; (ii) examine the possibility of expanding the high school technology resource assistant initiative to include elementary, middle, and adult education schools, (iii) recognize the state share of the costs of support staff required to maintain equipment in schools that is necessary to meet the requirements of the Standards of Quality, other state law, or the Board of Education's regulations; (iv) evaluate the feasibility of support for teacher training, including the development of an online instructional and testing program to facilitate the achievement of technological competencies and assess such proficiencies; and (v) examine the integration of the technology replacement program into such

formula. In addition, the Joint Legislative Audit and Review Commission is requested to study ways to enhance the use of federal assistance for educational technology, such as continuation of the E-rate program and the implementation of state tax credits for businesses that contribute technology resources to schools. The Department of Education and all school divisions of the Commonwealth shall provide technical assistance to the Joint Legislative Audit and Review Commission.

All agencies of the Commonwealth shall provide assistance to the Joint Legislative Audit and Review Commission for this study, upon request.

The Joint Legislative Audit and Review Commission shall complete its work by November 30, 2003, and shall submit its written findings and recommendations to the Governor and the 2004 Session of the General Assembly as provided in the procedures of the Division of Legislative Automated Systems for the processing of legislative documents.

Appendix B

Educational Technology and the Literary Fund

The Literary Fund has been Virginia's primary funding source that has explicitly provided funding for school technology over the last 15 years. The Fund has been used since FY 1990 to pay the debt service on Virginia Public School Authority (VPSA) notes issued to school divisions for capital related technology expenditures. As discussed in Chapter I, in recent years, funding for technology has focused on the State's SOL Technology Initiative. DOE estimates that State allocations for the initiative will be $58 million annually until completion of the SOL Technology Initiative in 2009, and anticipates that this will continue to be funded through the issue of VPSA notes, with the debt serviced paid by the Literary Fund.

Background and History of Funding for Technology Through the Literary Fund

The Literary Fund is a permanent fund that was established in 1810 to provide schools for the poor in Virginia. Its primary purpose has been to provide low-interest loans to school divisions to help them meet school building capital costs, but the Fund may be used for other public school purposes. The Fund continually generates revenues from criminal fines, fees and forfeitures, unclaimed property, repayments of prior Literary Fund loans, interest on the principal of the Fund, and more recently, unclaimed lottery winnings.

Specific guidelines on how the Fund may be used are provided in the *Code of Virginia* and *Constitution of Virginia*. The *Code of Virginia* allows the funds to be used for:

> (i) erecting, altering or enlarging school buildings in such school divisions; (ii) purchasing and installing educational technology equipment and infrastructure; (iii) equipping school buses for alternative fuel conversions and for construction of school bus fueling facilities for supplying compressed natural gas or other alternative fuels; and (iv) refinancing or redemption of negotiable notes, bonds, and other evidences of indebtedness or obligations incurred by a locality on behalf of a school division which has an application for a Literary Fund loan for an approved school project pending before the Board of Education.

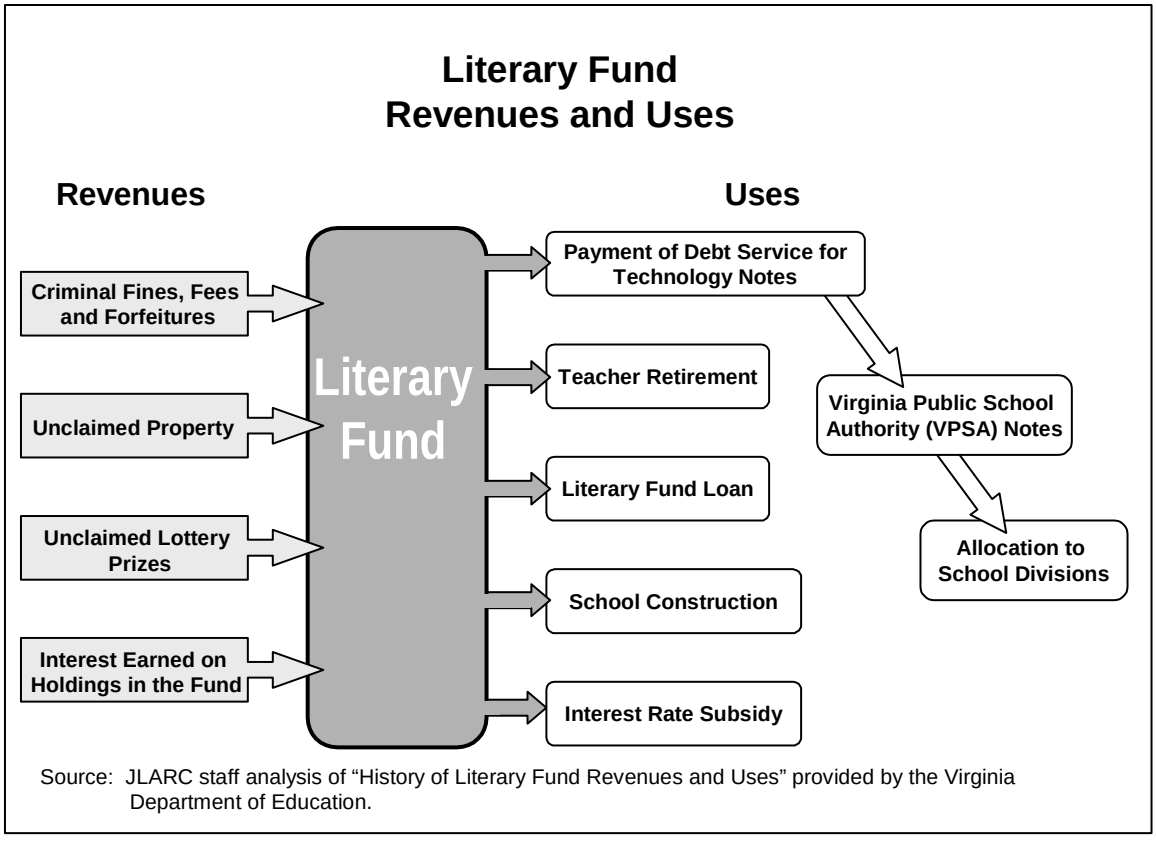
The *Constitution of Virginia* states that the Literary Funds may be used for public school purposes, including teacher retirement, as long as the principal of the fund is at least $80 million.

The Department of Education is responsible for the day-to-day management of the Literary Fund while the Board of Education is responsible for allocating funds. However, a majority of funds are earmarked for various programs annually through acts of the General Assembly. In recent years the Literary Fund has pri-

marily been used to provide funding for: (1) teacher retirement, (2) low interest loans and interest rate subsidies to school divisions, (3) education technology equipment, and (4) school construction grants. The figure below illustrates the revenues and uses of the Fund.

The table on the following page illustrates that Literary Fund revenues, including credits and adjustments, have increased an average of 8 percent annually from $45.7 million in 1983 to $197.2 million in 2002. Credits are from unspent Literary Loan funds allocated in previous years. As of December 31, 2002, the principle of the fund totaled $596.18 million.

Over the years, the majority of funds have been used for teacher retirement and Literary Fund loans. The Literary Fund has also been the primary source of funding for education technology initiatives. The first technology initiative funded by the Literary Fund began in 1988, and focused on providing computers to assist with remediation instruction in middle schools and distance learning equipment. Literary funds are not provided directly to school divisions for technology. Instead school divisions receive funds through the issuance of Virginia Public School Authority (VPSA) notes, and the Literary Fund provides 100 percent of the debt service on the notes. (The VPSA is a bond bank, which provides low-cost financing of capital



Source: JLARC staff analysis of "History of Literary Fund Revenues and Uses" provided by the Virginia Department of Education.

Literary Fund Revenues and Uses, FY 1983-2004 (in millions)

Fiscal Year	Revenue, Credits, and Adjustments*	Fund Uses				
		Teacher Retirement	Literary Fund Loans	Interest Rate Subsidy Program	School Construction Grant Program	Payment of Debt Service for Technology
1983	$45.70	$31.70	$41.92			
1984	$48.40	$44.40	$13.09			
1985	$51.10	$10.00	$40.43			
1986	$58.80	$22.00	$32.77			
1987	$64.40	$15.00	$64.95			
1988	$67.80	$32.10	$36.21	$8.45		
1989	$80.10	$10.00	$68.87	$11.03		
1990	$85.10	$60.00	$22.16	$27.90		$2.53
1991	$102.10	$36.80	$16.37	$10.61		$2.97
1992	$102.92	$101.10				$6.76
1993	$100.90	$84.50				$6.76
1994	$101.53	$93.91				$2.97
1995	$118.99	$82.26	$23.19	$10.07		
1996	$113.44	$34.99	$48.89	$12.27		$10.83
1997	$126.37	$41.09	$67.16	$8.82		$10.08
1998	$127.72	$15.53	$78.25	$9.96		$22.37
1999	$157.26	$7.76	$111.27	$5.60	$8.40	$33.82
2000	$157.31	$0.00	$99.58	$9.97	$10.19	$33.46
2001	$184.03	$0.00	$117.79	$18.82	$8.15	$36.40
2002	$197.06	$110.00		$11.32	$9.20	$51.99
2003*	n/a	$112.80				$51.80
2004*	n/a	$118.45				$55.00
Total	**$2,091.03**	**$1064.38**	**$882.90**	**$144.83**	**$35.94**	**$327.34**

*Estimated amounts based on *2003 Virginia Acts of Assembly.* Revenues are not available until the August following the end of the fiscal year.

Source: Virginia Department of Education.

projects for public schools in Virginia.) The General Assembly authorizes the issuance of VPSA notes for technology and backs the notes with a moral obligation of the State. This moral obligation ensures the VPSA that the State will repay the notes either through Literary or general funds. Since the General Assembly began authorizing VPSA notes for technology, the Literary Fund has provided all of the funds to pay the debt service on the notes.

In FY 2000, the General Assembly began to explicitly authorize funding for the current SOL Technology Initiative. The current SOL Technology Initiative follows the State's technology goals for: (1) retrofitting and upgrading existing school buildings to use educational technology, (2) providing net-work ready multimedia microcomputers for use at the classroom level, and (3) providing a five-to-one ratio of pupils-to-network-ready computers.

Funds for technology provided through the VPSA technology notes are limited to non-recurring hardware costs. This may include the purchase of additional computers to bring schools up to the State's goal of five-to-one students-to-computers or other hardware or upgrade costs to allow schools to provide appropriate networking capabilities. Funds may not be used for leases, including leases of computers, or ongoing telecommunications costs, such as monthly Internet costs. For example, one school division indicated that it cannot use the VPSA allotments for its one-to-one student-to-laptop computer program because the computers are leased.

The following table demonstrates that since FY 2002, allocations of VPSA notes for the SOL technology initiative have averaged $58.0 million annually based on a formula of $26,000 per school and $50,000 per division. Unlike the SOQ funding formula (or Literary Fund school construction loan rates), the amount allocated is not based on a school division's composite index. However, school divisions are required to provide a 20 percent match for the funds received, and at least 25 percent of the local match must be used for teacher training in the use of technology. The local match may be reduced for school divisions with a composite index of local ability-to-pay below 0.20.

Education Technology Initiatives Funded by the Literary Fund

Year	VPSA Notes Authorized	Literary Fund Debt Service Payments on VPSA Notes Authorized*
2000	$50.0 million	$36.4 million
2001	$56.9 million	$39.0 million
2002	$58.3 million	$52.0 million
2003	$58.4 million	$51.8 million
2004	$58.6 million	$55.0 million
Total	**$282.2 million**	**$234.2 million**

*The amount of VPSA notes authorized and the amount of debt service payments will not be equal for any given year. Since VPSA technology notes are repaid over five years, debt service payments reflect the payment plus interest for notes issued in previous years.

Source: Virginia Acts of Assembly.

Since the start of the SOL technology initiative in FY 2000, the General Assembly has authorized $282.2 million in VPSA technology notes. During the same time period, the General Assembly also appropriated $234.2 million in Literary funds for payment of debt service on technology notes.

Although recent funding for technology initiatives has been consistent over the years, in FY 1995 and FY 1999 the General Assembly did not authorize the release of VPSA technology notes. The hold in FY 1999 may have occurred for a variety of reasons, such as to allow school divisions to organize their technology plans for the current SOL technology initiative or to maintain current funding levels. (In FY

1999 and FY 2000 funding levels for VPSA technology notes through the Literary fund remained constant and did not increase as in other years.)

In Recent Years the General Assembly Has Been Committed to Providing Funding for the SOL Technology Initiative Through the Literary Fund

Although the Literary Fund has provided funding for a variety of programs for the past 20 years, funding for teacher retirement, Literary Fund loans, and Interest Rate subsidies through the Fund has fluctuated considerably. Based on previous allocations, it appears that the amount of funding provided to these programs is based on the availability of general funds for teacher retirement. When general funds are low, Literary Fund dollars have been shifted to help pay for teacher retirement costs. When this has happened, at least one other Literary Fund program is typically placed on hold. For example, when the State experienced a budget shortage in the early to mid 1990's and early 2000's, teacher retirement transfers from the Fund were high. Therefore, it appears that to offset the high allocation for retirement, the Literary Loan and the Interest Rate Subsidy programs were put on hold. The Literary Loan program, used to help finance school construction, has not been available in FY 2002, FY 2003, or FY 2004.

Consequently, there is a concern on the part of school divisions that the Literary Fund is volatile, and may not provide the ongoing support for the SOL Technology Initiative. This concern stems from the history of the General Assembly reducing funding for other Literary Fund programs when additional funding for teacher retirement is needed from the Fund and because no VPSA technology notes were issued in 1995 and 1999.

However, it appears that in recent years the General Assembly has been committed to the issuance of VPSA technology notes and the payment of the notes through the Literary Fund, despite the decreases in funding for the Literary Loan and Interest Rate Subsidy programs. For example, in FY 2002 funding for teacher retirement through the Literary Fund increased from $0 in the previous year to $110.0 million. During the same time period, the Literary Fund Loan program decreased a comparable amount from $117.8 million in FY 2001 to $0 in FY 2002. However, during the same time period, the General Assembly has continued to authorize the release of VPSA technology notes backed with Literary Funds. In fact, the amount of funding has increased from $50.0 million in FY 2000 to $58.6 million in FY 2004, despite continued increases in teacher retirement. While no funds were issued for technology in FY 1995 and FY 1999, it appears that these policy decisions were not driven by a lack of Literary funds. In FY 1999, transfers for teacher retirement ($7.76 million) did not significantly reduce the Literary Fund, leaving additional funds available for technology.

Although the management of the Literary Fund is primarily driven by annual budget policies that can change on an annual basis, it appears that the General Assembly is currently committed to providing technology through the authorization of VPSA notes and the payment of the debt service through the Literary Fund.

Funding for the technology initiative has increased in recent years even when other programs have been placed on hold or reduced.

Appendix C

Detailed Illustrative Funding Combinations

Combination 1 -- Prevailing Costs

Table 1: Statewide Total Educational Technology Costs

Technology Integration Personnel	FY 2005	FY 2006	Biennium Total
Salaries	$14,349,616.79	$14,953,216.04	$29,302,832.83
Fringe Benefits	$2,709,807.58	$2,876,426.30	$5,586,233.87
Total for Technology Integration Personnel	*$17,059,424.37*	*$17,829,642.34*	*$34,889,066.70*
Technical Support Personnel			
Salaries	$67,799,025.25	$70,575,302.55	$138,374,327.80
Fringe Benefits	$13,534,089.22	$14,165,842.14	$27,699,931.36
Total for Technical Support Personnel	*$81,333,114.47*	*$84,741,144.69*	*$166,074,259.16*
Technology Hardware Replacement	*$53,677,479.58*	*$55,485,931.23*	*$109,163,410.81*
Infrastructure, Connectivity & Software	*$41,318,017.87*	*$42,710,066.04*	*$84,028,083.91*
Other Ed. Tech. Costs	*$32,248,219.75*	*$33,334,696.73*	*$65,582,916.48*
Estimated Total for Ed. Technology Costs	**$225,636,256.03**	**$234,101,481.03**	**$459,737,737.06**

Estimated FY 02 Spending for Specific Categories of Ed. Tech. Costs (State & Local)	
Estimated SOQ Ed. Tech. Costs	*$175,029,995.59*
VPSA	*$47,986,797.85*
Technology Resource Initiative	*$8,499,079.67*
Electronic Classroom	*$2,521,503.84*
Total State and Local Dollars Spent on Ed. Tech. in FY 02	**$368,784,677.02**

Table 2: Apportionment of Educational Technology Costs to State and Local Governments

	FY 2005	FY 2006	Biennium Total
State Portion of Educational Technology Costs			
Technology Integration Personnel	$9,398,312.51	$9,800,797.35	$19,199,109.86
Technical Support Personnel	$44,796,994.52	$46,584,504.81	$91,381,499.33
Technology Hardware Replacement	$29,840,164.80	$30,786,465.31	$60,626,630.11
Infrastructure, Connectivity & Software	$22,969,343.42	$23,697,754.32	$46,667,097.74
Other Ed. Tech. Costs	$17,927,298.36	$18,495,814.38	$36,423,112.74
Estimated Total State Cost	***$124,932,113.60***	***$129,365,336.18***	***$254,297,449.78***
Estimated Total Local Cost	***$100,704,142.43***	***$104,736,144.85***	***$205,440,287.29***
Estimated Total for Ed. Tech. Costs	**$225,636,256.03**	**$234,101,481.03**	**$459,737,737.06**

State Portion of Estimated Ed. Tech. Costs in FY 02	
Included in current SOQ (est.)	*$97,101,334.32*
VPSA (Reported Amounts)	*$39,988,998.21*
Technology Resource Initiative	*$4,956,252.00*
Electronic Classroom	*$1,324,043.98*

Estimated Local Dollars Spent on Ed. Tech. in FY 02	
Local match of SOQ costs (est.)	*$77,928,661.26*
Local match for VPSA (est.)	*$7,997,799.64*
Loc mtch Tech Res. Init. (est.)	*$3,542,827.67*
Loc mtch Electronic Class. (est.	*$1,197,459.86*
Other ed. tech. costs (est.)	*$134,747,300.07*

Total Dollars Spent on Ed. Tech in FY 02: $368,784,677.02

Combination 2 -- DOE Advanced Level Staffing Guidelines; 5:1 Ratio, 5-Year Hardware Replacement Model

Table 1: Statewide Total Educational Technology Costs

Technology Integration Personnel	FY 2005	FY 2006	Biennium Total
Salaries	$25,659,270.15	$26,746,615.89	$52,405,886.04
Fringe Benefits	$4,913,149.57	$5,145,493.12	$10,058,642.70
Total for Technology Integration Personnel	*$30,572,419.73*	*$31,892,109.01*	*$62,464,528.74*
Technical Support Personnel			
Salaries	$76,724,558.55	$79,790,292.19	$156,514,850.74
Fringe Benefits	$15,249,969.55	$15,948,755.11	$31,198,724.67
Total for Technical Support Personnel	*$91,974,528.10*	*$95,739,047.31*	*$187,713,575.41*
Technology Hardware Replacement	*$70,402,392.37*	*$72,774,324.20*	*$143,176,716.58*
Infrastructure, Connectivity & Software	*$41,318,017.87*	*$42,710,066.04*	*$84,028,083.91*
Other Ed. Tech. Costs	*$32,248,219.75*	*$33,334,696.73*	*$65,582,916.48*
Estimated Total for Ed. Technology Costs	**$266,515,577.82**	**$276,450,243.30**	**$542,965,821.12**

Estimated FY 02 Spending for Specific Categories of Ed. Tech. Costs (State & Local)

Estimated SOQ Ed. Tech. Costs	*$175,029,995.59*
VPSA (Reported Amounts)	*$47,986,797.85*
Technology Resource Initiative	*$8,499,079.67*
Electronic Classroom	*$2,521,503.84*
Total State and Local Dollars Spent on Ed. Tech. in FY 02	**$368,784,677.02**

Table 2: Apportionment of Educational Technology Costs to State and Local Governments

	FY 2005	FY 2006	Biennium Total
State Portion of Educational Technology Costs			
Technology Integration Personnel	$16,889,816.26	$17,584,126.35	$34,473,942.61
Technical Support Personnel	$51,239,823.24	$53,234,403.98	$104,474,227.21
Technology Hardware Replacement	$39,137,809.88	$40,378,960.18	$79,516,770.06
Infrastructure, Connectivity & Software	$22,969,343.42	$23,697,754.32	$46,667,097.74
Other Ed. Tech. Costs	$17,927,298.36	$18,495,814.38	$36,423,112.74
Estimated Total State Cost	***$148,164,091.15***	***$153,391,059.21***	***$301,555,150.36***
Estimated Total Local Cost	***$118,351,486.67***	***$123,059,184.09***	***$241,410,670.75***
Estimated Total for Ed. Tech. Costs	**$266,515,577.82**	**$276,450,243.30**	**$542,965,821.12**

State Portion of Estimated Ed. Tech. Costs in FY 02

Included in current SOQ (est.)	*$97,101,334.32*
VPSA	*$39,988,998.21*
Technology Resource Initiative	*$4,956,252.00*
Electronic Classroom	*$1,324,043.98*

Estimated Local Dollars Spent on Ed. Tech. in FY 02

Local match of SOQ costs (est.)	*$77,928,661.26*
Local match for VPSA (est.)	*$7,997,799.64*
Loc mtch Tech Res. Init. (est.)	*$3,542,827.67*
Loc mtch Electronic Class. (est.)	*$1,197,459.86*
Other ed. tech. costs (est.)	*$134,747,300.07*

Total Dollars Spent on Ed. Tech in FY 02: $368,784,677.02

Combination 3 -- Board of Education-based Recommendation; 5:1 Ratio, 5-Year Hardware Replacement Model

Table 1: Statewide Total Educational Technology Costs

	FY 2005	FY 2006	Biennium Total
Technology Integration Personnel			
Salaries	$51,991,365.19	$54,178,318.99	$106,169,684.17
Fringe Benefits	$9,954,183.70	$8,461,986.03	$18,416,169.73
Total for Technology Integration Personnel	*$61,945,548.89*	*$62,640,305.01*	*$124,585,853.90*
Technical Support Personnel			
Salaries	$66,127,911.34	$68,854,043.99	$134,981,955.33
Fringe Benefits	$13,192,128.51	$14,626,562.71	$27,818,691.22
Total for Technical Support Personnel	*$79,320,039.84*	*$83,480,606.70*	*$162,800,646.55*
Technology Hardware Replacement	*$70,402,392.37*	*$72,774,324.20*	*$143,176,716.58*
Infrastructure, Connectivity & Software	*$41,318,017.87*	*$42,710,066.04*	*$84,028,083.91*
Other Ed. Tech. Costs	*$32,248,219.75*	*$33,334,696.73*	*$65,582,916.48*
Estimated Total for Ed. Technology Costs	**$285,234,218.72**	**$294,939,998.69**	**$580,174,217.42**

Estimated FY 02 Spending for Specific Categories of Ed. Tech. Costs (State & Local)	
Estimated SOQ Ed. Tech. Costs	*$175,029,995.59*
VPSA (Reported Amounts)	*$47,986,797.85*
Technology Resource Initiative	*$8,499,079.67*
Electronic Classroom	*$2,521,503.84*
Total State and Local Dollars Spent on Ed. Tech. in FY 02	**$368,784,677.02**

Table 2: Apportionment of Educational Technology Costs to State and Local Governments

	FY 2005	FY 2006	Biennium Total
State Portion of Educational Technology Costs			
Technology Integration Personnel	$34,116,498.49	$34,425,734.11	$68,542,232.61
Technical Support Personnel	$43,662,159.53	$45,893,146.94	$89,555,306.47
Technology Hardware Replacement	$39,137,809.88	$40,378,960.18	$79,516,770.06
Infrastructure, Connectivity & Software	$22,969,343.42	$23,697,754.32	$46,667,097.74
Other Ed. Tech. Costs	$17,927,298.36	$18,495,814.38	$36,423,112.74
Estimated Total State Cost	***$157,813,109.69***	***$162,891,409.94***	***$320,704,519.62***
Estimated Total Local Cost	***$127,421,109.04***	***$132,048,588.76***	***$259,469,697.80***
Estimated Total for Ed. Tech. Costs	**$285,234,218.72**	**$294,939,998.69**	**$580,174,217.42**

State Portion of Estimated Ed. Tech. Costs in FY 02	
Included in current SOQ (est.)	*$97,101,334.32*
VPSA	*$39,988,998.21*
Technology Resource Initiative	*$4,956,252.00*
Electronic Classroom	*$1,324,043.98*
Estimated Local Dollars Spent on Ed. Tech. in FY 02	
Local match of SOQ costs (est.)	*$77,928,661.26*
Local match for VPSA (est.)	*$7,997,799.64*
Loc mtch Tech Res. Init. (est.)	*$3,542,827.67*
Loc mtch Electronic Class. (est.)	*$1,197,459.86*
Other ed. tech. costs (est.)	*$134,747,300.07*
Total Dollars Spent on Ed. Tech in FY 02:	**$368,784,677.02**

Combination 4 -- Site-Based Model; 5:1 Ratio, 5-Year Hardware Replacement Model

Table 1: Statewide Total Educational Technology Costs

	FY 2005	FY 2006	Biennium Total
Technology Integration Personnel			
Salaries	$87,384,169.85	$90,967,890.02	$178,352,059.87
Fringe Benefits	$16,746,053.49	$17,515,066.37	$34,261,119.87
Total for Technology Integration Personnel	*$104,130,223.34*	*$108,482,956.39*	*$212,613,179.74*
Technical Support Personnel			
Salaries	$92,948,368.84	$96,681,723.88	$189,630,092.72
Fringe Benefits	$18,841,390.70	$19,708,079.04	$38,549,469.74
Total for Technical Support Personnel	*$111,789,759.54*	*$116,389,802.92*	*$228,179,562.47*
Technology Hardware Replacement	*$70,402,392.37*	*$72,774,324.20*	*$143,176,716.58*
Infrastructure, Connectivity & Software	*$41,318,017.87*	*$42,710,066.04*	*$84,028,083.91*
Other Ed. Tech. Costs	*$32,248,219.75*	*$33,334,696.73*	*$65,582,916.48*
Estimated Total for Ed. Technology Costs	**$359,888,612.88**	**$373,691,846.29**	**$733,580,459.17**

Estimated FY 02 Spending for Specific Categories of Ed. Tech. Costs (State & Local)

Estimated SOQ Ed. Tech. Costs	*$175,029,995.59*
VPSA (Reported Amounts)	*$47,986,797.85*
Technology Resource Initiative	*$8,499,079.67*
Electronic Classroom	*$2,521,503.84*
Total State and Local Dollars Spent on Ed. Tech. in FY 02	**$368,784,677.02**

Table 2: Apportionment of Educational Technology Costs to State and Local Governments

	FY 2005	FY 2006	Biennium Total
State Portion of Educational Technology Costs			
Technology Integration Personnel	$58,182,807.33	$60,484,616.50	$118,667,423.83
Technical Support Personnel	$62,242,853.20	$64,668,579.18	$126,911,432.38
Technology Hardware Replacement	$39,137,809.88	$40,378,960.18	$79,516,770.06
Infrastructure, Connectivity & Software	$22,969,343.42	$23,697,754.32	$46,667,097.74
Other Ed. Tech. Costs	$17,927,298.36	$18,495,814.38	$36,423,112.74
Estimated Total State Cost	***$200,460,112.19***	***$207,725,724.56***	***$408,185,836.75***
Estimated Total Local Cost	***$159,428,500.69***	***$165,966,121.73***	***$325,394,622.42***
Estimated Total for Ed. Tech. Costs	**$359,888,612.88**	**$373,691,846.29**	**$733,580,459.17**

State Portion of Estimated Ed. Tech. Costs in FY 02

Included in current SOQ (est.)	*$97,101,334.32*
VPSA	*$39,988,998.21*
Technology Resource Initiative	*$4,956,252.00*
Electronic Classroom	*$1,324,043.98*

Estimated Local Dollars Spent on Ed. Tech. in FY 02

Local match of SOQ costs (est.)	*$77,928,661.26*
Local match for VPSA (est.)	*$7,997,799.64*
Loc mtch Tech Res. Init. (est.)	*$3,542,827.67*
Loc mtch Electronic Class. (est.)	*$1,197,459.86*
Other ed. tech. costs (est.)	*$134,747,300.07*

Total Dollars Spent on Ed. Tech in FY 02: $368,784,677.02

Combination 5 -- Higher Aspiration Combination; 1:1 Ratio, 5-Year Hardware Replacement Model

Table 1: Statewide Total Educational Technology Costs

Technology Integration Personnel	FY 2005	FY 2006	Biennium Total
Salaries	$87,384,169.85	$90,967,890.02	$178,352,059.87
Fringe Benefits	$16,746,053.49	$17,515,066.37	$34,261,119.87
Total for Technology Integration Personnel	*$104,130,223.34*	*$108,482,956.39*	*$212,613,179.74*
Technical Support Personnel			
Salaries	$92,948,368.84	$96,681,723.88	$189,630,092.72
Fringe Benefits	$18,841,390.70	$19,708,079.04	$38,549,469.74
Total for Technical Support Personnel	*$111,789,759.54*	*$116,389,802.92*	*$228,179,562.47*
Technology Hardware Replacement	*$330,540,970.04*	*$341,677,248.53*	*$672,218,218.57*
Infrastructure, Connectivity & Software	*$41,318,017.87*	*$42,710,066.04*	*$84,028,083.91*
Other Ed. Tech. Costs	*$32,248,219.75*	*$33,334,696.73*	*$65,582,916.48*
Estimated Total for Ed. Technology Costs	**$620,027,190.54**	**$642,594,770.62**	**$1,262,621,961.16**

Estimated FY 02 Spending for Specific Categories of Ed. Tech. Costs (State & Local)	
Estimated SOQ Ed. Tech. Costs	*$175,029,995.59*
VPSA (Reported Amounts)	*$47,986,797.85*
Technology Resource Initiative	*$8,499,079.67*
Electronic Classroom	*$2,521,503.84*
Total State and Local Dollars Spent on Ed. Tech. in FY 02	**$368,784,677.02**

Table 2: Apportionment of Educational Technology Costs to State and Local Governments

	FY 2005	FY 2006	Biennium Total
State Portion of Educational Technology Costs			
Technology Integration Personnel	$58,182,807.33	$60,484,616.50	$118,667,423.83
Technical Support Personnel	$62,242,853.20	$64,668,579.18	$126,911,432.38
Technology Hardware Replacement	$183,752,983.47	$189,580,214.78	$373,333,198.25
Infrastructure, Connectivity & Software	$22,969,343.42	$23,697,754.32	$46,667,097.74
Other Ed. Tech. Costs	$17,927,298.36	$18,495,814.38	$36,423,112.74
Estimated Total State Cost	***$345,075,285.78***	***$356,926,979.16***	***$702,002,264.94***
Estimated Total Local Cost	***$274,951,904.76***	***$285,667,791.46***	***$560,619,696.22***
Estimated Total for Ed. Tech. Costs	**$620,027,190.54**	**$642,594,770.62**	**$1,262,621,961.16**

State Portion of Estimated Ed. Tech. Costs in FY 02	
Included in current SOQ (est.)	*$97,101,334.32*
VPSA	*$39,988,998.21*
Technology Resource Initiative	*$4,956,252.00*
Electronic Classroom	*$1,324,043.98*

Estimated Local Dollars Spent on Ed. Tech. in FY 02	
Local match of SOQ costs (est.)	*$77,928,661.26*
Local match for VPSA (est.)	*$7,997,799.64*
Loc mtch Tech Res. Init. (est.)	*$3,542,827.67*
Loc mtch Electronic Class. (est.)	*$1,197,459.86*
Other ed. tech. costs (est.)	*$134,747,300.07*

Total Dollars Spent on Ed. Tech in FY 02: $368,784,677.02

Appendix D

Technology Function Code, 2001-2002 Annual School Report

FUNCTION	68000	TECHNOLOGY
COST CENTER	9	DISTRICT WIDE

	OBJECTS	ACTIVITY									
		68100	68200	68300	68400	68500	68600	68700	68800	68900	
		CLASSROOM INSTRUCTION	INSTRUCTIONAL SUPPORT	ADMINISTRATION	ATTENDANCE & HEALTH	PUPIL TRANS.	OPERATIONS & MAINT.	SCHOOL FOOD & OTHER NON-INSTR. OPERATIONS	FACILITIES	DEBT SERVICE & FUND TRANSFERS	TOTAL TECHNOLOGY
	Personal Services:										
1110	Technology, Administrative										0.00
1120	Technology, Instructional										0.00
1133	Technology, Technical Development										0.00
1141	Technology, Technical Support										0.00
1150	Technology, Clerical										0.00
	Employee Benefits:										
2100	FICA Benefits										0.00
2210	VRS Benefits										0.00
2300	HMP Benefits										0.00
2400	GLI Benefits										0.00
2500	Disability Insurance										0.00
2600	Unemployment Insurance										0.00
2700	Worker's Compensation										0.00
2750	Retiree Health Care Credit										0.00
2800	Other Benefits										0.00
	Purchased Services:										
3000	Purchased Services										0.00
	Internal Services:										
4000	Internal Services										0.00
	Other Charges:										
5001	Telecommunications										0.00
5400	Leases and Rentals										0.00
5500	Travel										0.00
5800	Miscellaneous										0.00
	Materials and Supplies:										
6000	Materials and Supplies										0.00
6040	Technology - Software / On-line Content										0.00
6050	Non-Capitalized Technology Hardware										0.00
6060	Non-Capitalized Technology Infrastructure										0.00
	Capital Outlay Replacements:										
8110	Technology - Hardware										0.00
8120	Technology - Infrastructure										0.00
	Capital Outlay Additions:										
8210	Technology - Hardware										0.00
8220	Technology - Infrastructure										0.00
	Other Uses of Funds:										
9000	Other Uses of Funds										0.00
	Page Total:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix E

Assumptions Used in the JLARC Staff Estimate of Technology Costs Funded through the Standards of Quality

Description of Annual School Report (ASR) Expenditure Codes Included in the Estimate of Technology Costs Funded through the SOQ

(Administration cost components treated according to revised SOQ methodology used in the current biennium)

Expenditure Item	ASR Codes Included in Low Estimate		Explanation of Low Estimate	ASR Codes Included in High Estimate		Explanation of High Estimate
	Object	Function		Object	Function	
Technology Salary Costs	1110	68200, 68300 (72%), 68400, 68500, 68600, 68800	Other than classroom instruction, school food, and debt service, positions probably were included in prevailing support positions.	1110	68100, 68200, 68300 (72%), 68400, 68500, 68600, 68800	Several divisions indicated that they have only started reporting technology positions under classroom instruction with new technology schedule. In prior ASRs, these positions were reported under different function codes.
	1120	68200	If positions were classified as improvement of instruction or media services, they would have been included in prevailing support positions	1120	68200, 68300, 68400, 68500, 68600, 68800	If these positions were reported under anything other than classroom instruction, they may have been included as prevailing support positions.
	1133	68300 (72%), 68400, 68500, 68600, 68800	Positions likely included in prevailing support positions if reported in these function codes.	1133	68100, 68200, 68300 (72%), 68400, 68500, 68600, 68800	Several divisions indicated that they have only started reporting technology positions under classroom instruction and instructional support with new technology schedule. In prior ASRs these positions were reported under different function codes.
	1141	68300 (72%), 68400, 68500, 68600, 68800	Positions likely included in prevailing support positions if reported in these function codes.	1141	68100, 68200, 68300 (72%), 68400, 68500, 68600, 68800	Several divisions indicated that they have only started reporting technology positions under classroom instruction and instructional support with new technology schedule. In prior ASRs these positions were reported under different function codes.
	1150	68200, 68300 (72%), 68400, 68500, 68600, 68800	Positions likely included in prevailing support positions if reported in these function codes.	1150	68100, 68200, 68300 (72%), 68400, 68500, 68600, 68800	Several divisions indicated that they have only started reporting technology positions under classroom instruction with new technology schedule. In prior ASRs these positions were reported under different function codes.
Rate Determined Benefit Costs			Used the FY 2002 benefit rates for retirement, retiree health care credit, social security, group life insurance, and the health care premium. Used the instructional retirement rates (4.24%) since these are mainly professional positions. Range in estima			Used the FY 2002 benefit rates for retirement, retiree health care credit, social security, group life insurance, and the health care premium. Used the instructional retirement rates (4.24%) since these are mainly professional positions. Range in estima
Prevailing Benefit Costs	2500	68100, 68200, 68300, 68400, 68500, 68600, 68800	Based on codes used for prevailing benefit calculations. Low estimate based on including all divisions (even those reporting 0) in the prevailing calculation. Many divisions did not report expenditures for these codes, even though they likely incurred e	2500	68100, 68200, 68300, 68400, 68500, 68600, 68800	Based on codes used for prevailing benefit calculations. High estimate based on including just those divisions reporting expenditures in the prevailing calculation. Many divisions did not report expenditures for these codes, even though they likely inc
	2600	68100, 68200, 68300, 68400, 68500, 68600, 68800		2600	68100, 68200, 68300, 68400, 68500, 68600, 68800	
	2700	68100, 68200, 68300, 68400, 68500, 68600, 68800		2700	68100, 68200, 68300, 68400, 68500, 68600, 68800	
	2800	68100, 68200, 68300, 68400, 68500, 68600, 68800		2800	68100, 68200, 68300, 68400, 68500, 68600, 68800	

Expenditure Item	ASR Codes Included in Low Estimate Object	Function	Explanation of Low Estimate	ASR Codes Included in High Estimate Object	Function	Explanation of High Estimate
Non-personnel Costs	3000	68100, 68200, 68300, 68400, 68500, 68600	Based on codes used for prevailing non-personnel calculations.	3000	68100, 68200, 68300, 68400, 68500, 68600	Same as low estimate.
	4000	68100, 68200, 68300, 68400, 68500, 68600, 68800		4000	68100, 68200, 68300, 68400, 68500, 68600, 68800	
	5001	68100, 68200, 68300, 68400, 68500, 68600, 68700, 68800		5001	68100, 68200, 68300, 68400, 68500, 68600, 68700, 68800	
	5400	68100, 68200, 68300, 68400, 68500, 68600		5400	68100, 68200, 68300, 68400, 68500, 68600	
	5500	68100, 68200, 68300, 68400, 68500, 68600, 68800		5500	68100, 68200, 68300, 68400, 68500, 68600, 68800	
	5800	68100, 68200, 68300, 68400, 68500, 68600, 68800		5800	68100, 68200, 68300, 68400, 68500, 68600, 68800	
	6000	68100, 68200, 68300, 68400, 68500, 68600, 68800		6000	68100, 68200, 68300, 68400, 68500, 68600, 68800	
	6040	68100, 68200, 68300, 68400, 68500, 68600, 68800		6040	68100, 68200, 68300, 68400, 68500, 68600, 68800	
	6050	68100, 68200, 68300, 68400, 68500, 68600, 68800		6050	68100, 68200, 68300, 68400, 68500, 68600, 68800	
	6060	68100, 68200, 68300, 68400, 68500, 68600, 68800		6060	68100, 68200, 68300, 68400, 68500, 68600, 68800	
	8110	68100, 68200, 68300, 68400, 68600		8110	68100, 68200, 68300, 68400, 68600	
	8120	68100, 68200, 68300, 68400, 68600		8120	68100, 68200, 68300, 68400, 68600	
	9000	68100, 68200, 68300, 68400, 68600		9000	68100, 68200, 68300, 68400, 68600	

Appendix F

Agency Response

As part of an extensive data validation process, the major entities involved in a JLARC assessment effort are given an opportunity to comment on an exposure draft of the report. Appropriate technical corrections resulting from the written comments have been made in this revision of the report.

This appendix contains the written response of the Department of Education.

SEP 08 2003

COMMONWEALTH of VIRGINIA

DEPARTMENT OF EDUCATION
P.O. Box 2120
Richmond, Virginia 23218-2120

JO LYNNE DEMARY, Ed.D.
Superintendent of Public Instruction

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September 3, 2003

The Honorable Kevin G. Miller
Chairman, Joint Legislative Audit and Review Commission
Suite 1100, General Assembly Building
Capitol Square
Richmond, VA 23219

Dear Senator Miller:

Thank you for allowing the Department of Education (DOE) to review and comment on the exposure draft of the report on a *State Funding Formula for Educational Technology*. We have provided numerous verbal comments and suggestions to Joint Legislative Audit and Review Commission (JLARC) staff in response to the draft report and we hope they were helpful. While we were provided a copy of the exposure draft in its entirety, we only received a portion of the changes made to the exposure draft in response to our comments. Because we have only seen a portion of the changes made to the exposure draft, primarily the changes made to the Annual School Report (ASR) recommendations, our comments in this letter are limited to these sections of the report.

We have reviewed the ASR recommendations and, to the extent that DOE staff can administratively incorporate the ASR recommendations proposed, we will do so. Some of the recommendations are sound and can be incorporated without action by the General Assembly; however, some may require action by the General Assembly to authorize them or to provide the resources to support the needed changes.

If the General Assembly decides to adopt a funding formula for education technology and that funding formula requires additional detail in reporting expenditures, DOE will update the ASR to meet the specific data requirements of the formula. Please be aware that some of the recommendations could require DOE to change its processes in a way that cannot be supported with existing resources if they are to be fully implemented. For example, DOE staff can and will perform a preliminary analysis of technology expenditures reported in the technology function of the ASR to make sure school divisions report expenditures in that function at aggregate levels; however, if a process is recommended (as suggested in the exposure draft) that would require DOE

to analyze year-to-year variances by object level line item and investigate those variances in each school division, current staff resources would not be sufficient and it could not be accomplished.

DOE has made numerous improvements to the ASR to increase the quality and level of detail of the data and we will continue to make any additional changes that will provide the detail necessary to meet state funding requirements. We look forward to working further with JLARC and the General Assembly in addressing the ASR recommendations as well as other important issues addressed in the report.

Sincerely,

Jo Lynne DeMary

Jo Lynne DeMary, Ed.D

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Final Report: Review of the Virginia Housing Development Authority, August 2000
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Special Report: The Secretarial System (October 2002)
Special Report: State Business Incentive Grant Programs (November 2002)
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VRS Semi-Annual Investment Report No. 20 (July 2003)
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Technical Report: State Funding Formula for Educational Technology (September 2003)
Review of State Spending: December 2003 Update
Implementation Review: Virginia Information Technologies Agency, December 2003 Status Report
Best Practices for the Support Services of School Divisions (December 2003)
Review of Virginia's Activity in Maximizing Federal Grant Funding (December 2003)
Acclimation of Virginia's Foreign-Born Population (December 2003)
*Semi-Annual VRS Investment Report No. 21 (*December 2003)
*Review of the State's Passenger Vehicle Fleet (*December 2003)
Review of Factors and Practices Associated with School Performance in Virginia (December 2003)

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