

Using the Evidence-Based Method to Identify Adequate Spending Levels for Vermont Schools

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Chapter 1

The Vermont Evidence-Based Adequacy Study

INTRODUCTION

One of the critical questions facing school finance today is how much does it cost to provide the resources needed to implement education programs that will ensure all students have an equal and robust opportunity to meet their state's proficiency standards and be prepared for college and/or careers. This document, prepared as part of the Vermont School Finance Adequacy Study, uses the Evidence-Based (EB) model (Odden & Picus, 2014) to provide the state with an estimate of the cost of such a system.

Following this introductory chapter, Chapter 2 provides a brief description of the EB model and the school improvement model that supports it. Chapter 3 offers a detailed description of the EB model, describing the personnel resources needed for regular education programs, along with estimated dollar per pupil resources needed for instructional materials, technology and other support services. In addition, Chapter 3 describes the additional resources needed for students who are struggling to meet proficiency standards, and offers estimates of the resources needed at the central office and to provide for maintenance and operations. Transportation and food services are not included in this model.

To estimate the costs of adequacy for Vermont, an Excel-based simulation model is being developed. Future chapters of this report will describe the model, its use, and the cost estimates it provides for the State. The model will be flexible, allowing the State to compare current education expenditures with the EB model's estimated costs.. It will offer the State the ability to simulate alternative formula and ratio specifications for every element in the EB model, and to view results in comparisons to the core EB model and current costs. In addition, the simulation model will be designed so that alternative combinations of school districts can be aggregated into alternative supervisory district configurations to help districts understand the fiscal implications of possible approaches for meeting the Act 46 requirements for alternative structures.

An important component of this analysis is a review of the core EB elements by groups of education professionals from across Vermont. Specifically, we invited four Evidence-Based Professional Judgment panels to review the components of the model and provide feedback on the adequacy of the model. The panels will be asked to recommend changes they think are necessary to ensure adequacy and to tailor the core EB model to the specifics of Vermont's education system. One panel will specifically focus on the central office and possible consolidation structures. The recommendations from these panels and the possible cost implications will be described in Chapter 4 of this report. We will also seek public input through a series of public "hearings" across Vermont. These hearings will allow us to hear the concerns and suggestions of education stakeholders, educators, and the public as this adequacy study proceeds.

An important component of this adequacy study is our effort to identify strategies used in successful and improving schools in Vermont. To that end, the research team has conducted

day-long case studies in five schools. The case studies provide information on multiple aspects of the improvement strategies in each of these schools and describe details about specific school resources, including, class size, percent of electives versus core subjects, and the level of resources for pupil support resources. A cross-site analysis of the case studies will be included in Chapter 5, and the individual case studies will be part of an appendix to this study.

After the Professional Judgment panels, public hearings, and findings from the case studies are complete, the research team will use the key findings on issues specific to Vermont to make appropriate changes to the core EB model. The costs of these changes will be compared to the costs of the core EB model and presented in a concluding chapter of this report.

WHAT THIS STUDY DOES NOT ADDRESS

Although many people assume that an adequacy study addresses all possible education funding issues, that is rarely the case. Before proceeding, we identify five issues this study will not address:

1. **Capital construction.** The study will not address issues of capital expenditures or funding.
2. **Market salaries for educators.** Although a few adequacy studies have included studies of the degree to which educator salaries are market based, that requires a major effort that is not part of this study. As a result, to price each staff element in the model, we will use state average salary figures from 2014-15.
3. **Transportation.** Although transportation is a significant cost concern, it is not part of this study. Moreover, the impact of school consolidations as required by Act 60 will have unpredictable implications for pupil transportation needs and costs. We recommend the state re-visit this issue once much of the unification of districts is complete.
4. **Food services.**
5. **Debt service.**

This study addresses all other significant components of the educational system. The goal is to identify the strategies and resources needed to enable schools and districts to dramatically improve student performance, particularly on new goals that target learning to more rigorous college and career ready standards.

Chapter 2

The School Improvement Model

The intent of Vermont's school funding model is to identify the costs of providing an array of educational goods and services that allows each school and school district to provide all students an equal opportunity to meet the state's student performance standards. Although a direct linkage between funding and student performance does not exist, the intent of an adequacy study is to identify a base per pupil spending level, together with extra resources for students from poverty or non-English speaking backgrounds and/or with disabilities, that are adequate to provide all students with robust opportunities to meet college and career ready standards.

Regardless of whether high school graduates go on to college or enter the workforce, today's global, knowledge-based economy requires a similar set of skills and expertise of each graduate. No matter what course of studies a high school student completes – college prep or career tech -- all Vermont students are expected to achieve to college and career ready standards. This includes children from low-income homes, students of color, English language learners (ELL) and students with disabilities. Since the 1990s, under both Acts 60 and 68, Vermont's policy makers have sought to provide equitable access to educational resources, but have not directly addressed the question of how much school revenue is needed in each school and district, although the issue of how much money is needed has been on the policy agenda for several years. Act 46 requires the state to conduct an adequacy study to estimate how much money is needed to ensure all students have access to programs that will enable them to meet state standards and be prepared for college or the workforce. This study is designed to estimate that adequate funding level for all schools and districts.

Before presenting the EB analysis that will be used to calibrate these key elements of the Vermont funding model, this chapter provides a description of the school improvement model that undergirds the EB model. The expectation is that funds provided through the school funding formula will be used to boost student achievement and close achievement gaps. Thus, this chapter contains an explicit and detailed description of the school improvement model embedded in the EB approach to adequate school funding. The concept is to link the level of funding with its effective use. Put differently, the EB model not only identifies a base level of staff and dollar resources, and extra resources for students struggling to meet standards, but also indicates how resources can be used to boost student performance and attain other education goals.

THE SCHOOL IMPROVEMENT MODEL EMBEDDED IN THE EVIDENCE-BASED APPROACH TO SCHOOL FINANCE ADEQUACY

The EB model used to estimate an adequate spending level for schools has been designed to allow districts and schools to provide every child with an equal opportunity to learn to state performance standards, which are currently the Common Core and College and Career Ready standards. The EB model is unique in that it is derived from research and best practices that identify programs and strategies that increase student learning. Further, the formulas and ratios for school resources that have been developed from that research have been reviewed by dozens of educator panels in multiple states over the past decade, and adjusted both to meet specific

state standards and also evolving best practices. The model relies on two major types of research:

1. Reviews of research on the student achievement effects of each of the model's individual major elements, with a focus more recently on randomized controlled trials, the "gold standard" of evidence on "what works."
2. Studies of schools and districts that have dramatically improved student performance over a 4-6 year period – what is sometimes labeled "a doubling of student performance" on state tests.

An Overview of the EB School Improvement Model

As a result of our research and work in other states, the EB approach has become more explicit in identifying the components of a school improvement model, and seeks to articulate how all the elements in the funding model are linked at the school level to strategies that when implemented produce notable improvements in student achievement (see Odden & Picus, 2014, Chapter 5).

Improving and high performing schools have clear and specific student achievement goals, including goals to reduce achievement gaps linked to poverty and minority status. The goals are nearly always specified in terms of performance on state assessments, though many schools also include behavior goals.

Compared to traditional schools where teachers work in isolated classrooms, improving schools organize instruction differently. Regardless of the context – urban, suburban or rural, rich or poor – improving and high performing schools organize teachers into collaborative teams: grade level teams in elementary schools and subject or course teams in secondary schools. With the guidance and support of instructional coaches, the teacher teams work with student data – usually short-cycle or formative assessment data – to:

- Plan and develop standards-based curriculum units
- Teach those units simultaneously
- Debrief on how successful the units were, and
- Make changes when student performance does not meet expectations.

This collaborative teamwork makes instruction "public" over time by identifying a set of instructional strategies that work in the teachers' school. Over time all teachers are expected to use the instructional strategies that have been demonstrated to improve student learning and achievement.

Improving and high performing schools also provide an array of "extra help" programs for students struggling to achieve to standards. This is critical, because the number of struggling students is likely to increase as more rigorous curriculum programs are implemented to prepare all students for college and careers. Individual tutoring, small group tutoring, after-school academic help and summer school focused on reading and mathematics for younger students,

and courses needed for high school graduation for older students, represent the array of “extra help” strategies these improving schools deploy. The idea is to “hold standards” constant and vary instructional time.

These schools exhibit dense leadership. Teachers lead by coordinating collaborative teams and through instructional coaching. Principals lead by structuring the school to foster instructional improvement. The district leads by insuring that schools have the resources to deploy the strategies outlined above with a focus on attaining aggressive student performance goals, improving instructional practice and taking responsibility for student achievement results.

Successful and improving schools seek out top talent. They know that the challenge to prepare students for the competitive and knowledge-based global economy is difficult, and requires smart and capable teachers and administrators to effectively get the educational job done.

We have continued to enhance the details of the strategy of school improvement embedded in the EB funding model. We most recently summarized our findings in Chapter 5 of the fifth edition of our textbook (Odden & Picus, 2014) as well as in several books that profile schools and districts that have moved the student achievement needle (Odden & Archibald, 2009; Odden, 2009; Odden, 2012). We have also studied dramatically improving schools in Vermont (as part of our firm’s 2011 assessment of the equity of the Vermont school funding system), Maine and Maryland as part of school finance adequacy studies we conducted in those states. We found the theory of improvement embodied in the EB model reflected in nearly all these successful schools (Picus, Odden, et al., 2011; Picus, Odden, et al., 2013). The Maine cases and two of the earlier Vermont cases show how small schools in rural settings follow similar strategies to those in the EB model. In addition, other researchers and analysts (Anrig, 2015; Blankstein, 2010, 2011; Chenoweth, 2007, 2009) as well as a recent compendium of results on educational effectiveness and improvement (Chapman, Muijs, Reynolds, Sammons and Teddlie, 2016) have found similar features of schools that significantly improve student performance and reduce achievement gaps. Our studies of improving schools in Maryland are not yet public but reinforce and align with the findings of the school cases in Vermont and Maine. We will have additional Vermont cases over the course of this adequacy study.

In another recent book, Greg Duncan and Richard Murnane (2014) reached similar conclusions on how schools boost student learning. They note that for all students to have a chance at success in the emerging global economy, they will need high quality preschool programs, followed by effective elementary and secondary schools. The key features needed in each school include: 1) leadership focused on improving instructional practice; 2) within school organization of teachers into teams that over time create a set of effective instructional practices and deploy them systematically in all classrooms; 3) a culture of assistance (e.g., instructional coaches and ongoing professional development) and accountability (e.g., adults taking responsibility for the impact of their school actions on student performance); and 4) an array of extra help strategies to extend learning time for any student who needs more time to achieve to standards.

Although the details of studies of improving and high performing schools vary, and different authors highlight somewhat different elements of the process, the overall findings are more

similar than different. This suggests all schools can improve if they have adequate resources – that is a goal of the current adequacy studies. Then, the key to dramatic improvement in student learning is for schools and districts to effectively deploy those adequate resources.

The Ten Strategies in the EB School Improvement Model

For clarity, the elements of the school improvement strategy embedded in the EB funding model are organized into ten areas. In general, we find that schools and districts that produce large gains in student performance follow ten similar strategies (see Chapter 4 and 5 of Odden & Picus, 2014; Odden, 2009), resources for each of which are included in the EB model:

1. Analyze student data to become deeply knowledgeable about performance issues and to understand the nature of the achievement gap. The test score analysis usually first includes review of state test results and then, over time, analysis of short cycle/interim (e.g., Renaissance Learning Star Enterprise) as well as benchmark assessments (e.g., NWEA MAP) to help tailor instruction to precise student needs, to progress monitor students with an Individual Education Plan to determine whether interventions are working, and to follow the progress of students, classrooms and the school over the course of the academic year. Improving schools are “performance data hungry.”
2. Set higher goals, such as aiming to educate at least 95 percent of the students in the school to proficiency or higher on state reading and math tests; seeing that a significant portion of the school’s students reach advanced achievement levels; having more high school students take and pass AP classes; and making significant progress in closing the achievement gap. The goals tend to be numerically explicit, and far beyond just producing “improvement” or “making AYP.” Further, because the goals are ambitious, even when not fully attained they help the school produce large gains in student performance.
3. Review evidence on good instruction and effective curriculum. Successful schools throw out the old curriculum, replace it with a different and more rigorous curriculum, and over time create their specific view of what good instructional practice is to deliver that curriculum. Changing curriculum is a must for schools implementing more rigorous college and career ready standards. And such new curriculum requires changes in instructional practice. Successful schools also want *all* teachers to learn and deploy new instructional strategies in their classrooms, so they also seek to make good instructional practice systemic to the school and not idiosyncratic to each teacher’s individual classroom.
4. Invest heavily in teacher training that includes intensive summer institutes and longer teacher work years, provide resources for trainers, and, most importantly, fund instructional coaches in all schools. Time is provided during the regular school day for teacher collaboration focused on improving instruction. Nearly all improving schools have found resources to provide instructional coaches to work with school-based teacher data teams, to model effective instructional practices and to observe teachers and give

helpful but direct feedback. This focus has intensified now that schools are delivering a more rigorous curriculum focused on educating all students to college and career proficiency levels. In addition, professional development is viewed as an ongoing and not a “once and done” activity.

5. Provide extra help for struggling students and, with a combination of state and federal Title 1 funds, provide some combination of tutoring in a 1 to 1, 1 to 3, or 1 to 5 tutor to student format. In some cases this also includes extended day, summer school, and English language development for all ELL students. These Tier 2 interventions in the Response to Intervention (RTI) approach to helping struggling students achieve to standards were absolutely critical. For many students, one dose of even high quality instruction is not enough; many students need a combination of extra help services in order to achieve to their potential. No school producing large gains in student learning ignored these extra help strategies altogether or argued that small classes or preschool were substitutes.
6. Restructure the school day to provide more effective ways to deliver instruction. This can include multi-age classrooms in elementary schools, and block schedules and double periods of mathematics and reading in secondary schools. Schools also “protect” instructional time for core subjects, especially reading and mathematics. Further, and critically important, improving schools today organize teachers into collaborative teams – grade level teams in elementary schools and subject/course teams in secondary schools. These teams meet during the regular school day, often daily, and collaboratively develop curriculum units, lesson plans to teach them, and common assessments to measure student learning that results. Further, teams debrief on the impact of each collaboratively developed unit, reviewing student learning overall and across individual classrooms.
7. Provide strong leadership and support for data-based decision-making and improving the instructional program, usually through the superintendent, the principal and teacher leaders. Instructional leadership is “dense” and “distributed” in successful schools; leadership derives from the teachers coordinating collaborative teacher teams, from instructional coaches, the principal and even district leaders. Both teachers and administrators provide an array of complementary instructional leadership.
8. Create professional school cultures characterized by ongoing discussion of good instruction and teachers taking responsibility for the student performance results of their actions. Over time, the collaborative teams that deliver instruction produce a school culture characterized by: 1) high expectations of performance on the part of both students and teachers, 2) a systemic and school-wide approach to effective instruction, 3) a belief that instruction is public and that good instructional practices are expected to be deployed by every individual teacher, and 4) an expectation that the adults in the school are responsible for the achievement gains made (or not made) by students. Professionals in these schools accept responsibility for student achievement results.

9. Bring external professional knowledge into the school, e.g., hiring experts to provide training, adopting research-based new curricula, discussing research on good instruction, and working with regional education service agencies as well as the state department of education. Successful schools do not attain their goals by “pulling themselves up by their own boot straps.” They aggressively seek outside knowledge, find similar schools that produce results and benchmark their practices to them, and operate in ways that typify other professions.
10. Finally, talent matters. Many improving schools today consciously seek to recruit and retain the best talent, from effective principal leaders to knowledgeable, committed and effective teachers. They seek individuals who are mission-driven to boost student learning, willing to work in a collaborative environment where all teachers are expected to acquire and deliver the school’s view of effective instructional practice, and who are accountability focused. Often such schools also have principals who have lead the school for many years.

In sum, the schools that have boosted student performance deploy strategies that are strongly aligned with those embedded in the EB model. Further, in our adequacy and recalibration work in many other states including Maine, Maryland, North Dakota, Washington, Wisconsin and Wyoming, we found that most educators shared this view of how schools can increase student performance. These practices bolster our claim that if funds are provided and used to implement these effective strategies, significant student performance gains should follow.

Finally, as noted above, we are conducting additional case studies in Vermont to determine whether school improvement in the “Green Mountain State” is similar to or different from this model.

Chapter 3

Using The Evidence-Based Model To Identify A Base Spending Level And Extra Resources For Struggling Students

This chapter describes the components of the EB model used to build a foundation for estimating a new base spending level, along with additional resources for students from poverty backgrounds, for students who are ELL and for students with disabilities. Following an overview, the five parts of this chapter include the following:

1. Staffing for core programs, which includes preschool, full-day kindergarten, core teachers, elective/specialist teachers, instructional facilitators/coaches, core tutors, core guidance counselors, core nurses (the latter three constituting recent changes and additions to the EB model), substitute teachers, supervisory aides, librarians, principals/assistant principals and school secretaries
2. Dollar per student resources, including gifted and talented, professional development, school-based computers and other technology, instructional materials and supplies, and extra duty/student activities
3. Central functions: maintenance and operations, central office
4. Resources for struggling students including tutors, extended day, summer school, ELL programs, alternative schools and special education, and
5. Staff compensation.

In each section, the report provides an analysis of each element in the EB funding model in the context of current research.

OVERVIEW

Table 3.1 below provides a summary of all the recommendations suggested by the EB model. Chapter 6 shows how these recommendations are combined into a new base per pupil figure and additional per pupil resources for struggling students from low income and ELL backgrounds, and with disabilities.

Table 3.1
Summary of Current EB Model Recommendations

EB Model Element	Current EB Formula, Ratio or Dollar per pupil figure
STAFF RESOURCES FOR CORE PROGRAMS	
1a. Full-day Preschool	Preschool classrooms are staffed at a class size of 1 teacher and 1 aide for every 17 students.
1b. Full-day Kindergarten	Full-day kindergarten program. Each K student counts as 1.0 pupil in the funding system.
2. Core elementary class sizes/Core teachers	Grades PreK-3: 15 Grades 4-5: 25 Grade PreK-5,6 average: 17
3. Secondary class sizes/Teachers	Grades 6-12: 25, reduced to 20 per Vermont class size guidelines
4. Elective teachers	Elementary Schools: 20% of core elementary teachers Middle Schools: 20% of core middle school teachers High Schools: 33 1/3% of core high school teachers
5. Instructional Coaches	1.0 Instructional coach position for every ~200 students
6. Core Tutors	One tutor position in each prototypical school (Additional tutors are enabled through the at-risk and ELL student counts in Element 22)
7. Substitute Teachers	5% of core and elective teachers, instructional coaches, tutors (and teacher positions in additional tutoring, extended day, summer school and ESL resources)
8. Core Guidance Counselors and Nurses	1 guidance counselor for every 357 grade PreK-5 students, changed to 1 per 300 Prek-5 students per Vermont standards 1 guidance counselor for every 250 grade 6-12 students, changed to 1 per 200 GR 6-12 students per Vermont standards. 1 nurse for every 750 PreK-12 students, changed to 1 per 500 Prek-12 students per Vermont standards. (Additional student support resources are provided on the basis of student at-risk and ELL students in Element 23)
9. Supervisory Aides	1 for every 178.5 elementary students 1 for every 225 middle school students 1 for every 200 high school students
10. Librarians	1.0 librarian position for each prototypical school down to 300 students, then prorated down with a minimum of 0.5 for smaller schools. 1.0 librarian aide prorated up from 300 to 600 students.
11. Principal/Assistant Principal	1.0 principal for the 357-student prototypical elementary school and down to the 119 student elementary school. 1.0 principal for the 450-student prototypical middle school and down to the 150 student middle school. 1.0 principal and 1.0 assistant principal for the 600-student

	prototypical high school, with the assistant principal eliminated at 300 students but a principal down to the 150 student high school.
12. School Site Secretarial Staff	1 secretary position for every 178.5 elementary students 1 secretary position for every 225 middle school students 1 secretary position for every 200 high school students
DOLLAR PER STUDENT RESOURCES	
13. Gifted and Talented	\$40 per student
14. Professional Development	10 days of student-free time for training built into teacher contract year \$125 per student for trainers (In addition to instructional coaches (Element 5) and time for collaborative work provided by Element 4)
15. Instructional Materials	\$190 per student for instructional and library materials
16. Short Cycle/Interim Assessments	\$25 per student for short cycle, interim and formative assessments
17. Computer Technology and Equipment	\$250 per student for school computer & technology equipment
18. Career Technical Education Equipment	\$10,000 per CTE teacher for specialized equipment
19. Extra Duty Funds and Student Activities	\$300 per student for co-curricular activities including sports and clubs
CENTRAL OFFICE FUNCTIONS	
20. Maintenance and Operations	Separate computations for custodians, maintenance workers and groundskeepers.
21. Central Office Staffing	A dollar per student amount for central office staffing and non-personnel resources is computed based on the district's total enrollment.
RESOURCES FOR STRUGGLING STUDENTS	
22. Tutors	1.0 tutor position for every 125 non-ELL free and reduced price lunch eligible students, and 1.0 tutor position for every 125 ELL students (in addition to the one core tutor position in each prototypical school). These positions are provided additional days for professional development (Element 14) and substitute days (Element 7).
23. Additional Pupil Support	1.0 pupil support position for every 125 non-ELL free and reduced price lunch eligible students, and 1.0 pupil support position for every 125 ELL students.
24. Extended Day	1.0 FTE teacher position for every 120 at risk and ELL students.

25. Summer School	1.0 FTE teacher position for every 120 at risk and ELL students.
26. English Language Learner Students	1.0 teacher position for every 100 identified ELL students. This provision is in addition to tutoring, additional pupil support, extended day and summer school resources. These positions are provided additional days for professional development (Element 14) and substitute teachers (Element 7).
27. Alternative Schools	One assistant principal position and one teacher position for every 7 alternative school students.
28. Special Education	7.1 teacher positions per 1000 students for services for students with mild and moderate disabilities and the related services of speech/hearing pathologies and/or OT PT. This allocation equals approximately 1 position per 141 students. 1.0 psychologist per 1,000 students to overview IEP development and ongoing review. Full state funding for students with severe disabilities, and state-placed students, minus the cost of the basic education program and Federal Title VIB, with a cap on the number covered at 2% of all students. Provided at the District or Supervisory Union level.
ADDITIONAL ISSUES	
Staff Compensation	Average of previous year salaries For benefits: Retirement or pension costs: 0, fully paid by the state Social Security: 6.45% up to a maximum of \$118,500 Medicare: 1.2% with no maximum Workers' Compensation: 0.82% Unemployment Insurance: \$102 per employee Health insurance fixed amount at \$13,090

Response to Intervention

Before proceeding, we note that the design of the EB model, which includes core and elective teachers for all children and provides additional resources for struggling students, reflects the *Response to Intervention (RTI)* model. RTI is a three-tier approach to meeting student needs. Tier 1 refers to core instruction for all students. The EB model seeks to make core instruction as effective as possible with its small class sizes, provisions for collaborative time, robust professional development resources and strong recommendation that teachers be organized into collaborative teams. Effective core instruction is the foundation on which all other educational strategies depend to effectively add value. Tier 1 usually includes some differentiated instruction in the regular classroom. After Tier 1 instruction, Tier 2 services are provided to students still struggling to achieve to standards before being given an IEP and labeled as a student with a disability. The EB model's current Tier 2 resources include one core tutor for every prototypical school and additional resources triggered by poverty and ELL student counts that provide funding for tutoring, extended day, summer school, additional pupil support and ESOL services for ELL students. Tier 3 includes all special education services.

Pupil Counts

The EB model typically recommends that states use an ADM pupil count for the funding formula. The EB model also includes a modest declining enrollment cushion, which is the larger of the average ADM of the previous year or the previous year.

Vermont uses several pupil counts in its current formula. In addition, many Vermont districts "tuition-out" students to schools in other districts and sometimes to private schools. Thus, Vermont uses a count of resident students and a count of "attending" students, i.e., counts of students where they are actually attending school.

Since the EB recommendations and cost analysis is tailored to each school we use a student count based on where children attend school. For this work we used the Spring Census count, or in Vermont's vernacular, average daily attendance (ADA). Because excused absences are counted as an attending day, this student count is closer to what most states call average daily membership (ADM). We use three years of these pupil counts. We do this to provide a cushion for schools with declining enrollment, treating a school's enrollment as the higher the most recent pupil count, or the average of the three preceding years

This approach to modeling costs allows the dollars to follow students. This approach has the potential to reduce administrative efforts currently devoted to negotiating and sending tuition payments across districts and supervisory union boundaries for students who reside in one district/SU but attend school in another.

To this basic student count, the model will include two pupil counts for resident students that attend non-public schools; one count for students attending a non-public school within Vermont and a second count for students attending a non-public school outside of Vermont.

We note that our current EB approach to providing additional resources for poverty (i.e., students eligible for free and reduced price lunch) and ELL students has been changed from what appears in our textbook to make the EB recommendations for extra resources for ELL students clearer. All ELL students, regardless of eligibility for free and reduced price lunch, trigger tutoring, additional pupil support, extended day, summer school and ESOL resources. In the past, ELL students were included in an at-risk pupil count that was an unduplicated count of students eligible for free or reduced price lunch or ELL, with any one student counted only once. Today, though, the EB method defines at-risk students as non-ELL students eligible for free and reduced meals in grades PreK-12. The intent of this definition is to ensure that all ELL students, whether or not they are also free and reduced price lunch eligible students, as well as all non-ELL free and reduced price lunch eligible students, trigger resources for extra help services, yet to make sure that any individual student is counted only once for these resources.

Prototypical Schools and Districts

A key component of the EB model is the use of prototypical schools and districts to indicate the general level of resources in schools and districts, and to serve as a heuristic to calculate the base per pupil funding level. This figure can also be used to compute weights for programs for struggling students if a state elects to rely on a weighted pupil formula for distributing funds to *districts*. The EB model identifies resources for prototypical elementary, middle and high schools, as well as for a prototypical district. The model uses specific prototype school sizes so the relative levels of resources for all students are explicit. As described below, the standard EB prototypical school models will not work in Vermont because of the small average school size. Before describing our approach to prototypical schools in Vermont, we provide evidence on school and district size to help situate the discussion.

Research on School and District Size

Before describing the approach to prototypical schools in Vermont, we review the research on school size. Research on school size is quite consistent in its conclusions. However, most of the research on school size addresses the question of whether large schools – those significantly over 1,000 students – are more efficient and more effective than smaller school units (schools of 300 to 500), and whether cost savings and performance improvements can be identified by consolidating small schools or districts into larger entities. The research generally shows that school units of roughly 400-600 elementary students and between 500 and 1,000 secondary students are the most effective and most efficient (Lee & Smith, 1997; Raywid, 1997/1998; Ready & Lee, 2004).

Moreover, the research on diseconomies of small and large scale, which should consider both costs and outcomes, generally provides mixed evidence for a consolidation policy. In an early review of the literature, Fox (1981) concluded that little research had analyzed output in combination with input and size variables. Ten years later, after assessing the meager extant research that did address costs as well as outcomes, Monk (1990) concluded that there was little financial support for school consolidation.

In more recent reviews of scale economies and diseconomies and potential cost savings from consolidation, Andrews, Duncombe & Yinger (2002) and Duncombe and Yinger (2007, 2010) found that the optimum size for elementary schools was in the 300-500 student range, and for high schools was in the 600-900 range. Both findings suggest that the very large urban districts and schools across America are larger than the optimum size and need to be downsized somehow, and that the potential cost savings from consolidation of small districts and schools are realistically scant. In sum, the research suggests that elementary school *units* be in the range of 400-500 students and that secondary school *units* be in the range of 500-1,000 students.

These studies suggest that consolidation of very small schools is likely to produce cost savings, even if the consolidated schools are somewhat smaller than 300-500 students the literature suggests is the most efficient size.

Prototypical Schools and Districts for Vermont

In most states, the EB approach identifies resources for prototypical elementary, middle and high schools with enrollments of 450, 450 and 600 respectively. While these prototypical school sizes reflect the research on the most effective and efficient school sizes, in reality few schools are exactly the size of the prototypes. The EB model uses these prototypes to indicate the relative level of resources in schools, as well as to calculate a base district per pupil cost. Actual resources to individual schools are then prorated up or down based on the actual enrollment of each school.

Few schools in Vermont are as large as the prototypical schools generally used in the EB model. In addition, Vermont has very clear standards on class size that are somewhat smaller than the EB model parameters. Consequently, the prototypical school sizes have been revised downward to reflect both the reality of actual school sizes in Vermont and to meet existing academic standards on school size across the state.¹

As a result of these two factors, we have developed a range of prototypical schools that are more reflective of the reality of Vermont. Specifically the prototypes we developed are PK-5, 6-8 and 9-12. We included Pre-K in the prototypes because preschool is now required in Vermont. While these prototypes do not reflect all of the school organizations used in Vermont, they provide the flexibility to assign resources (and thus costs) to any school.

For elementary schools, we use a prototypical school of 357 students, which is a school of 3 sections of 17 students in each grade PK-5. We also develop a two section and one section

¹ Vermont academic standards require that, “Classes in grades K-3, when taken together, shall average fewer than 20 students per teacher. In grades 4-12, when taken together, classes shall average fewer than 25 students per teacher. The total class roll of a teacher shall not exceed 100 students, except where the specific nature of the teacher’s assignment (such as in certain art, music, or physical education programs) is plainly adaptable to the teaching of greater numbers of students while meeting the educational goals of the program.”

<http://education.vermont.gov/publications/model-policies>

elementary school, which are schools with two sections of 17 students per grade (238 students) or schools with one section of 17 students (119 students) per grade respectively.

For secondary schools, the standard EB model has a middle school of 450 students and a high school of 600 students, both with class sizes of 25. Given Vermont's class size guidelines, the Vermont model will use class sizes of 20, although we will continue to use prototypical schools sizes of 450 and 600 with additional prototypes established at enrollments of 300 and 150 students. The result is four high school prototypes (600, 450, 300 and 150 students) and three middle school prototypes (450, 300, and 150 students). To meet Vermont's class size standards, staffing for these schools will assume core class sizes of 20 students rather than the 25 used in other EB models.

We will finalize the school prototypes after the Professional Judgment Panels and conversations with staff and other Vermont education leaders.

Our approach is to estimate the resources needed in each of the ten prototypical schools identified above (3 elementary, 3 middle and 4 high school) and calculate the per pupil costs of each. Then for each school in Vermont, we will use the school's enrollment to compute base per pupil costs, which will be interpolated from the cost estimates of the two surrounding prototypes. For example, a middle school with 375 students will generate per pupil funding that is half way between the 300-student prototype and the 450-student prototype.

To these school level cost estimates, we provide estimates of district level costs based on enrollment at the district level, sum the school and district costs to achieve an estimated total school district cost. Our simulation model will enable us to "shift" schools into larger supervisory districts and re-estimate adequate cost levels to assist districts and policy makers in understanding the implications of the Act 46 alternative structures. As with individual school resources, the model accommodates different school district sizes and the resources required as the enrollment of a district changes.

Our approach is designed to meet the unique district and supervisory union structure in Vermont, and the current efforts to establish alternative district structures under the requirements of Act 46. In addition to the resources for schools and districts, resources are provided for special education, and based on student characteristics resources for struggling students as well.

In sum, the EB model will provide an estimate of the costs of adequacy for each school in Vermont as located in its current district and Supervisory Union. In addition, it will provide flexibility so that schools can be shifted into alternative supervisory district configurations and new costs estimates derived.

STAFFING FOR CORE PROGRAMS

This section covers full-day kindergarten, core teachers, elective/specialist teachers, instructional facilitators/coaches, core tutors, core guidance counselors, core nurses (the latter three being

changes and additions to the EB model), substitute teachers, supervisory aides, librarians, principals/assistant principals and school secretaries.

1a. Preschool

The EB model provides for full-day preschool. In 2014, Vermont enacted Act 166, which requires all Vermont school districts to provide universal publicly funded prekindergarten education for a minimum of ten hours per week for 35 weeks annually for all 3, 4 and 5-year-old children who are not enrolled in kindergarten. Act 166 was to come into effect on July 1, 2015; however, as a consequence of a transition policy, school districts may opt to wait until July 1, 2016 to fully implement Act 166.

Current EB Recommendation

Preschool classrooms are staffed at a class size of 1 teacher and 1 aide for every 17 students.

Analysis and Evidence

There is growing evidence that a high quality preschool program is an effective way to help all children succeed in school (Kauerz, 2006). Such programs are best paired with well-resourced elementary schools, which can continue the performance catch-up that preschool programs are designed to begin. And resourcing elementary schools adequately is a goal of this adequacy project. In addition, there is a growing recognition that integrating Preschool programs with the traditional public school system, particularly the K-3 grades, could strengthen the effect of both Preschool programs and Grades 1-3. This analysis of preschool will estimate the structure of a high quality program for three- and/or four-year-olds that would be integrated with a high quality preschool-grade 3 programs.

Much of the research on the effectiveness of preschool-grade 3 programs has focused on the preschool component, with less research on the advantages of integrated programs that continue from preschool through the Grade 3, so the preschool research is addressed first. Drawing from a number of major studies that found long-term positive effects of pre-school programs on student learning, Reynolds and Temple (2008) constructed five possible pathways through which early childhood development programs produced their impacts, including a:

- Cognitive advantage pathway that leads to enhanced literacy, language and numeracy skills, and better school readiness (see also Conger, 2008 for evidence on the impact of early learning on acquisition of English language skills for English Language Learners)
- Family support pathway describing benefits from greater parental involvement in education and enhanced parenting skills (see also Kalil & Crosnoe, 2008)
- School support pathway that argues for high quality education programs beyond pre-school to strengthen the learning advantages of early childhood development programs, a pathway allowed by an overall adequate funding system
- Social adjustment pathway suggesting benefits from increased classroom and peer social skills and positive teacher-child relationships, and

- Motivational pathway arguing that early education programs provide benefits in terms of achievement motivation and commitment to school.

Whatever the pathway, most researchers find that “high quality” preschool, particularly for students from lower income backgrounds, significantly affects future student academic achievement as well as other desired social and community outcomes (Barnett, 2008, 2010, 2011a, 2011b; Camilli, et al., 2010; Pianta, et al., 2012; Reynolds, et al., 2001, 2011; Reynolds and Temple, 2006, 2008; Schweinhart et al., 2005). These longitudinal studies show that students from lower income backgrounds who experience a high quality, full-day preschool program perform better in learning basic skills in elementary school, score higher on academic goals in middle and high school, attend college at a greater rate, and as adults, earn higher incomes and engage in less socially-undesirable behavior.

In specifying more specific positive impacts, Lynch (2007), (Heckman, 2011) and a recent report from the Education Commission of the States (Workman, Griffith & Atchison, 2014) identify the multiple benefits of preschool programs for children who participate in “high quality” preschool programs:

- Require less special education
- Are less likely to repeat a grade
- Are less likely to need child welfare services
- Enroll in K-12 education better prepared resulting in lower spending at that level
- Are less likely to engage in criminal activity as juveniles and adults
- Are less likely to need social welfare support services as adults
- Generally have higher incomes when they enter the labor force
- Pay higher taxes as a result of their higher incomes, and
- Are likely to have employer-provided health insurance.

The consistently recurring theme in all of the analyses is that the multiple benefits and, as is discussed next, long term “savings” accrue to “high quality” preschool programs. Although to a large extent, a high quality program is defined by the individuals employed to run the program and their commitment to their job, as well as a comprehensive array of services beyond just the “school” component, it is possible to identify the resource levels needed to support such high quality programs.

Russo (2007) identified the components of effective preschool-grade 3 programs to include:

- Voluntary, full-day *preschool* available to all 3-and 4-year-old children
- Full-day *kindergarten* that builds on preschool experiences and is available to all children, which is supported by the current funding system
- Standards, curriculum, instruction, and assessments aligned within and across grades from preschool through grade three, which can be accomplished with new curriculum standards

- Curriculum focused on emotional development, social skills, and self-discipline, as well as reading and mathematics
- Early education lead teachers qualified to teach any grade level from preschool through grade 3 and compensated based on public elementary school teacher salaries, and
- Families and teachers who work together to ensure the success of all children.

More recently, the National Institute for Early Education Research (NIEER) has established ten quality benchmarks to identify program quality. Its ten Preschool “high quality” preschool program standards are similar to the above and include:²

1. Comprehensive learning standards.
2. Teachers with a bachelor degree.
3. Teachers with specialized training in early childhood.
4. Assistant teachers with a Child Development Associate credential or the equivalent.
5. Teacher in-service training of at least 15 hours per year.
6. Maximum class sizes of 20 or less.
7. Staff to child ratios of 1 to 10 or better.
8. Vision, hearing and health screening and referral and support services.
9. At least one meal per day provided.
10. Site visits to ensure program quality.

Nearly all of the longitudinal studies of preschool programs have relied on data from three preschool programs that meet the above standards: the High-Scope Perry Preschool Program, the Carolina Abecedarian Project, and the Chicago Child-Parent Center Program. These results reinforce the finding that the most robust impacts of preschool programs are those that have studied the effect of high quality programs.

In sum, high quality preschool, offered for a full day and taught by fully certified and trained teachers using a rigorous but appropriate early childhood curriculum can provide initial effects of 0.9 standard deviation that fall to 0.45 in later primary years. By themselves, preschool programs can reduce achievement gaps linked to race and income by half. And the effect of preschool programs can be enhanced if followed by high quality education programming in the elementary grades, particularly grades K-3.

Furthermore, there is increasing recognition that preschool should be provided for *all students*. Research shows that this strategy produces significant gains for children from middle class backgrounds and even larger impacts for students from lower income backgrounds (Barnett, Brown & Shore, 2004). A prominent economist also supports this position (Greeley, 2014; Heckman, 2011).

² See <http://nieer.org/yearbook/compare/> for a detailed description of the NIEER quality standards.

Impact of Statewide Preschool Programs

Researchers have also analyzed the success of larger, more universal, i.e., statewide, preschool initiatives. A 2003 study of state-funded preschool programs in six states – California, Georgia, Illinois, Kentucky, New York, and Ohio – found that children from lower income families start catching up to their middle income peers when they attend a preschool program (Jacobson, 2003). There is evidence that state-wide universal programs in Georgia (Henry, et. al. 2006) and Oklahoma (Gromley, Jr. et. al. 2005) have improved the performance of students who participated in those programs. In addition, a 2007 study showed that preschool programs in New Jersey’s urban districts had not only significant short-term cognitive and social impacts, but also long-term, positive impacts on students who enrolled in them, closing the achievement gap by 40 percent in second grade for a two year preschool program (Frede, Jung, Barnett et al., 2007).

Fiscal Returns to Preschool

Generally, estimates of the long term financial benefits of preschool programs are reported as returns to investment. Reynolds and Temple (2008) reported that in addition to benefits on child well being and student achievement, high quality preschool programs for low income children at risk for underachievement produced economic returns ranging from \$4 to \$10 per dollar invested. Others make similar arguments (e.g. Heckman et al., 2010). Indeed, several studies conclude that there is a return over time of *eight to ten dollars* for every one dollar invested in high quality preschool programs (Barnett, 2007; Barnett & Masse, 2007; Karoly et al., 1998; Reynolds et al., 2011; Zigler, Gilliam & Jones, 2006; and Gromley, 2007).

In a more detailed analysis, Lynch (2007) found that voluntary, high quality, publicly funded preschool programs targeted to the poorest 25 percent of three-and four-year old children generate substantial benefits that would eclipse the costs of the programs in six years. By 2050, Lynch estimated that the annual benefits of these preschool programs would exceed the program costs in that year by a ratio of 12.1 to 1. He estimated the costs of a high quality half-day program for these children at \$6,300 (2006 dollars) for each of the 2 million children enrolled. He further estimated that if those programs were funded mainly by individual states (rather than the Federal Government), by 2050, all 50 states would realize net benefits in tax revenues from the programs in between four and 29 years.

Further, Lynch (2007) estimated that if a voluntary, high quality publicly funded universal half-day preschool program for three-and four-year-olds were established, budgetary savings would surpass costs in about nine years and that by 2050 benefits would exceed costs by an 8.2:1 ratio. He assumed these preschool programs would also cost about \$6,300 per student and would enroll approximately 7 million children when fully phased in. Note University of Chicago economist Heckman (2015) goes beyond these assertions and argues investments in early childhood education could reduce deficits and improve the overall economy.

The Case for Integrated Preschool-Grade 3 Programs

The discussion above considered preschool programs, but said little about preschool-grade 3 programs or their benefits. While there is growing evidence that integrating preschool programs with primary grades can lead to increased educational benefits, this field has been less explored.

Takanishi and Kauerz (2008) argue that the preschool-grade 3 years are the “cornerstone” of any educational system, and point out the importance of quality integrated preschool-grade 3 programs in providing strong foundations for lifelong learning, educational excellence and competitiveness in the marketplace. Bogard (2003) suggests that variability in preschool experiences is a strong predictor of children’s outcomes, and that the link is even stronger for low-income children. She suggests that a preschool-grade 3 approach to early childhood education will help to “level the playing field” by supporting better teacher preparation and qualifications, as well as establishing sequential learning experiences from preschool through the 3rd grade.

One of the challenges in thinking about preschool-grade 3 programs is the need to coordinate traditional education programs in K-3 with preschool programs. This takes on a number of dimensions. First, even if the preschool programs are in the same school, the need to coordinate education programs (curriculum, professional development, teacher collaboration, school facilities) becomes more complex with the addition of more staff, more students and more grade levels to integrate into the program. Second, many preschool programs are offered by providers other than the public school system – frequently at sites other than the local school. This makes all of the coordination efforts more complex yet.

Finally, this is further complicated by the fact that in the foreseeable future, preschool programs will remain voluntary. This means some children will continue to come to kindergarten without the benefit of preschool programs, and other children who have had access to preschool programs will likely bring very different experiences to the first years of formal schooling. In addition, the success of a preschool-grade 3 program also depends on the quality of the educational program in grades K-3, which varies across schools, school districts and even states. This study addresses that issue by using an EB model to estimate the resources needed for a high quality program in all preschool- grade 3 classrooms.

Many of the components of success for high quality preschool programs are also part of the components advocated by preschool-grade 3 supporters. These include full-day programs with low pupil/teacher ratios staffed by highly qualified teachers and aides, along with support for articulating curriculum, professional development, teacher collaboration, and helping children with special educational needs.

In earlier research, Picus, Odden and Goetz (2009), as part of an overall effort to cost out preschool-grade 3 programs in all states, developed case studies of several integrated Preschool programs. The case studied showed that such programs were provided in regular elementary school settings; often organized schools into preschool-grade 1, grade 2-3, and grades 4-5 collegial teacher teams; provided preschool teachers with the same pupil free time as the grade

level elementary teachers so they could all meet during the regular school day for collaborative planning; integrated the preschool-grade 1 curriculum; and generally augmented a K-5 elementary school with an additional one to three preschool classrooms. And, most of the preschool classrooms were staffed with one teacher and one aide for every 15-20 students. In addition, and as recommended by the NIEER standards, such programs had classroom teachers that were fully certified as early childhood educators and paid on the same salary schedule as the other teachers in the school and school system (see also, Camilli, et al., 2010; Whitebrook, 2004).

The Evidence-Based Method to Providing Preschool Integrated Program

The EB method has been used to identify costs for integrated preschool programs in three recent studies. The first was the major study 50 state study Picus Odden & Associates conducted for The Fund For Child Development, which developed estimated costs for providing such programs, using various assumptions of eligibility and participation, in all states in the country (Picus, Odden & Goetz, 2009). The second was a study conducted in 2011 as part of an adequacy study for the state of Texas (Picus, Odden, Goetz & Aportela, 2012). The third was an analysis conducted for Maine as part of a 2013 recalibration of its adequacy-oriented school funding system (Picus et al., 2013). In these three studies, the EB elementary school model was used to develop a per Preschool pupil cost for a high quality preschool program. The per-pupil cost for Pre-K was derived from a prototypical preschool program of 150 students, which included 10 classrooms of 15 students each. In addition, most of the staffing and program elements included in the EB model's typical elementary school were included for the preschool students.

The Pre-K elements draw from the elements and ratios that the EB model provides for regular elementary schools. The major difference is that for all preschool classes, the EB model provides 1 FTE teacher position and 1 FTE instructional aide position for every 15 preschool students. The EB preschool teachers trigger elective teachers and substitutes just as in a regular elementary school. Pupils also trigger instructional coaches, pupil support, "census" or "mainstream" special education resources, secretaries, and all the per pupil dollar amounts – technology, instructional materials, professional development, and assessments – as for a regular elementary school. The model includes an assistant principal position to provide a preschool program coordinator. And the model includes central office costs such as central administration and operation and maintenance. Further, the model includes putting preschool teachers on the same salary schedule as teachers of other grades, as a way to insure that the staff in the programs are high quality (Camilli, et al., 2010; Whitebrook, 2004).

Our approach in Vermont where Pre-K is required is to include preschool in the prototypical elementary school program. The preschool grades will be staffed with one teacher and one instructional aide for every 17 students. Since those students will also trigger elective teachers, it would be possible for schools to create Pre-K, K and grade 1 collaborative reaching teams to coordinate the early elementary education program. If preschool students were also at risk, they will trigger the resources for summer school and after school programs, allowing for a year-round, full service preschool program.

1b. Full-Day Kindergarten

The EB model provides for full-day kindergarten. For many years, Vermont has supported full-day kindergarten for all five-year olds.

Current EB Recommendation

Full-day kindergarten program. Each K student counts as 1.0 pupil in the funding system.

Analysis and Evidence

Research shows that full-day kindergarten, particularly for students from low-income backgrounds, has significant positive effects on student learning in the early elementary grades (Gullo, 2000; Slavin, Karweit & Wasik, 1994). Fusaro's (1997) late 1990s meta-analysis of 23 studies comparing the achievement effect of full-day kindergarten to half-day kindergarten programs, found an average effect size of +0.77³, which is substantial. Children participating in full-day kindergarten programs do better in learning the basic skills of reading, writing and mathematics in the primary grades than children who receive only a half-day program or no kindergarten at all (see also Lee, Burkam, Ready, Honigman & Meisels, 2006).

In 2003, using nationally-representative, longitudinal data from the Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS–K), Denton, West & Walston (2003) showed that children who attended full-day kindergarten had a greater ability to demonstrate reading knowledge and skill than their peers in half-day programs, across the range of family backgrounds. Cooper, et al.'s (2010) comprehensive meta-analysis reached similar conclusions, finding the average effect size of students in full-day versus half-day kindergarten to be +0.25. Moreover, a *randomized controlled trial*, the “gold standard” of education research, found the effect of full-day versus half-day kindergarten to be about +0.75 standard deviations (Elicker & Mathur, 1997). As a result of this research, funding full-day kindergarten for 5-year-olds as well as for 4-year-olds is an increasingly common practice among the states (Kauerz, 2005).

Since research suggests that children from all backgrounds can benefit from full-day kindergarten programs, the EB model supports a full-day program for all students, by counting such students as 1.0 in the state aid formula.

2. Elementary Core Teachers/Class Size

In staffing schools and classrooms, the most expensive decision superintendents and principals make is that of class size. Core teachers are defined as the grade-level classroom teachers in elementary schools. In middle and high schools, core teachers are those who teach core subjects such as mathematics, science, language arts, social studies and world language.

³ Effect size is the amount of a standard deviation in higher performance that the program produces for students who participate in the program versus students who do not. An effect size of 1.0 indicates that the average student's performance would move from the 50th to the 83rd percentile. The research field generally recognizes effect sizes greater than 0.25 as significant and greater than 0.50 as substantial.

Current EB Recommendation

Grades PreK-3: 15 Grades 4-5: 25
Average Pre-K-5,6: 17

Analysis and Evidence

The gold standard of educational research is randomized controlled trials, which provide scientific evidence on the impact of a certain treatment (Mosteller, 1995). Thus, the primary evidence on the impact of small classes today is the Tennessee STAR study, which was a large scale, *randomized controlled experiment* of class sizes of approximately 15 compared to a control group of classes with approximately 24 students in kindergarten through grade 3 (Finn and Achilles, 1999; Word, et al., 1990). The study found that students in the small classes achieved at a significantly higher level (effect size of about 0.25 standard deviations) than those in regular class sizes, and that the impacts were even larger (effect size of about 0.50) for low-income and minority students (Finn, 2002; Grissmer, 1999; Krueger, 2002). The same research also showed that a regular class of 24-25 with a teacher and an instructional aide *did not* produce a discernible positive impact on student achievement, a finding that undercuts proposals and widespread practices that place instructional aides in elementary classrooms (Gerber, Finn, Achilles, & Boyd-Zaharias, 2001).

Subsequent research showed that the positive impacts of the small classes in the Tennessee study persisted into the middle and high school years, and the years beyond high school (Finn, Gerger, Achilles & J.B. Zaharias, 2001; Konstantopoulos & Chung, 2009; Krueger, 2002; Mishel & Rothstein, 2002; Nye, Hedges & Konstantopoulos, 2001a, 2001b). Longitudinal research on class size reduction also found that the lasting benefits of small classes include a reduction in the achievement gap in reading and mathematics in later grades (Krueger & Whitmore, 2001).

Although some argue that the impact of the small class sizes is derived primarily from just kindergarten and grade 1, Konstantopoulos and Chung (2009) found that the longer students were in small classes (i.e., in grades K, 1, 2 and 3) the greater the impact on grade 4-8 achievement. They concluded that the full treatment – small classes in all of the first four grades – had the greatest short and long term impacts.

Though differences in analytical methods and conclusions characterize some of the debate over class size (see Hanushek, 2002 and Krueger, 2002), the EB model reflects those concluding that class size makes a difference, but only class sizes of approximately 15 students with one teacher (and not class sizes of 30 with an aide or two teachers) and only for kindergarten to grade 3.

Finally, in these times when funds for schools are scarce, it is legitimate to raise the issue of the cost of small classes versus the benefits. Whitehurst and Chingos (2010) argue that though the Tennessee STAR study supports the efficacy of small classes, there is other research today that has produced more ambiguous conclusions. However, they also note that this other research includes class size reductions in grades above K-3 and “natural experiments” rather than

randomized controlled trials. Most importantly, they also conclude that while the costs of small classes are high, the benefits, particularly the long-term benefits, outweigh the costs and that small class sizes in grades K-3 “pay their way.”

Vermont academic standards require that, “Classes in grades K-3, when taken together, shall average fewer than 20 students per teacher. In grades 4-12, when taken together, classes shall average fewer than 25 students per teacher. The total class roll of a teacher shall not exceed 100 students, except where the specific nature of the teacher’s assignment (such as in certain art, music, or physical education programs) is plainly adaptable to the teaching of greater numbers of students while meeting the educational goals of the program.”

(<http://education.vermont.gov/publications/model-policies>) As noted above, for Vermont we have created new elementary school prototypes to meet the unique school organizations found in the State. The Vermont EB model relies on average elementary class sizes of 17 students, a size that meets the Vermont academic standards for elementary class size.

3. Secondary Core Teachers/Class Size

In middle and high schools, core teachers are those who teach core subjects such as mathematics, science, language arts, social studies and world language. Advanced Placement classes in these subjects are considered core classes.

Current EB Recommendation

Grades 6-12: 25, reduced to 20 per Vermont class size guidelines

Analysis and Evidence

There is less research evidence on the most effective class size in grades 4-12 than there is on effective class size in grades K-3. As a result, in developing the EB model, we sought evidence on the most appropriate secondary class size from typical and best practices to identify the most appropriate class size for these grades. The national average class size in middle and high schools is roughly 25, and nearly all comprehensive school reform models were developed on the basis of a class size of 25 (Odden, 1997a; Stringfield, Ross & Smith, 1996), a conclusion on class size reached by the dozens of experts who created these whole-school design models.

Although many professional judgment panels in many states have recommended secondary class sizes of 20, none cited research or best practices to support that proposal.

Citing more recent studies, Whitehurst and Chingos (2010) argue that there might be a modest linear relationship in improving student performance when class size drops from between 25 and 30 students to 15, but our view of the evidence and impact is that the gains identified are modest at best, and insufficient to alter the EB class size formulas.

The secondary EB class size recommendations are larger than the general parameters of class size policy in Vermont. The State’s guidelines for grades 4-12, when taken together, require that “... classes shall average fewer than 25 students per teacher. The total class roll of a teacher shall not exceed 100 students, except where the specific nature of the teacher’s assignment (such as in certain art, music, or physical education programs) is plainly adaptable to the teaching of greater numbers of

students while meeting the educational goals of the program” (see <http://education.vermont.gov/publications/model-policies>). These standards suggest that the prototypical class sizes for secondary schools needs to be reduced to 20, because a teacher providing instruction for five periods would need to average no more than 20 students a period to meet the standard of not exceeding a total of 100 students on class rolls.

4. Elective/Specialist Teachers

In addition to core classroom teachers, the EB model provides additional elective, or specialist teachers, to support core teachers. This allows schools to offer a full liberal arts curriculum – core and electives – as well as time during the school day for teachers to collaborate on instructional plans, participate in professional development activities and otherwise plan for classroom instruction. Generally, non-core or elective teachers, also called specialist teachers, offer courses in such subjects as music, band, art, physical education, health, and career-technical education.

Current EB Recommendation
Elementary Schools: 20% of core elementary teachers
Middle Schools: 20% of core middle school teachers
High Schools: 33 1/3% of core high school teachers

Analysis and Evidence

In addition to the core subjects addressed above, schools need to provide a solid well-rounded curriculum including art, music, library skills and physical education. Teachers also need some time during the regular school day to work collaboratively and engage in job-embedded professional development. Providing every teacher – core and elective – one period a day for collaborative planning and focused professional development requires an additional 20 percent allocation for elective teachers. Using this elective staff allocation, every teacher – core and elective – would teach 5 of 6 periods during the day, and have one period for planning, preparation and collaborative work. One of the most important elements of effective collaborative work is team-focused data-based decision-making, using student data to improve instructional practices, now shown to be effective by a recent *randomized controlled trial* (Carlson, Borman & Robinson, 2011). Indeed, this is one of the consistent findings of research on successful turnaround schools during the past several years (Anrig, 2015).

The 20 percent additional staff is adequate for elementary and middle schools, but the EB method developed a different argument for high schools. If the goal is to have more high school students take a core set of rigorous academic courses, and learn the course material at a high level of thinking and problem solving, cognitive research findings suggest that use of longer class periods, such as a block schedule, may be a better way to organize the instructional time of a high school. (Bransford, Brown and Cocking, 1999; Donovan & Bransford, 2005a, 2005b, 2005c). Typical block scheduling for high schools includes four 90-minute blocks where teachers provide instruction for three of those 90-minute blocks and have one block – or 90

minutes – for planning, preparation and collaboration each day. This schedule requires elective teachers at a rate of 33 1/3 percent of the number of core teachers. This block schedule would operate with students taking four courses each semester attending the same classes each day, or with students taking eight courses each semester while attending different classes every other day. Such a schedule could also accommodate a few “skinny” blocks (45 minute periods) for some classes. Each of these specific ways of structuring a block schedule, however, requires an additional 33 1/3 percent of the number of core teachers to serve as elective teachers to provide the regular teacher with a “block” for planning, preparation and collaboration each day.

It should be noted that this staffing recommendation for high schools would be sufficient for high schools to provide students with a rigorous set of courses for grades 9-12, and the 21 credits required for high school graduation in Vermont and to be college ready.

We explicitly note that the elective teacher recommendation described above does not provide sufficient resources, at the same class sizes, for either middle schools or high schools to offer a 7 period day and require teachers to instruct for only 5 of those periods. The EB model does not resource schools at that level for two primary reasons. First, the EB model formulates recommendations on strategies and resources that help to improve student performance in the core subjects of reading/English/language arts, mathematics, science, history/geography and world language, in part by providing nearly an hour of instruction in each of these subjects daily. Restructuring the day to add a seventh period is usually accomplished by reducing the minutes of instruction in core subjects, and thus is not a strategy that is likely to boost performance in those subjects, regardless of the arguments about the motivational aspects of elective classes. Second, increasing the provision of specialist and elective teachers to 40 percent in both middle and high schools is more costly. Therefore, a recommendation of 40 percent specialists and elective teachers in secondary schools would result in added costs and a potential decrease in instructional effectiveness for the core subjects, something that is not aligned with the framework for the EB approach to adequacy.

5. Instructional Facilitators/Coaches

Coaches, or instructional facilitators, coordinate the instructional program but most importantly provide the critical ongoing instructional coaching and mentoring that the professional development literature shows is necessary for teachers to change and improve their instructional practice (Cornett & Knight, 2008; Crow, 2011; Garet, Porter, Desimone, Birman, & Yoon, 2001; Joyce & Calhoun, 1996; Joyce & Showers, 2002). This means that they spend the bulk of their time with teachers, modeling lessons, giving feedback to teachers, working with teacher collaborative teams, and generally helping to improve the instructional program. The few instructional coaches who also function as school technology coordinators provide the technological expertise to fix small problems with the computer system, install software, connect computer equipment so it can be used for both instructional and management purposes, and provide professional development to embed computer technologies into a school’s curriculum. This report expands on the rationale for these individuals in the section on professional development (Element 16), but includes them here as they represent teacher positions.

Current EB Recommendation

1.0 Instructional coach position for every ~200 students.

Analysis and Evidence

A few states (e.g., Arkansas, New Jersey, Wyoming and to a modest degree North Dakota) explicitly provide resources for school and classroom-based instructional coaches, yet instructional coaches are key to making professional development work (see Element 16). Most comprehensive school designs (see Odden, 1997; Stringfield, Ross & Smith, 1996), and EB studies conducted in other states – Arizona, Arkansas, Kentucky, Maine, North Dakota, Texas, Washington, Wisconsin and Wyoming – call for school-based instructional facilitators or instructional coaches (sometimes called mentors, site coaches, curriculum specialists, or lead teachers).

Early research found strong effect sizes (1.25-2.71) for coaches as part of professional development (Joyce & Calhoun, 1996; Joyce & Showers, 2002). A 2010 evaluation of a Florida program that provided reading coaches for middle schools found positive impacts on student performance in reading (Lockwood, McCombs & Marsh, 2010). A related study found that coaches provided as part of a data-based decision-making initiative also improved both teachers' instructional practice and student achievement (Marsh, McCombs & Martorell, 2010). More importantly, a recent *randomized controlled trial* of coaching (Pianta, Allen & King, 2011) found significant positive impacts in the form of student achievement gains across four subject areas – mathematics, science, history, and language arts. This gold standard of research provides further support to this element as an effective strategy to boost student learning.

In terms of numbers of coaches, several comprehensive school designs suggest that although one instructional coach might be sufficient for the first year of implementation of a school-wide program, in a school with about 500 students, additional instructional coaches are needed in subsequent years. Moreover, several technology-heavy school designs recommend a full-time facilitator who spends at least half-time as the site's technology expert. Thus, drawing from all programs, we conclude that 1.0 FTE instructional coach/technology coordinator is needed for every 200 students in a school. This resourcing strategy works for elementary as well as middle and high schools.

Although instructional coaching positions are identified as FTE positions, schools could divide the responsibilities across several individual teachers. For example, the 3.0 positions in a 600-student high school could be structured with six half-time teachers and instructional coaches. In this example, each teacher/coach would work 50 percent time as a coach – perhaps in one curriculum area such as reading, math, science, social studies or technology – and 50 percent time as a classroom teacher or tutor.

We note that this level of staffing for coaches, combined with the additional elements of professional development discussed below, focus on making Tier 1 instruction (in the Response to Intervention frame) as effective as possible, providing a solid foundation of high quality instruction for everyone, including students who struggle to learn to proficiency.

6. Core Tutors/Tier 2 Intervention

The most powerful and effective approach for helping students struggling to meet state standards is individual one-to-one or small group (1-3 or 1-5 maximum) tutoring provided by licensed teachers (Shanahan, 1998; Wasik & Slavin, 1993). In earlier reports, the EB model allocated tutors to schools on the basis of the number of at-risk students. Since that time, it has recognized that all schools, even with no at-risk students, have some struggling students and need some minimum Tier 2 resources. Thus, the EB model has been modified so that each prototypical school receives at least one tutor regardless of the number of at risk students. *Consequently, the report identifies tutor resources a school receives under the current EB model here in the core staffing section and also discusses the need for more tutors in Element 22 below.*

Current EB Recommendation

One tutor position in each prototypical school.*

*Additional tutors are enabled through the at-risk and ELL pupil counts in Element 22.

Analysis and Evidence

Students who must work harder and need more assistance to achieve to proficiency levels especially benefit from preventative tutoring (Cohen, Kulik, & Kulik, 1982). Tutoring program effect sizes vary by the components of the approach used, e.g. the nature and structure of the tutoring program, but effect sizes on student learning reported in meta-analyses range from 0.4 to 2.5 (Cohen, Kulik & Kulik, 1982; Shanahan, 1998; Shanahan & Barr, 1995; Wasik & Slavin, 1993) with an average of about 0.75 (Wasik & Slavin, 1993).

The impact of tutoring programs depends on how they are staffed and organized, their relation to the core program, and tutoring intensity. Researchers (Cohen, Kulik, & Kulik, 1982; Farkas, 1998; Shanahan, 1998; Wasik & Slavin, 1993) and experts on tutoring practices (Gordon, 2009) have found greater effects when the tutoring includes the following:

- Professional teachers as tutors
- Tutoring initially provided to students on a one-to-one basis
- Tutors trained in specific tutoring strategies
- Tutoring tightly aligned to the regular curriculum and to the specific learning challenges, with appropriate content-specific scaffolding and modeling
- Sufficient time for tutoring, and
- Highly structured programming, both substantively and organizationally.

Several specific structural features are associated with effective one-to-one tutoring programs:

- First, each tutor would tutor one student every 20 minutes, or three students per hour. This would allow one tutor position to tutor 18 students a day. (Since tutoring is such an intensive activity, individual teachers might spend only half their time tutoring; but a 1.0

FTE tutoring position would allow 18 students per day to receive 1-1 tutoring.) Four positions would allow 72 students to receive individual tutoring daily in the prototypical elementary and middle schools.

- Second, most students do not require tutoring all year long. Tutoring programs generally assess students quarterly and change tutoring arrangements. With modest changes such as these, close to half the student body of a 400-student school unit could receive individual tutoring during the year.
- Third, not all students who are from a low-income background require individual tutoring, so core tutors and a portion of the at risk tutor allocation could be used for students in the school who might not be from a lower income family but nevertheless have a learning issue that could be remedied by tutoring. This also is part of the rationale for including 1 tutor in each prototypical school, regardless of the number of at risk students.

Though this discussion focuses on *individual* tutoring, schools could also deploy these resources for small group tutoring. In a detailed review of the evidence on how to structure a variety of early intervention supports to prevent reading failure, Torgeson (2004) shows how one-to-one tutoring, one-to-three tutoring, and one-to-five small group sessions (all Tier 2 interventions) can be combined for different students to enhance their chances of learning to read successfully. One-to-one tutoring would be reserved for the students with the most severe reading difficulties, scoring say, at or below the 20th or 25th percentile on a norm referenced test, or below basic level on state achievement tests. Intensive instruction for groups of three-to-five students would then be provided for students above those levels but below the proficiency level.

It is important to note that the instruction for all student groups needing extra help needs to be more explicit and sequenced than that for other students. Young children with weakness in knowledge of letters, letter sound relationships and phonemic awareness need explicit and systematic instruction to help them first decode and then learn to read and comprehend. As Torgeson (2004:12) states:

Explicit instruction is instruction that does not leave anything to chance and does not make assumptions about skills and knowledge that children will acquire on their own. For example, explicit instruction requires teachers to directly make connections between letters in print and the sounds of words, and it requires that these relationships be taught in a comprehensive fashion. Evidence for this is found in a recent study of preventive instruction given to a group of high at risk children in kindergarten, first grade and second grade [.....] only the most [phonemically] explicit intervention produced a reliable increase in the growth of word-reading ability ... schools must be prepared to provide very explicit and systematic instruction in beginning word-reading skills to some of their students if they expect virtually all children to acquire work-reading skills at grade level by the third grade Further, explicit instruction also requires that the meanings of words be directly taught and be explicitly practiced so that they are accessible when children are reading text.... Finally, it requires not only direct practice to build fluency.... but also careful,

sequential instruction and practice in the use of comprehension strategies to help construct meaning.

Torgeson (2004) goes on to state that meta-analyses consistently show the positive effects of reducing reading group size (Elbaum, Vaughn, Hughes & Moody, 1999) and identifies experiments with both one-to-three and one-to-five teacher-student groupings. Though one-to-one tutoring works with 20 minutes of tutoring per student, a one-to-three or one-to-five grouping requires a longer instructional time for the small group – up to 45 minutes. The two latter groupings, with 45 minutes of instruction, reduced the rate of reading failure to a miniscule percentage.

For example, if the recommended numbers of tutors are used for such small groups, one FTE reading position could teach 30 students a day in the one-to-three setting with 30 minutes of instruction per group, and 30+ students a day in the one-to-five setting with 45 minutes of instruction per group. Four FTE tutoring positions could then provide this type of intensive instruction for up to 120 students daily. In short, though the EB model emphasizes 1-1 tutoring, and some students need 1-1 tutoring, other small group practices (which characterize the bulk of Tier 2 interventions) can also work, with the length of instruction for the small group increasing as the size of the group increases.

Though Torgeson (2004) states that similar interventions can work with middle and high school students, the effect is often smaller, as it is much more difficult to undo the lasting damage of not learning to read once students enter middle and high schools with severe reading deficiencies. However, a new randomized control study (Cook et al., 2014), discussed below, found similarly positive impacts of a tutoring program for adolescents in high poverty schools IF it was combined with counseling as well. This is made possible by the EB model as it includes such additional non-academic pupil support resources (see Element 23 discussion).

The above rationale for tutors is strengthened by two recent *randomized controlled trials* of the effectiveness of tutoring for struggling students, which support our logic for providing a minimum level of tutor support in all schools as well as additional tutors for schools with more need. At the elementary level, using a randomized controlled trial, May et al., (2013) assessed the impact of tutors in a Reading Recovery program. In the third year of a five-year evaluation, they found that Reading Recovery tutoring had an effect size of 0.68 on overall reading scores relative to the population of students eligible for such services in the specific study, and a 0.47 effective size relative to the national population of first grade struggling readers. The effects were similarly large for reading words and reading comprehensive sub-scales.

For students in high schools, Cook, et al. (2014) reported on a *randomized controlled trial* of a two-pronged intervention that provided disadvantaged youth with tutoring *and* counseling. They found that intensive individualized academic extra help – tutoring – combined with non-academic support seeking to teach grade 9 and 10 youth social-cognitive skills based on the principles of cognitive behavioral therapy (CBT), led to improved math and reading performance. The study sample consisted mainly of students from low income and minority backgrounds, which generally pose the toughest challenges. The effect size for math was 0.65

and for reading was 0.48; the combined program also appeared to increase high school graduation by 14 percentage points (a 40 percent hike). The authors concluded that this intervention seemed to yield larger gains in adolescent outcomes per dollar spent than many other intervention strategies.

These studies are highlighted for several reasons. First, they represent new, *randomized controlled trials*, the “gold standard” of research supporting the efficacy of tutoring. Second, they show that tutoring can work not only for elementary but also for high school students, whereas most of the tutoring research addresses only elementary-aged students. Third, they show that tutoring can work even in the most challenging educational environments. And fourth, they bolster the EB argument below that extra help resources in schools triggered by poverty/at risk status should also include some non-academic, counseling resources, as the treatment in the second study was tutoring combined with counseling.

In earlier adequacy studies reports and even in the recently published 5th edition of our textbook (Odden & Picus, 2014), we recommended tutor positions be provided only on the basis of at-risk student counts. The recommended ratio was one position for every 100 at risk students with a minimum of one for each prototypical school. As a result, a school without any at-risk students would receive the minimum of 1 tutor position for struggling students, but a school with 100 at-risk students would receive the same tutoring or Tier 2 intervention resources, even though it might have more need for such additional resources. Today, educators and policymakers across the country not only argue that schools with few low-income students still have students who struggle to learn to proficiency, but also that the number of such students will likely increase with the more rigorous college and career ready standards. We agree with those arguments and have modified the EB recommendations for tutoring resources as a result.

The revised EB model provides one tutor/Tier 2-intervention position in each prototypical school. In parallel with that change, the EB model adjusts the ratio for additional tutor positions to one position for every 125 at-risk and ELL students. The additional support beyond the first tutor per prototypical school is discussed again in Section 22 (struggling students) below.

The revised EB recommendation for tutor/Tier 2-intervention positions is more generous than the previous recommendation of 1/100 at-risk or ELL students with a minimum of one for each prototypical school. In the above example, a prototypical school with no at-risk or ELL students would receive 1.0 position, as would a prototypical school with 100 at-risk or ELL students. The revised EB recommendation would provide 1.0 position to the school with no at-risk or ELL students, but would provide a 1.0 core tutor position for a school with 100 at-risk of ELL students plus an additional 0.8 (100/125) position for the 100 at-risk or ELL students, for a total of 1.8 positions.

7. Substitute Teachers

Schools need substitute teachers to cover classrooms when teachers are sick for short periods of time, absent for other reasons, or on long term sick or pregnancy leave. In many other states, substitute funds are budgeted at a rate of about ten days for each teacher. The current EB model

approach of providing funding equal to five percent of the cost of teacher salaries approximates that ten-day figure.

Current EB Recommendation
5% of core and elective teachers, instructional coaches, tutors (and teacher positions in additional tutoring, extended day, summer school and ELL).

Analysis and Evidence

Five percent of a teacher work year equals approximately 10 days, so this provision provides up to ten days of substitute teacher resources for each teacher. This approach does not mean that each teacher is provided ten substitute days a year; it means the district receives a “pot” of money approximately equal to 10 substitute days per year for all teachers, in order to cover classrooms when teachers are sick for short periods, absent for other reasons, or on long term sick or pregnancy leave. This allocation is not for 10 days above what is currently provided; it simply is an amount of money for substitute teachers estimated at 10 days for each teacher on average. These substitute funds are not meant to provide for student free days for professional development. The professional development recommendations are fully developed in a separate section below (Element 16) and do not require substitute teachers.

8. Core Guidance Counselors and Nurses

The previous EB model provided student or pupil support resources without specifying guidance counselor or nurse positions. During the past five years, that approach has been changed to provide guidance counselor and nurse positions in the core program, and to provide additional pupil support positions (e.g., social workers and family liaison persons) on the basis of at-risk student counts as described in Element 23 below. Thus, core student support services now specify guidance counselor and nurse positions.

Current EB Recommendation
1 guidance counselor for every 357 PreK-5 students, changed to 1 per 300 Prek-5 students per Vermont standards.
1 guidance counselor for every 250 6-12 students, changed to 1 per 200 grade 6-12 students per Vermont standards.*
1 nurse for every 750 PreK-12 students, changed to 1 per 500 Prek-12 students per Vermont standards.

*Additional student support resources are provided on the basis of at-risk and ELL student counts in Element 23.

Analysis and Evidence

Schools need guidance counselors and nurses. For guidance counselors, the EB model uses the standards from the American School Counselor Association (ASCA). Those standards

recommend one counselor for every 250 secondary (middle and high school) students. This produces 1.8 pupil support positions for a 450-student prototypical middle school and 2.4 pupil support positions for a 600-student prototypical high school.

Vermont standards require secondary guidance counselors at the rate of 1 for every 200 students, which would produce 1.5 positions for a school with 300 students.

Today many states require guidance counselors in elementary schools as well. Moreover, even in states that do not require counselors at the elementary level, a growing number of elementary schools have begun to employ these personnel. Consequently, the EB model has been modified in recent years to include a minimum of one guidance counselor for a prototypical elementary school. The EB model provides additional pupil support personnel to schools on the basis of at risk student counts as described in Element 23 below.

Since the EB prototypical elementary school has 357 students, the elementary counselor ratio needs to be changed to 1 counselor position for every 300 elementary students per Vermont standards.

The physical and medical needs of students also have changed dramatically over the past several years. Many students need medications during the school day; often, school staff are required to administer such medications. Other students have additional medical or physical needs, and our experience in several states is that these needs have been growing over the past decade. Thus, the EB model has been enhanced to provide nurses as core positions. Drawing from the staffing standard of the National Association of School Nurses, the EB model now provides core school nurses at the rate of 1 FTE nurse position for every 750 students. However, Vermont standards require one nurse position for every 500 students.

9. Supervisory Aides

Supervisory aides are non-certified individuals who provide needed services and supervision needed in a school such as lunch duty, hallways and external door monitoring, and helping elementary students get on and off buses. Supervisory aides do not provide assistance to teachers inside or outside the classroom nor instruction of any kind to students.

Current EB Recommendation
1 for every 178.5 elementary students
1 for every 225 middle school students
1 for every 200 high school students

Analysis and Evidence

Elementary, middle, and high schools need staff for responsibilities that include lunch duty, before and after school playground supervision, sometimes bus duty and other responsibilities that do not require a licensed teacher. Covering these duties generally requires an allocation of

supervisory aides at about the rate of 2.0 FTE aide positions for a school of 450 students. This ratio has been adapted to the Vermont specific prototypical schools.

Research does not support the use of instructional aides for improving student performance. The Tennessee STAR study (described in element 2 above), also produced evidence that instructional aides in a regular-sized classroom do not add instructional value, i.e., do not positively impact student achievement (Gerber, Finn, Achilles & Boyd-Zaharias, 2001).

At the same time, districts may want to consider a possible use of instructional aides that is supported by research. Two studies have shown how instructional aides could be used to tutor students. Farkas (1998) has shown that if aides are selected according to clear and rigorous literacy criteria, are trained in a specific reading tutoring program, provide individual tutoring to students in reading, and are supervised, then they can have a significant impact on student reading attainment. Some districts have used Farkas-type tutors for students still struggling in reading in the upper elementary grades. Another study by Miller (2003) showed that such aides could also have an impact on reading achievement if used to provide individual tutoring to struggling students in the first grade.

We note that neither of these studies supports the typical use of instructional aides as general teacher helpers. Evidence shows that instructional aides can have an impact, but only if they are selected according to educational criteria, trained in a specific tutoring program, deployed to provide tutoring to struggling students, and closely supervised.

10. Librarians

Most schools have a library, and the staff resources must be sufficient to operate the library and to incorporate appropriate technologies into the library system.

Current EB Recommendation

1.0 librarian position for each prototypical school down to 300 students,
then prorated down, with a minimum of 0.5 for smaller schools.

1.0 librarian aide prorated up from 300 to 600 students.

Analysis and Evidence

There is scant research on the impact of school librarians on student achievement. In 2003, however, six states conducted studies of the impacts of librarians on student achievement: Florida, Minnesota, Michigan, Missouri, New Mexico, and North Carolina. In 2012, Colorado also conducted a statewide study using data from 2005-2011. The general finding is that, regardless of family income, children with access to endorsed librarians working full time perform better on state reading assessments (Rodney, M.J., Lance, K.C. & Hamilton-Rennell, C, 2003; Lance, K.C. & Hofschire, L, 2012). The Michigan study found that regardless of whether the librarian was endorsed, student achievement was better for low-income children, but having an endorsed librarian was associated with higher achievement than having an unendorsed

librarian (Rodney, M.J., Lance, K.C. & Hamilton-Rennell, C, 2003). Each state examined the issue differently, but library staffing and the number of operating hours were generally associated with higher academic outcomes. The EB model recommendation for library staff is derived from best practices in other states, state statutes where they exist and the above research.

This recommendation aligns with standards for library programs for Vermont schools, which state that, “The services of a certified library media specialist shall be made available to students and staff. Schools with over 300 students shall have at least one full-time library media specialist and sufficient staff to implement a program that support literacy, information and technology standards. Schools with fewer than 300 students shall employ a library media specialist on a pro-rata basis.”

11. Principals and Assistant Principals

Every school unit needs a principal. There is no research evidence on the performance of schools with or without a principal. All comprehensive school designs, and all prototypical school designs from all professional judgment studies around the country, include a principal for every school unit.

Current EB Recommendation

1.0 principal for the 357-student prototypical elementary school and down to the 119 student one section elementary school.

1.0 principal for the 450-student prototypical middle school and down to the 150 small middle school.

1.0 principal and 1.0 assistant principal for the 600-student prototypical high school, with the assistant principal eliminated at 300 students but a principal down to the 150 student high school.

Analysis and Evidence

Few if any comprehensive school designs for 500 students include assistant principal positions. Very few school systems around the country provide assistant principals to schools with 500 or fewer students. The EB model recommends that instead of one school with a large number of students, school buildings with large numbers of students be subdivided into multiple school units within the building, with each unit having a principal. This implies that one principal would be required for each school unit. The EB model provides one assistant principal for the prototypical high school, largely for discipline and athletics. Murphy (2016) provides a good overview of the key roles principals play in organizing schools to boost student learning.

12. School Site Secretarial Staff

Every school site needs secretarial support to provide clerical and administrative support to administrators and teachers, to answer the telephone, greet parents when they visit the school, and help with paperwork.

Current EB Recommendation

1 secretary position for every 178.5 elementary students
1 secretary position for every 225 middle school students
1 secretary position for every 200 high school students.

Analysis and Evidence

The secretarial ratios included in the EB model generally are derived from common practices across the country. There is no research on the impact that clerical staff have on student outcomes, yet it is impossible to have a school operate without adequate clerical staff support.

DOLLAR PER STUDENT RESOURCES

This section addresses areas that are resourced by dollar per student amounts, including gifted and talented, professional development, computers and other technology, instructional materials and supplies, and extra duty/student activities.

13. Gifted and Talented Students

A complete analysis of educational adequacy should include gifted and talented students, most of whom perform above state proficiency standards. This is important for all states whose citizens desire improved performance for students at all levels of achievement.

Current EB Recommendation

\$40 per student.

Analysis and Evidence

Research shows that developing the potential of gifted and talented students requires:

- Effort to discover the hidden talent of low income and/or culturally diverse students
- Curriculum materials designed specifically to meet the needs of talented learners
- Acceleration of the curriculum, and
- Special training in how teachers can work effectively with talented learners.

Discovering hidden talents in low-income and/or culturally diverse high ability learners

Research studies on the use of performance assessments, nonverbal measures, open-ended tasks, extended try-out and transitional periods, and inclusive definitions and policies show that these produce increased and more equitable identification practices for high-ability culturally diverse and/or low-income learners. Access to specialized services for talented learners in the elementary years is especially important for increased achievement among vulnerable students. For example, high-ability, culturally-diverse learners who participated in three or more years of specialized elementary and/or middle school programming, had higher achievement at high school graduation, as well as other measures of school achievement, than a comparable group of high-ability students who did not participate (Struck, 2003).

Access to curriculum

Overall, research shows that curriculum programs specifically designed for talented learners produce greater learning than regular academic programs. Increased complexity of the curricular material is a key factor (Robinson & Clinkenbeard, 1998). Large-scale curriculum projects in science and mathematics in the 1960s, such as the Biological Sciences Curriculum Study (BCSC), the Physical Science Study Committee (PSSC), and the Chemical Bond Approach (CBA), benefited academically talented learners (Gallagher, 2002). Further, curriculum projects in the 1990s designed to increase the achievement of talented learners in core content areas such as language arts, science, and social studies, produced academic gains in persuasive writing and literary analysis (VanTassel-Baska, Johnson, Hughes & Boyce, 1996; VanTassell-Baska, Zuo, Avery & Little, 2002), scientific understanding of variables (VanTassel-Baska, Bass, Ries, Poland & Avery, 1998), and problem generation and social studies content acquisition (Gallagher & Stepien, 1996; Gallagher, Stepien & Rosenthal, 1992).

Access to acceleration

Because academically talented students learn quickly, one effective option for serving them is acceleration of the curriculum. Many educators and members of the general public believe acceleration always means skipping a grade. However, there are at least 17 different types of acceleration ranging from curriculum compacting (which reduces the amount of time students spend on material) to subject matter acceleration (going to a higher grade level for one class) to high school course options like Advanced Placement or concurrent credit (Southern, Jones & Stanley, 1993). In some cases, acceleration means *content* acceleration, which brings more complex material to the student at his or her current grade level. In other cases, acceleration means *student* acceleration, which brings the student to the material by shifting placement. Reviews of the research on different forms of acceleration have been conducted across several decades and consistently report the positive effects of acceleration on student achievement (Gallagher, 1996; Kulik & Kulik, 1984; Southern, Jones & Stanley, 1993), including that of Advanced Placement classes (Bleske-Rechek, Lubinski & Benbow, 2004). Multiple studies also report participant satisfaction with acceleration and benign effects on social and psychological development.

Access to trained teachers

Research and teacher reports indicate that general classroom teachers make very few, if any, modifications for academically talented learners (Archambault, et al, 1993), even though talented students have mastered 40 to 50 percent of the elementary curriculum before the school year begins. In contrast, teachers who receive appropriate training are more likely to provide classroom instruction that meets the needs of talented learners. Students report differences among teachers who have had such training, and independent observers in the classroom document the benefit of this training as well (Hansen & Feldhusen, 1994). Curriculum and instructional adaptation requires the support of a specially trained coach at the building level, which could be embedded in the instructional coaches recommended above (Reis & Purcell, 1993). Overall, learning outcomes for high- ability learners are increased when they have access to programs whose staff have specialized training in working with high ability learners, which could be accomplished with the professional development resources recommended below. Overall, research on gifted programs indicates that the effects on student achievement vary by the strategy of the intervention. Enriched classes for gifted and talented students produce effect sizes of about +0.40 and accelerated classes for gifted and talented students produce somewhat larger effect sizes of +0.90 (Gallagher, 1996; Kulik & Kulik, 1984; Kulik & Kulik, 1992).

Practice implications

At the elementary and middle school levels, our understanding of the research on best practices is to place gifted students in special classes comprised of all gifted students and accelerate their instruction, because such students can learn much more in a given time period than other students. When the pull-out and acceleration approach is not possible, an alternative is to have these students skip grades in order to be exposed to accelerated instruction. Research shows that neither of these practices systemically produces social adjustment problems. Many gifted students get bored and sometimes restless in classrooms that do not have accelerated instruction. Moreover, both of these strategies have little or no cost, except for scheduling and training of teachers, resources for which are provided by Professional Development (Element 14). The primary approach to serving gifted students in high schools is to enroll them in advanced courses, such as advanced placement (AP) and International Baccalaureate (IB), to participate in dual enrollment in post-secondary institutions, or to have them take courses through distance learning mechanisms.

We confirmed our understanding of best practices for the gifted and talented with the directors of three of the gifted and talented research centers in the United States: Dr. Elissa Brown, Director of the Center for Gifted Education, College of William & Mary; Dr. Joseph Renzulli, The National Research Center on the Gifted and Talented at the University of Connecticut; and Dr. Ann Robinson, Director of the Center for Gifted Education at the University of Arkansas at Little Rock.

To implement additional practice implications, the University of Connecticut center developed a very powerful Internet-based platform, Renzulli Learning, which provides for a wide range of programs and services for gifted and talented students. Renzulli stated that such an approach was

undoubtedly the future for the very bright student and in 2005 could be supported by a grant of \$25 per student in a district. Field (2007) found that after 16 weeks, students given access to an Internet-based program, such as Renzulli Learning to read, research, investigate, and produce materials, significantly improved their overall achievement in reading comprehension, reading fluency and social studies.

Recently, Renzulli Learning was sold to Compass Learning, an educational organization headquartered in Austin, Texas with technology-based applications used around the country. Compass Learning has renamed the Renzulli Learning program GoQuest. According to the company's website,⁴ a student's first experience with Renzulli Learning is with the Renzulli Profiler, a detailed online questionnaire that allows the Renzulli software to generate a personal profile of each student's top interests, learning styles, and expression styles, making it easier for teachers to get to know their students and effectively differentiate instruction. Once a profile is generated, students and teachers may use it to guide their exploration of the 40,000 online educational resources in the Renzulli database. Students can engage in self-directed learning by exploring safe, fully-vetted resources that have been specifically matched to their individual profiles. Further, teachers can browse the database of resources to find activities that also align to specific objectives, skills, as well as State and Common Core Curriculum Standards.

This past summer, we spoke with a lead representative of Compass Learning, who described the attributes of Renzulli Learning and other products provided by Compass Learning. In that conversation, we confirmed a new pricing structure for Renzulli Learning. The cost today is \$40 per student for up to 125 students in a school, at which point the cost is \$5,000 for a school and all students have full access to the program.

Compass Learning also offers products that can be used for both teaching the regular curriculum and providing extra help to struggling students. These products integrate the instructional strategies with results of testing data from three of the most popular testing systems many districts use: the MAP results from Northwest Evaluation Association (NWEA), the STAR Enterprise assessments from Renaissance Learning, and Scantron. The costs of these additional Compass Learning programs range from \$70 to \$115 per student per program, and could be funded from a district's regular instructional and professional development budgets or the resources provided by the At-Risk or ELL programs.

Based upon our review of current costs for the Renzulli (GoQuest) program, the EB model now includes a rate of \$40 per student for school year 2016-17. This would allow all schools – small or large – to provide a high quality gifted and talented program option for every child.

⁴ <http://www.renzullilearning.com/whatisrenzullilearning.aspx>

14. Intensive Professional Development

Professional development (PD) includes a number of important components. This section describes the specific dollar resource recommendations the EB model provides for PD. In addition to the resources listed here, PD includes the instructional coaches described in Element 7 and the collaborative planning time provided by the provisions for elective or specialist teachers. Those staff positions are critical to an adequate PD program along with the resources identified in this section.

Current EB Recommendation

10 days of student-free time for training built into teacher contract year
\$125 per student for trainers
(In addition to instructional coaches (Element 5) and time for collaborative work provided by Element 4)

Analysis and Evidence

Effective teachers are the most influential factor in student learning (Rowan, Correnti & Miller, 2002; Wright, Horn & Sanders, 1997) and more systemic deployment of effective instruction is key to improving student learning and reducing achievement gaps (Odden, 2011a; Raudenbusch, 2009). All school faculties need ongoing professional development. Improving teacher effectiveness through high quality professional development is arguably one of the most important resource use strategies.

An ongoing, comprehensive and systemic professional development strategy is the way in which all the resources recommended in this report are transformed into high quality, Tier 1 instruction that increases student learning. Further, though the key focus of professional development is better instruction in the core subjects of mathematics, reading/language arts, writing, history and science, the professional development resources in the EB model are adequate to address the instructional needs for gifted and talented, special education, English language learning students, for embedding technology into the curriculum, and for elective teachers as well. Finally, all beginning teachers need intensive professional development, first in classroom management, organization and student discipline, and then in instruction. Finally, the most effective way to “induct” and “mentor” new teachers is to have them working in functional collaborative teacher teams, discussed above for Elements 4 and 5.

Fortunately, there is recent and substantial research on effective professional development and its costs (e.g., Crow, 2011; Odden, 2011b). Effective professional development is defined as professional development that produces change in teachers’ classroom-based instructional practice that can be linked to improvements in student learning. The practices and principles that researchers and professional development organizations use to characterize “high quality” or “effective” professional development draw upon a series of empirical research studies that linked program strategies to changes in teachers’ instructional practice and subsequent increases in student achievement. Combined, these studies and recent reports from Learning Forward, the

national organization focused on professional development (see Crow, 2011), identified six structural features of effective professional development:

- The *form* of the activity – that is, whether the activity is organized as a study group, teacher network, mentoring collaborative, committee or curriculum development group. The above research suggests that effective professional development should be school-based, job-embedded and focused on the curriculum taught rather than a one-day workshop.
- The *duration* of the activity, including the total number of contact hours that participants are expected to spend in the activity, as well as the span of time over which the activity takes place. The above research has shown the importance of continuous, ongoing, long-term professional development that totals a substantial number of hours each year, at least 100 hours and closer to 200 hours.
- The degree to which the activity emphasizes the *collective participation* of teachers from the same school, department, or grade level. The above research suggests that effective professional development should be organized around groups of teachers from a school that over time includes the entire faculty.
- The degree to which the activity has a *content focus* – that is, the degree to which the activity is focused on improving and deepening teachers’ content knowledge as well as how students learn that content. The above research concludes that teachers need to know well the content they teach, need to know common student miscues or problems students typically encounter while learning that content, and effective instructional strategies linking the two. The content focus today should emphasize content for college and career ready curriculum standards.
- The extent to which the activity offers opportunities for *active learning*, such as opportunities for teachers to become engaged in the meaningful analysis of teaching and learning, for example by scoring student work or developing, refining and implementing a standards-based curriculum unit. The above research has shown that professional development is most effective when it includes opportunities for teachers to work directly on incorporating the new techniques into their instructional practice with the help of instructional coaches (see also Joyce & Showers, 2002).
- The degree to which the activity promotes *coherence* in teachers’ professional development by aligning professional development to other key parts of the education system, such as student content and performance standards, teacher evaluation, school and district goals, and the development of a professional community. The above research supports tying professional development to a comprehensive, inter-related change process focused on improving student learning.

Form, duration, and active learning together imply that effective professional development includes some initial learning (e.g. a two-week – 10 day – summer training institute) as well as considerable longer-term work in which teachers incorporate the new methodologies into their actual classroom practice, with guidance provided by instructional coaches. Active learning implies some degree of collaborative work and coaching during regular school hours to help the teacher incorporate new strategies into his/her normal instructional practices. It should be clear that the greater the duration of the initial training as well as coaching, the more time is required of teachers as well as professional development trainers and coaches.

Content focus means that effective professional development focuses largely on subject matter knowledge, what is known about how students learn that subject, and the actual curriculum that is used to teach the content. Today, this means a curriculum program to ensure students are college and career ready when they graduate from high school. Collective participation implies that professional development includes groups of and at some point all teachers in a school, who then work together to implement the new strategies, engage in data-based decision-making (Carlson, Borman & Robinson, 2011) and build a professional community.

Coherence suggests that the professional development is more effective when the signals from the policy environment (federal, state, district, and school) reinforce rather than contradict one another or send multiple, confusing messages. Coherence also implies that professional development opportunities should be given as part of implementation of new curriculum and instructional approaches, today focusing on the Common Core curriculum. Note that there is little support in this research for the development of individually oriented professional development plans; the research implies a much more systemic approach.

Each of these six structural features has cost implications. Form, duration, collective participation, and active learning require various amounts of both teacher and trainer/coach/mentor time, during the regular school day and year and, depending on the specific strategies, outside of the regular day and year as well. This time costs money. Further, all professional development strategies require some amount of administration, materials and supplies, and miscellaneous financial support for travel and fees. Both the above programmatic features and the specifics of their cost implications are helpful to describe the resource needs of specific professional development programs.

From this research on the features of effective professional development, the EB model includes the following for a systemic, ongoing, comprehensive professional development program:

- Ten days of student free time for training via an extension of the teacher work year, and
- Funds for training at the rate of \$125 per student.

These resources are in addition to:

- Instructional coaches (Element 5), and
- Collaborative work with teachers in their schools during planning and collaborative time periods (Elements 4).

These resources and professional development elements are fully aligned with Vermont's professional development standards.

15. Instructional Materials

The need for up-to-date instructional materials is paramount. Newer materials contain more accurate information and incorporate the most contemporary pedagogical approaches. New curriculum materials are critical today as school systems shift to more rigorous college and career ready standards. To ensure that materials are current, twenty states have instituted adoption cycles in which they specify or recommend texts that are aligned to state learning standards (Ravitch, 2004). Up-to-date instructional materials are expensive, but vital to the learning process. Researchers estimate that up to 90 percent of classroom activities are driven by textbooks and textbook content (Ravitch, 2004). Adoption cycles with state funding attached allow districts to upgrade their texts on an ongoing basis instead of allowing these expenditures to be postponed indefinitely.

Current EB Recommendation

\$190 per student for instructional and library materials.

Analysis and Evidence

This section first addresses costs of instructional materials and second library materials.

Instructional Materials

Vermont has adopted the Common Core State Standards (CCSS) in Language Arts and Mathematics. Access to standards-aligned instructional resources is critical for teachers and students to successfully implement these standards. Vermont currently does not have textbook adoption cycles. However, it is wise for districts and schools to evaluate and review the uniformity and quality of the instructional materials and textbooks periodically, typically every six years or so. Adoption cycles backed by State funding for materials allow districts to upgrade their textbooks and instructional materials on an ongoing basis instead of postponing these purchases indefinitely. In 2004, 20 states had instituted adoption cycles in which they specify or recommend texts aligned to state learning standards (Ravitch). These cycles range from five to seven years. Vermont should consider a textbook adoption cycle as a mechanism of providing students with recent, relevant and reliable information. Textbook adoption is a time consuming, labor-intensive process; without state encouragement, these important decision processes can be delayed by districts for extended periods, to the detriment of the instructional programs and student learning.

The type and cost of textbooks and other instructional materials differ across elementary and secondary levels. Textbooks at the secondary level are more complex and thus more expensive. Elementary grades, on the other hand, use more workbooks, worksheets and other consumables than the secondary level. Both elementary and secondary levels require extensive pedagogical aides such as math manipulatives and science supplies that help teachers to demonstrate or present concepts using different pedagogical approaches.

Textbook prices range widely. At the high school level, textbooks can cost from \$80 to \$140. Most major textbook companies now offer electronic versions of their texts; however, contrary to popular belief, these versions can be more expensive than the paper-based texts. Some digital versions are offered with time-bound contracts, much like library database subscriptions, while others may require the purchase of the paper texts with the digital license. Most digital-only materials from standard publishers are the same price or are only marginally discounted from the paper-based version. Many publishers will offer to sell the paper-based texts with the electronic version for a 20% to 30% premium.

Unless Vermont decides to fund a one-to-one student computer program, it is not practical to rely exclusively on electronic-based textbooks. One-to-one programs also rely on home-based Internet connectivity. Until a one-to-one computer program is funded, it is necessary to continue to purchase paper-based textbooks to ensure all students have access to curriculum appropriate resources.

Considering the move to the CCSS, districts should focus on purchasing curriculum and instructional materials that will assist teachers to drive student success. The CCSS require more reading from information texts across all curricular subject areas. This necessitates the purchase of additional materials that have not been required prior to the implementation of these more rigorous curriculum standards Vermont and virtually all other states have adopted. A six-year standard adoption cycle would allow districts to purchase new and updated instructional materials for each course and subject every six years, ensuring curriculum materials are up-to-date. The resources provided by the \$170 per student allow school districts to have a six-year standard adoption.

With more rigorous curriculum standards as a backdrop, the current EB recommendation is to create one unified rate of instructional materials per ADM, regardless of whether the student is an elementary or secondary school student. For school year 2016-17, the rate of \$170 per student will support the purchase of instructional materials that are best organized to take advantage of Vermont teaching strategies. This funding level would also allow the purchase of digital access to some textbooks if districts desire to adopt and experiment with digital access to textbook materials. If combined with a regular adoption cycle, this annual allocation will allow districts to focus on purchasing new curricular materials for one subject area a year, including textbooks and supplementary materials, all of which are needed to enable teachers to raise student achievement.

Library Materials

The National Center for Educational Statistics (NCES) reports the average national expenditure for library materials in the 2011-12 school year was \$16 per pupil, excluding library salaries (NCES, 2015). Over 90% of the \$16 was spent on book titles and the remainder on other resources such as subscription databases. In the past, electronic databases were increasing in use, however use has declined in recent years as many instructional resources such as the Khan Academy and Wikipedia are offered free to the public.

Electronic database services vary in price and scope and are usually charged to school districts on an annual per student basis. Depending on the content of these databases, costs can range from \$1-5 per database per year per student.

Inflating these numbers to adequately meet the needs of school libraries, the EB recommendation includes funding of \$20 per student to pay for library texts and electronic services. These figures modestly exceed the national average, allowing librarians to strengthen print collections. At the same time, it allows schools to provide, and experiment with, the electronic database resources on which students rely (Tenopir, 2003).

Adding this \$20 per student figure to the \$170 per student figure for instructional materials, brings the current EB recommendation to \$190 per student for instructional and library materials for school year 2016-17.

16. Short Cycle/Interim Assessments

The need to monitor the progress of students with Individual Education Programs, to benchmark students' progress over the course of the year, and for teachers to engage in collaborative work using student data, requires that faculties have access to short cycle, interim assessment data.

Current EB Recommendation

\$25 per student for short cycle, interim and formative assessments.

Analysis and Evidence

Data-based decision-making has become an important element in school reform over the past decade. It began with the seminal work of Black and William (1998) on how ongoing data on student performance could be used by teachers to frame and reform instructional practice, and continued with current best practice on how professional learning communities use student data to improve teaching and learning (DuFour, et al., 2010; Steiny, 2009). The goal is to have teachers use data to inform their instructional practice, identify students who need interventions and improve student performance (Boudett, City & Murnane, 2007). As a result, data-based decision-making has become a central element of schools that are moving the student achievement needle (Odden, 2009, 2012).

Recent research on data-based decision-making has documented significant positive impacts on student learning. For example, Marsh, McCombs and Martorell (2010) showed how data-driven decision-making in combination with instructional coaches produced improvements in teaching practice as well as student achievement. Further, a recent study of such efforts using the gold standard of research – a *randomized controlled trial* – showed that engaging in data-based decision-making using interim assessment data improved student achievement in both mathematics and reading (Carlson, Borman & Robinson, 2011).

There is some confusion in terminology when referring to these assessment data. Generally, these student performance data are different from those provided by state accountability or summative testing, such as Vermont's end-of-year tests. The most generic term is "interim data," meaning assessment data collected in the interim between the annual administrations of state accountability tests, though some practitioners and writers refer to such data as "formative assessments." There are several kinds of such "interim" assessment data. Benchmark assessments, short cycle or formative assessments, screeners, and other student performance data gathered between the annual administrations of state accountability assessments. The following discusses several of these systems.

NWEA MAP

According to the Measures of Academic Progress (MAP) website, these assessments are electronically administered and scored achievement tests designed to measure growth in student learning for individual students, classrooms, schools, and districts. The tests provide accurate and immediate scores to help teachers plan instructional programs, place new students in the appropriate courses, and screen students for special programs. MAP is a computerized adaptive testing system that tailors tests to a student's achievement level. Each student takes a test that is dynamically developed for him or her as the test is being administered. The program instantly analyzes the student's response to each test question and, based on how well the student has answered all previous questions, selects a question of appropriate difficulty to display next. The standard package includes tests for reading, language usage, mathematics, and the upper math series (Algebra I, Geometry, Algebra II, Integrated Math I, and Integrated Math II). A science assessment has recently been added to the MAP package. Further, NWEA has created a Skills Navigator for math and reading that can be used to progress monitor students receiving interventions. The Navigator is also an on-line assessment.

MAP assessments, which usually are administered in September, January and May and represent "benchmark" assessments, i.e., assessments that show how students are progressing over the course of the year to state proficiency. In the fall, the results from the screener portion of the MAP can be used to place students into small reading or math groups, and to identify appropriate interventions.

The core MAP assessments can be administered three to a maximum of four times a year. The cost for the reading, language usage and math assessments is \$13.50 per student per year. The new science test costs an additional \$2.50 per pupil. The Skills Navigator used for monitoring the progress of students with interventions can be administered as often as needed and costs \$7 per student and covers both reading and math. All together these assessments would cost \$23 per pupil. NWEA would negotiate a lower cost if the state negotiated a deal and paid for all students.⁵

⁵ These cost figures were obtained from an NWEA state liaison for the MAP assessments, Carolyn Mock.

DIBELS

One assessment used across the country is the Dynamic Indicators of Basic Early Literacy Skills (DIBELS). DIBELS includes a set of procedures and measures for assessing the acquisition of early literacy skills from kindergarten through sixth grade. They are *administered by teachers* and designed to be short (one to six minute) fluency measures used to regularly monitor the development of early literacy and early reading skills. DIBELS is comprised of seven measures to function as indicators of phonemic awareness, alphabetic principle, accuracy and fluency with connected text, reading comprehension, and vocabulary. DIBELS were designed for use in identifying children experiencing difficulty in acquisition of basic early literacy skills in order to provide support early and prevent the occurrence of later reading difficulties. The cost is a nominal \$1 per student.

Sometimes DIBELS is administered by instructional coaches, guidance counselors, Title I teachers, or a trained paraprofessional, but not by the student's classroom teacher. Under these circumstances, the assessment data must then be provided to teachers if they are to use the results in classroom activities. It is best for classroom teachers to administer all short cycle assessments.

AIMSWEB

Another assessment that is frequently used in Vermont is AIMSWEB. AIMSWEB, now owned by Pearson, is an assessment system that provides up to 33 alternate forms per skill, per grade. AIMSWEB covers more skill areas and grade levels than any other assessment system. Although browser-based scoring allows teachers to automatically upload scores to the AIMSWEB database system, the assessment itself is administered to each individual student by the teacher. AIMSWEB assessments include:

- Reading: early literacy, Spanish early literacy, reading (English and Spanish) and reading maze.
- Language arts: spelling and written expression.
- Mathematics: early numeracy, math concepts and applications, and math computations.
- Behavior: Exclusive screening, monitoring, and intervention tools for behavior and social skills.

The complete AIMSWEB package costs \$6 per student.

FAST, Renaissance Learning, and STAR Enterprise

More schools are shifting to online, computer adaptive assessment systems linked to a learning progression. One such system is FAST, a system covering both reading and mathematics available for low cost from the University of Minnesota. Another system is Renaissance Learning STAR Enterprise, which includes Early Literacy, Math and Reading. These systems require much less staff time than the aforementioned teacher administered assessments as students can take these assessments virtually on their own. Since they are online, computer adaptive systems, they provide immediate feedback to teachers and include many instructional

strategies to address any learning needs identified by the results. Both of these assessments can be administered as often as needed, at no extra cost, so they work well for progress monitoring.

The STAR Assessment programs support “instructional decisions, RTI, and instructional improvement” by measuring student progress in early literacy, reading, and math. The early literacy program measures student proficiency from the pre-kindergarten to grade 3. The reading and math programs assess student skills for grades 1 to 12. STAR tests are administered in an on-line, computer adaptive format. A science program is being developed. The math and language arts assessments have been modified to align with the expectations of Common Core standards. The new STAR 360 is a comprehensive K-12 assessment package, allowing educators to screen and group students for targeted instruction, measure student growth, predict performance on PARCC exams, and monitor achievement on Common Core State Standards. STAR 360 includes all the features of STAR Reading, STAR Math, and STAR Early Literacy, giving educators valid, reliable, actionable data in the least amount of testing time. It can be used for screening, benchmarking, student growth measurement, progress monitoring, and instructional planning. Educators have immediate access to the data and insights they need to improve student outcomes on PARCC exams.

Subscriptions to STAR products cost \$3.80 per student for each of math, reading and early literacy, and the smallest subscription size available is 100 students. The more comprehensive subscription, STAR 360, costs \$11.45 per student. In addition to the per student subscription fee, subscribers must pay a small annual fee (\$500 in 2013) for online product hosting services. New subscribers to STAR pay a one-time licensing fee of \$1,600.

Addressing the Costs of Assessment

Though districts need interim assessments to provide teachers with interim data for instructional decision making, grouping students, identifying appropriate interventions for struggling students, and monitoring the progress of all students, many districts have adopted too many and often overlapping assessments. DIBELS is largely a screener assessment. But AIMSWEB, FAST, MAP and STAR also can function as screeners. Districts do not need both DIBELS and one of FAST, MAP or STAR. Further, DIBELS and AIMSWEB (until recently), while popular, also require *teachers* to administer the assessments so consume teacher time. For these reasons, the online, computer adaptive assessments – STAR, MAP and FAST – have become more popular in many places, often replacing both DIBELS and AIMSWEB.

For more information about benchmark assessments, Hanover Research⁶ recently completed an extensive review of the above and other interim assessment systems, including costs and ratings of them from the National Center for Response to Intervention.

The EB Model now provides \$25 per pupil for short cycle, interim assessments, encouraging schools to take a parsimonious approach to these performance data. Indeed, the Renaissance Learning STAR assessments can function as both interim and benchmark assessments, can be used to progress monitor students with IEPs, include both math and reading Preschool-12, and

⁶ Hanover Research. (2013). *Review of K12 Literacy and Math Progress Monitoring Tools*. Washington, D.C.

cost less than this figure. In fact, some districts have dropped Scantron, NWEA MAP, and AimsWeb assessments and replaced them with just the single STAR Enterprise system that provides all the information of the previous three, and at a lower overall cost.

17. Computers, Technology and Equipment

Over time, schools need to embed technology in instructional programs and school management strategies. Today, more and more states require students not only to be technologically proficient but also to take some courses online in order to graduate from high school. Further, there are many online education options, from state-run virtual schools such as those in Florida and Wisconsin, to those created by private sector companies who run many virtual charter schools, such as K12 Inc. and Connections Academy. “Blended instructional” or “the flipped classroom” models, such as Rocketship, have also emerged (Whitmire, 2014). These programs infuse technology and online teaching into regular schools, provide more 1-1-student assistance, and put the teacher into more of a coaching role (see Odden, 2012). Research also shows that these technology systems work very well for many students, and can work very effectively in schools with high concentrations of lower income and minority students (Whitmire, 2014). Moreover, they can be less costly than traditional public schools (Battaglino, Haldeman & Laurans, 2012; Odden, 2012).

Current EB Recommendation

\$250 per student for school computer and technology equipment.

Analysis and Evidence

School-based technology and equipment provide access to a myriad of resources including the Internet, instructional software, multimedia resources, 21st Century business tools, and opportunities for peer interventions and communication. Increasingly, schools are embedding technology into instructional programs and school management strategies. Further, there are many online education options, from state-run virtual schools such as those in Florida and Wisconsin, to those created by private sector companies that run many virtual schools, such as K12 Inc. and Connections Academy.

Technology allows teachers to use different strategies for organizing and presenting knowledge, thus providing more individualized and improved instruction. Teachers can enhance learning through strategies such as “blended instruction” or the “flipped classroom,” in which much of the instruction takes place online outside of the classroom, and the teacher provides individualized support and intervention in the classroom (Whitmire, 2014).

Infusing technology and online teaching into schools can support one-to-one student assistance and put the teacher into more of a coaching role (see Odden, 2012). Research also shows that technology systems work very well for many students, and can work effectively in schools with high concentrations of lower income and minority students (Whitmire, 2014). Moreover, they can be less costly than traditional public schools; in fact, some virtual schools cost only half the

amount of traditional brick and mortar schools (Battaglino, Haldeman & Laurans, 2012; Odden, 2012).

Infusing technology into the school curriculum has associated costs for computer hardware, networking equipment, software, training and personnel associated with maintaining and repairing these machines. If these technology elements are not maintained and updated, teachers and students will become disengaged and learning opportunities will be lost.

Purchasing and embedding technology into the operation of schools has both direct and indirect costs. Direct costs include expenditures for the hardware, software, and labor costs for repairing and maintaining the infrastructure and machines. Indirect costs include the expenditures for professional development, loss of time for self-support and casual learning, and additional hours of user application development. This section of the EB Model focuses on direct technology costs, as the indirect costs of training and ongoing professional development are addressed in other model elements.

The EB Model assumes that no Vermont school is beginning at a baseline of zero. All Vermont schools have a variety of computers of varying ages, the large majority of which are connected to school networks and the Internet. Schools have been wired and most are now adding Wi-Fi capabilities and increasing bandwidth. The EB Model assumes major capital expenses such as access to fiber optics have been covered, or will be covered, with other capital funds.

The cost analysis does include funds for upgrading network switchgear and central servers that occur in the normal course of maintenance.

We refer readers to more detailed analysis of the costs of equipping schools with ongoing technology materials (Odden, 2012) that was spearheaded by Scott Price, now Chief Financial Officer for the Los Angeles County Office of Education, and who also wrote the bulk of this section. The analysis estimated four categories of technology costs totaling \$250 a student. The amounts by category should be considered flexible, as districts and schools need to allocate dollars to their highest technology priority outlined in state and district technology plans.

The per-student costs for each of the four subcategories are:

- Computer hardware: \$71
- Operating systems, productivity and non-instructional software: \$72
- Network equipment, printers and copiers: \$55
- Instructional software and additional classroom hardware: \$52.

This per student figure is sufficient for schools to purchase, upgrade and maintain computers, servers, operating systems and productivity software, network equipment, and student administrative system and financial systems software, as well as other equipment such as copiers. System software packages vary dramatically in price; the figure recommended would cover medium priced student administrative and financial systems software packages.

The \$250 per student figure, originally developed in 2006, updated in 2010 and reaffirmed in 2015, allows a school to have one computer for every two to three students. This ratio was sufficient to provide every teacher, the principal, and other key school-level staff with a computer, and to have an actual ratio of about one computer for every three-to-four students in each classroom.

Over the last few years, computer makers have developed alternative products, such as netbooks, Chromebooks and tablet computers that have a lower entry price point of about \$300 per unit compared to the \$500 to \$800 cost for laptop or desktop computers. For school districts that value lowering the student-to-computer ratio, purchase of these devices provides an opportunity to significantly increase the number of student devices when replacing traditional units at their end-of-life. By using non-traditional form factors with lower-priced units, districts can purchase more units and lower their student-to-computers ratios. Additionally, many times it is cheaper for a district to buy additional units of these less expensive computers than to purchase multi-year service agreements.

Though Chromebooks use a different operating system than typically used in the educational environment, most instructional and interactive testing software is browser-based, making the instructional software agnostic regarding operating systems. Additional software is being continually developed for these new platforms as they become more commonly used in the educational space. Google develops applications that will work offline when a Chromebook is not connected to the Internet. However, when the Chromebook is not connected to the Internet, the functionality of the applications may be limited. This can be a disadvantage for low-income students in one-to-one models or loan programs who do not have Internet access at home. Finally, Chromebooks and other such platforms are still not appropriate for the school or district administrative office functions.

As the ratio of these new devices to traditional devices increases there is opportunity for districts to explore one-to-one student-to-computer ratios at key grade levels. As high stakes computerized testing is pushed further into the primary grade levels, moreover, it is essential that students are able to comfortably use computers to demonstrate their knowledge. If students have not had sufficient practice with computers in a testing environment, computerized testing can become a barrier to successfully assessing student achievement. If students cannot comfortably type, text responses become more of a test of “hunt and peck” skills than a reflection of the student’s ability to respond to a prompt.

As Vermont moves to online testing, districts will need to increase the number of devices they have and expand their Internet bandwidth to accommodate this testing. Students will also have to become accustomed to using headphones that are required when testing groups of students together. Again, it is important that students feel comfortable with the computers they will use for testing so the hardware does not become a barrier to assessing student knowledge. Some students already may have some experience in online testing if they have used the NWEA MAP or Renaissance Learning STAR online assessment systems.

In considering the above factors, if a district begins to adopt a mix of standard and low cost units into district inventories, the “average” cost of a computer unit will drop depending on the percentage of higher and lower priced form factors. Despite this drop in average cost, the EB recommendation remains at \$71 per student for computer hardware, recognizing that introducing lower priced units will allow districts to move closer to a one-to-one student to computer ratio and improve refresh rates on all units. It will also allow students to experience a wider breadth of form factors that will better prepare them for the workplace.

In the past, the EB Model has recommended districts either incorporate maintenance costs into lease agreements or, if purchasing the equipment, buy 24-hour maintenance plans to eliminate the need for school or district staff to fix computers. For example, for a very modest amount, one can purchase a maintenance agreement from a number of computer manufacturers that guarantees computer repair on a next business day basis. In terms of educator concerns that it would be difficult for a manufacturer’s contractors to serve remote communities, the maintenance agreement makes meeting the service requirements the manufacturer’s or contractor’s problem and not the district’s problem. Many of the private sector companies that offer such service often take a new computer with them, leave it, and take the broken computer to fix, which often turns out to be more cost effective than to send technicians to fix broken computers. On the other hand, when districts analyze the cost of warranty programs for Chromebooks or similar low cost hardware, they may find it is more practical to replace broken machines than to pay for extended warranties.

As the number of computers in schools increases, it becomes more impractical to hard-wire connections into classrooms or other instructional spaces. Wireless connectivity is the only solution to creating an instructional environment in which Internet access is available anywhere, anytime on campus. Depending on campus configuration, it is possible to serve a small group of wireless computers with just a few wireless access points. However, as the number of computers being simultaneously used increases, additional access points must be added. The original EB Model technology and equipment figure of \$250 per pupil figure included funds to complete small on-campus infrastructure improvements.

The EB recommendation for technology remains at \$250. This figure has remained constant for several years. As technology has improved, price points for many technologies have remained fairly constant as the capacity and demands increase. While general computer and server costs have declined, other technology costs have risen. For example, as the need for bandwidth has increased, the older network switches with speeds of 100 megabits have been replaced with gigabit switches that cost the same as a 100 megabit seven years ago. If Vermont funds school-based technology and equipment at \$250 per ADM, districts will be able to gradually upgrade necessary network equipment within their campuses and to lower their student-to-computer ratios using a mixture of traditional and new devices.

One-to-One Computing [Optional Consideration]

One-to-one computing, meaning each student is issued a laptop to use in all classes and at home, has been successfully implemented in some grade levels in districts across the country. Maine,

which began a program of providing every student with a computer, has one of the longest running implementations of such a program.

Districts and schools usually begin one-to-one programs by assigning computers at a specific grade level and then letting the students use the computers as they advance to the next grades. In this manner, districts can build a one-to-one computer program over a series of years.

One-to-one programs are very expensive. These programs raise the cost of all four areas of the previously listed formula, namely: 1) computer hardware, 2) operating systems, productivity and other non-instructional software, 3) network equipment, bandwidth, Wi-Fi coverage, and 4) instructional software.

The largest increase occurs in computer hardware. In a one-to-one program, districts need to purchase a business grade laptop, approximately \$850 for a Windows-based machine, with a three-year warranty, which accounts for \$120 of the cost. A cost of \$850 may seem to be a high price for a laptop when local office superstores advertise a Windows 8, or now Windows 10, laptop for as little as \$300. However, these less expensive laptop models are consumer grade and many come with very limited, short-term warranties. Implementing a one-to-one laptop program requires districts to utilize a business-grade model of laptop specifically designed for a large enterprise like a school district.

The business-grade laptop model is designed with stronger materials to guard against wear-and-tear that occurs in the normal course of usage. It is a machine that has advanced specifications to ensure its relevance and usefulness over the four years a student will use the laptop. The laptop is based on standardized parts from the same manufacturer. This type of design provides a “constant” form factor with hardware components requiring only one set of common software drivers. This consistent design simplifies maintenance allowing a machine to be re-imaged in a few hours instead of requiring a technician to search for unique hardware drivers, recreate network settings, install print drivers and perform other such time-consuming tasks.

The Chromebook does present a less expensive platform than a Windows-based machine. Though Chromebooks have been used successfully at all grade levels, they are most commonly used in the primary grades. Chromebooks use Google Apps, which provide a basic word processor and presentation software. Google Apps has a much more limited set of features than Microsoft or Apple productivity suites. Google Apps utilize cloud computing, meaning the software resides on a server in an offsite location accessible by the Internet. If a Chromebook does not have Internet access, Google Apps become even more limited. This means if a student takes a Chromebook home, but does not have Internet access there or cannot configure their Internet access to connect the Chromebook, then its value at home to the student becomes nominal.

For secondary students, a Windows or Apple platform helps prepare students for the workplace and/or the postsecondary environment. A Windows or Apple based machine has access to the full suite of productivity software used in businesses whether online or offline. Apple and

Windows solutions also have robust image and video editing solutions not yet available with the Chromebook.

Apple has an excellent line of laptops for education. However, they are even more expensive than Windows-based platforms. This is the reason this analysis uses an enterprise grade, Windows laptop price to demonstrate the average cost of implementing a one-to-one program. Districts may be able to provide a one-to-one program for less by utilizing a Chromebook or other “netbook” platforms in the elementary grades, or even across grades. Other districts may choose the Apple platform, but should expect to spend additional funds for hardware.

The reason why the cost of a one-to-one program increases so quickly is the number of computers triples if a district has a three-to-one student to computer ratio. In a three-to-one ratio, three students bare the cost of one device over a four to five year timeframe. With a one-to-one program, one student carries the cost of one computer laptop over a shorter, three to four year period. To support the cost of an \$850 laptop, assuming a four-year computer refresh rate for both, a three-to-one student to computer ratio would require the support of just under \$71 per student ($\850 divided by 4 years equals \$212, that result divided by 3 students equals \$71 per student). In a one-to-one program, the same laptop would require the support of \$212 per student, three times the cost of the three-to-one ratio. The dynamics of this equation change with the device. Chromebooks would be less; laptops from Apple more.

Because going to a one-to-one ratio from a three-to-one ratio triples the number of computers, a tripling of the other three costs within the \$250 formula might be assumed. However, the cost curve is not as steep in the other three areas depending on the specific situation within each district.

For example, the \$250 per student formula sets aside \$55 per student for networking equipment, printers, and copiers. This figure presupposes capital costs for installation of district and school networks has already occurred and schools and districts are upgrading or replacing networking equipment such as switches and routers on a longer-term maintenance cycle. Considering the ongoing nature of the cost of these items, it would be very difficult to set aside funds from this area to extend the network or increase its capability, thus resources for copiers, printers, and the supplies needed to run these machines also come from this area.

To upgrade all district and school networks with the capacity to support a one-year implementation of a district wide one-to-one program would prove challenging and very expensive. Doubling or tripling the \$55 per student cost might not be sufficient to complete this type of effort. As Vermont moves statewide assessment online, it will need to invest in the schools’ networks in a more reasonable timeframe. To achieve a more sustainable pace of improving Internet access quality and coverage, the Legislature could double the \$55 network cost to \$110 per student, using the funds to extend their networks and increase bandwidth gradually. These are for within school costs such as switchgear at the main distribution facility (MDF) and in the intermediate distribution facilities (IDFs or switches for a building, or a building wing or even just a classroom) to handle the additional band width; additional IDFs in uncovered areas of the campus; wireless access points and wireless management software and

server; fiber and/or copper wire runs to those additional IDFS and wireless access; additional access points to infill the existing network because few classrooms have enough drops to connect each computer in one-to-one. IDfs are connected to the MDF, which is connected via routers to the Internet.

When districts in other states began computerized statewide assessments, many found the additional demand on their networks hindered a successful implementation of the testing. Networks simply had not been designed to handle the bandwidth necessary to adequately accommodate large numbers of computers all demanding bandwidth at once throughout all areas of the campus. Districts had to scramble to find funds to extend their networks, mainly through Wi-Fi, and increase their bandwidth by buying new switches and routers and converting older connections. One-to-one programs, if successfully implemented, can produce the same network demands of online testing each day of the school year.

To successfully implement one-to-one programs, all areas of the campus must provide Internet connectivity ensuring every student has access to sufficient bandwidth anytime and from any learning space within the campus. If students are dropped from the network or there is slow access, the learning process is interrupted and students are distracted. As Vermont implements more online assessments, it will be necessary to support districts in upgrading and extending their networks. In a high-stakes online testing environment, insufficient bandwidth will be a barrier to successful implementation and has the potential to mask student achievement.

Most campuses that have found the need to upgrade and extend their networks have chosen to do so through Wi-Fi. This is now the cheapest and most effective way to spread adequate bandwidth to all learning spaces. Large-scale implementation of Wi-Fi requires management software and hardware that can control and shift Wi-Fi resources based on the ebb and flow of need during the school day. Managed Wi-Fi is important in a non-one-to-one environment and absolutely necessary in a densely packed one-to-one situation. District technology personnel need the "dashboard" types of management that helps them understand bandwidth pinch points. Management of the Wi-Fi network creates an ongoing additional cost to the networking element of the formula.

It should be noted that once a network is "extended," meaning access points have been placed to provide sufficient bandwidth to all areas of the campus, the ongoing cost of this element would diminish, but would not return to the \$55 dollars per student as there are now more devices to maintain and replace in a natural maintenance cycle.

The other two elements of the formula deal with software, both enterprise software for financial and student systems and instructional software such as productivity or subscription-based data bases. The cost increase in these areas depends on the licensing. If licensing is per machine, then costs will increase as the numbers of computers rises. If the software is cloud-based and driven by the number of user logins, then additional machines will not generate additional costs. One example is the Microsoft Office package. Purchasing the license to install on a machine equates to a cost per machine; however, when using Office 365, the cost is per user and the user can download that package on multiple machines.

If all software were based on the number of logins and users, there would be no additional costs to these two software elements in a one-to-one implementation. However, if all software licenses were based on the number of computers on which the software resides, then the cost in this area would triple like the cost of the computers. The more likely scenario lies somewhere in between these extremes, with districts utilizing various products from the two different categories. For this reason, the one-to-one model estimates toward the middle, doubling the cost instead of tripling or projecting no increase at all. The actual cost will differ in each school district based on the mix it has. If extra funds are unspent in these two software elements, they should be directed to accelerate the network extension and the increase of bandwidth.

To summarize in Table 3.2, in a three-to-one student to computer ratio, the cost per student in the EB recommendation is \$250 per student. In a one-to-one environment, the cost rises to \$571 per student depending on the current networking capabilities of the district and its component schools and the software licensing agreements it maintains. It is important to note this does not include the increased costs for additional personnel needed to service the associated issues that come with three times as many computers.

Table 3.2: Cost of Implementing a 1-to-1 Student to Computer Ratio from a 3-to-1 Student to Computer Ratio.

Subcategory	3-to-1 Student-to-Computer Ratio	1-to-1 Student-to-Computer Ratio
Computer Hardware ⁷	\$71	\$213
Networking Equipment, Copiers, Printers	\$55	\$110
Non-Instructional Software	\$72	\$144
Instructional Software	\$52	\$104
Total Cost per Student	\$250	\$571

Benefits of One-to-One Computing

Advocates of one-to-one computing cite various benefits, including: improved student achievement (especially in writing skills), increased student engagement and collaboration, better implementation of project-based learning, an expansion of learning beyond the classroom, and instant access to information. Opponents claim it is difficult to isolate technology as the only contributing factor to these benefits. Other drawbacks mentioned include: the cost, need for increased student supervision, and the necessity to provide additional professional development to teachers and other district staff (Sauers & Mcleod, 2012; Jackson, 2009; Goodwin, 2011).

One of most important benefits of implementing a one-to-one program consists of extending the learning environment beyond the school day to the home. However, unless Internet access is

⁷ Costs are associated with implementing a one-to-one computing program with a full-featured Windows-based laptop. Computer hardware costs could be lowered significantly using Chromebooks. Cost savings would vary depending on the mix of platforms selected for the specific implementation.

ensured at a student's home and teachers use technology to change their strategies to take advantage of this access, then this benefit will be left unrealized.

One of the clear advantages of a one-to-one program is students collaborate more in off-hours on projects. This increases the frequency with which they practice writing and communicating in written and other forms. Once again this depends on the Internet access in the home.

Three basic scenarios exist regarding Internet access at home. If a student already has Internet access and a computer terminal provided at home for their use, it is likely that they will continue to use the home computer and the one-to-one laptop will remain in the backpack. Alternatively, if the student has Internet access at home but does not have access to a family computer, then the laptop would be used to varied success depending on whether the laptop could be configured to access the home connection and the software installed on the machine was cloud-based. In the third scenario, the student has no Internet access and no family computer available. In this case, the student will use the computer if applications are installed on the laptop, but would not be able to take full advantage of cloud-based software or even basic collaborative tools such as email or document sharing. In short, technology provides access to resources. One-to-one programs can extend access to technology beyond the school day if conditions are right to connect to the Internet in the home.

Successful one-to-one programs are driven by district/school leader advocates for these programs (Oliver, 2012). These programs demand a high level of coordination between the instructional and business sides of the school district. They require board and community support. This is why one-to-one is not a decision to be taken lightly and why states and/or districts usually experiment with pilot projects either at a school or grade level. If one-to-one programs were less complex and less expensive, many more districts and states would be implementing them.

Vermont may want to consider creating a specific competitive grant program for districts to institute one-to-one model programs that could be evaluated and emulated. Different form factors and platforms could be used to understand the strengths of each: Chromebook, Windows, and Apple. Different configurations of the one-to-one programs such as grade level, school level (elementary vs. secondary) and school site based, could be explored. Various successful programs have been implemented across the nation. This would give Vermont educators an opportunity to utilize one of these successful models to implement a program in its own educational environment.

The core EB recommendation for school-based computers and related technologies is \$250 per pupil.

18. Career Technical Education Teachers and Equipment/Materials

Vocational education, or its modern term, Career and Technical Education (CTE), has experienced a shift in focus during the past decade. Traditional vocational education focused on practical, applied skills needed for wood and metalworking, welding, automobile mechanics, typing and other office assistance careers, as well as courses in home economics. Today, many argue that voc-tech is more appropriately info-tech, nano-tech, biotech, and health-tech. The argument is that Career and Technical education should begin to incorporate courses that provide students with applied skills for new work positions in the growing and higher wage economy including information technologies (such as computer network management), engineering (such as computer-assisted design), a wide range of jobs in the expanding health portions of the economy and bio-technical positions – all of which can be entered directly from high school. The American College Testing Company and many policymakers have concluded that the knowledge, skills and competencies needed for college are quite similar to those needed for work in the higher-wage, growing jobs of the evolving economy, so all students need a solid academic high school program to be college and career ready when they graduate from high school.

Current EB Recommendation

\$10,000 per CTE teacher for specialized equipment.
Plus resources required to staff the 17 Vocational Technical Centers

Analysis and Evidence

A key question is whether new career and technical education programs require more resources. Many districts and states believe that new career-technical programs cost more than the regular program and even more than traditional vocational classes. However, in a review conducted for a Wisconsin school finance adequacy task force, a national expert on career-technical education (Phelps, 2006) concluded that the best of the new career-technical programs did not cost more, especially if the district and state made adequate provisions for professional development (as teachers in these new programs needed training) and computer technologies (as computer technologies were heavily used). These conclusions generally were confirmed by the cost analysis we conducted of Project Lead the Way (PLTW), one of the most highly rated and allegedly “expensive” career technical programs in the country.

PLTW (www.pltw.org) is a nationally recognized exemplar for secondary CTE education. Often implemented jointly with local post-secondary educational institutions and employer advisory groups, these programs usually feature project- or problem-based learning experiences, career planning and guidance services, and technical and/or academic skills assessments. Through hands-on learning, the programs are designed to develop the science, technology, engineering and mathematics (STEM) skills essential for achievement in the classroom and success in college or jobs not requiring a four-year college education. Today, PLTW is offered in more than 5,000 elementary, middle and high schools in all 50 states and enrolls over 500,000 students.

The curriculum features rigorous, in-depth learning experiences delivered by certified teachers, and end-of-course assessments. High-scoring students earn college credit recognized by more than 100 affiliated post-secondary institutions. Courses focus on engineering foundations (design, principles, and digital electronics) and specializations (e.g., architectural and civil engineering, bio-technical engineering) that provide students with career and college readiness competencies in engineering and science. Students need to take math through Algebra 2 in order to handle the courses in the program, which also meets many states' requirements for science and other mathematics classes.

The major cost areas for the program are in class size, professional development and computer technologies. Most programs recommend class sizes of 25, a figure larger than the secondary class sizes provided by the Vermont EB Funding Model. The professional development and most of the computer technology costs are covered through the professional development and technology components of the EB model.

However, a few of the PLTW concentration areas require a one-time purchase of expensive equipment. We checked with representatives of this program and confirmed that these costs can be covered by a \$10,000 allocation per career-technical education teacher. To implement this recommendation, Vermont would need to specify standards for career technical courses, and then collect the number of FTE career technical teachers for each school.

In Vermont, career and technical education is generally provided through 17 regional vocational technical centers or comprehensive high schools. Students who attend the centers are treated as enrolled at the secondary school they attend, and the cost of the technical centers is funded through state appropriations, tuition from the sending schools, and other career and technical education program grants. Funding through the EB model for these centers would largely be provided through the resources the students generate at their home schools and then sent to the regional technical center as tuition. Specific funding for the vocational technical programs would include \$10,000 for each full time CTE teacher either at the comprehensive high school or at each center, as well as resources for the specific staffing requirements of vocational technical centers (Sections 2370-2398 of the Vermont Education Code). In addition, the maintenance and operations costs of the stand-alone technical centers would need to be funded.

19. Extra Duty Funds/Student Activities

Elementary, middle, and high schools typically provide an array of non-credit producing after-school programs, from clubs and bands, to sports and other activities. Teachers supervising or coaching these activities usually receive small stipends for these extra duties.

Current EB Recommendation

\$300 per student for co-curricular activities including sports and clubs.

Analysis and Evidence

Research shows, particularly at the secondary level, that students engaged in student activities tend to perform better academically than students not so engaged (Feldman & Matjasko, 2005), although too much extra-curricular activity can be a detriment to academic learning (Committee on Increasing High School Students' Engagement and Motivation to Learn, 2004; Steinberg, 1996, 1997). Feldman and Matjasko (2005) found that participation in interscholastic (as compared to intramural) sports had a positive impact for both boys and girls on grades, post-secondary education aspirations, reducing drop-out rates, lowering alcohol and substance abuse, and led to more years of schooling. The effect was particularly strong for boys participating in interscholastic football and basketball. One reason for these impacts is that participation in interscholastic athletics placed students in new social groups that tended to have higher scholastic aspirations and those aspirations "rubbed off" on everyone. But the effects differed by race and gender, and were not as strong for African Americans.

During the past several years, the EB model has allocated between \$250 and \$300 per pupil for student activities, including inter-mural sports. These figures are in line with average amounts spent on such activities in many states. Currently, the EB model includes an overall figure of \$300 per pupil.

CENTRAL OFFICE FUNCTIONS

In addition to school-based resources, education systems also need resources for district level expenditures including operations and maintenance and the central office. The study does not address transportation. These are outlined below.

20. Operations and Maintenance

Computation of operations and maintenance costs is complicated by the lack of a strong or consistent research base. Many models allocate a percentage of current expenditures to operations and maintenance. The EB model uses formulas to compute the number of personnel needed *at the school level* for custodial, maintenance and grounds work.

Current EB Recommendation

Separate computations for custodians, maintenance workers and groundskeepers as outlined in the analysis and evidence section below.

Analysis and Evidence

Drawing on professional standards in the field as well as research, the EB method has conducted analyses of the cost basis for maintenance and operations (e.g., Picus & Odden, 2010; Picus & Seder, 2010). The discussion below summarizes the research on operations and maintenance, identifying the needs for custodians (school level), maintenance staff (district level) and groundskeepers (school and district level), as well as the costs of materials and supplies to support these activities.

Custodians

Custodians are responsible for the daily cleaning of classrooms and hallways as well as for routine furniture set-ups and take-downs. In addition, custodians often manage routine and simple repairs like minor faucet leaks, and are expected to clean cafeterias/multipurpose rooms, lockers and showers. Custodial workers' duties are time-sensitive, are structured and varied. Zureich (1998) estimates the time devoted to various custodial duties:

- Daily duties (sweep or vacuum classroom floors, empty trash cans and pencil sharpeners in each classroom, clean one sink with faucet, and ensure the security of rooms), which take approximately 12 minutes per classroom
- Weekly duties (dust reachable surfaces, dust chalk trays and clean doors, clean student desk tops, clean sink counters and spots on floors, and dust chalk/white boards and trays), each of which adds 5 minutes a day per classroom, and
- In addition to these services, non-cleaning services (approximately 145 minutes per day) provided by custodians include: opening school (checking for vandalism, safety and maintenance concerns), playground and field inspection, miscellaneous duties (teacher/site-manager requests, activity set-ups, repairing furniture and equipment, ordering and delivering supplies), and putting up the flag and PE equipment.

A formula that takes into consideration these cleaning and non-cleaning duties has been developed and updated by Nelli (2006). The formula takes into account teachers, students, classrooms, and gross square feet (GSF) in the school. The formula is:

- 1 Custodian for every 13 teachers, plus
- 1 Custodian for every 325 students, plus
- 1 Custodian for every 13 classrooms, plus
- 1 Custodian for every 18,000 Gross Square Feet (GSF), and
- The total divided by 4.

The formula calculates the number of custodians needed at prototypical schools. The advantage of using all four factors is that it accommodates growth or decline in enrollment and continues to provide schools with adequate coverage for custodial services over time.

Maintenance Workers

Maintenance workers function at the district level, rather than at individual schools. Core tasks provided by maintenance workers include preventative maintenance, routine maintenance and emergency response activities. Individual maintenance worker accomplishment associated with core tasks are: 1) HVAC systems, HVAC equipment, and kitchen equipment; 2) electrical systems, electrical equipment; 3) plumbing systems, plumbing equipment; and 4) structural work, carpentry and general maintenance/repairs of buildings and equipment (Zureich, 1998).

Zureich (1998) recommends a formula for maintenance worker FTEs incorporated into the funding model for instructional facilities as follows:

$$\begin{aligned} & [(\# \text{ of Buildings in District}) \times 1.1 + (\text{GSF}/60,000 \text{ SqFt}) \times \\ & \quad 1.2 + (\text{enrollment}/1,000) \times 1.3 \\ & \quad + \text{General Fund Revenue}/5,000,000) \times 1.2] / 4 \\ & = \text{Total number of Maintenance Workers needed.} \end{aligned}$$

A review of state facility standards suggests that for prototypical schools of the sizes used in the EB model, approximate gross square footage should be 63,000 for elementary and middle schools, and 110,000 for a high school. In addition, allowances are needed for central functions including a central office, warehousing and maintenance and operations facilities. We estimate these three facilities would require an additional 25,000 gross square feet of space. Maintenance and custodial supplies are estimated at \$0.70 per gross square foot, which for the prototypical district is 623,000 square feet.

Grounds Maintenance

The typical goals of a school grounds maintenance program are generally to provide safe, attractive, and economical grounds maintenance (Mutter & Randolph, 1987). This, too, is a district level function. Although groundskeepers generally work in teams and visit schools on a less than daily schedule, we have estimated groundskeeper resources on the basis of the number of schools. Specifically we have estimated that an elementary school needs the equivalent of 0.25 FTE groundskeeper staff, a middle school 0.5 FTE groundskeeper staff, and a high school 1.5 FTE groundskeeper staff.

Utilities

It is necessary to add the per student costs of utilities and insurance to these totals. It is unlikely that a district has much control over these costs in the short run and thus each district can best estimate future costs using their current expenditures for utilities and insurance as a base. The cost of utilities is estimated at \$26 per student.

21. Central Office Staffing/Non-Personnel Resources

All districts require central office staff to meet the overall management needs of the educational programs. We have developed a central office staffing recommendation based on school district size. The EB model assumes economies of scale as districts get larger, and provides estimated numbers of administrative (credentialed) and support (classified) staff at alternative district enrollments. The model has staffing resources for districts with fewer than 500 students to districts with more than 25,000 students. Because the largest district in Vermont has 4,000 students, our recommendations are based on districts up to that size. The model is flexible enough so that if a new supervisory district emerges with more than 4,000 districts in the future, resources can be estimated as well.

Current EB Recommendation

A dollar per student amount for central office staffing and non-personnel resources is computed based on the district's total enrollment.

Analysis and Evidence

Picus Odden and Associates has identified resources for central office positions in other reports and the most recent version of our textbook (see for example, Odden & Picus, 2014; Picus & Odden, 2010) drawing on a variety of research studies and professional standards for best practices. Over the past several years, we developed central office staffing recommendations in several states, including Maine, New Jersey, North Dakota, Washington, Wisconsin, Wyoming and Texas. In all states, we began our analysis with the research of Elizabeth Swift (2007), who used professional judgment panels to determine staffing for a prototypical district. That research addressed the issue of the appropriate staffing for a district of 3,500 students. Swift's work formed the basis of each state's analysis, although in three states (Washington, Wisconsin and North Dakota) we also conducted professional judgment panels to review the basic recommendations that emerged from Swift's research.

Through that work we were able to estimate the central office resources required for a district of 3,500 students. The initial studies provided for about 8 professional staff (superintendent, assistant superintendent for curriculum, business manager, and directors of human resources, pupil services, technology and special education) and nine clerical positions in a 3,500 student district. Although the research basis for staffing school district central offices is relatively limited, analysis of the Educational Research Service (2009) Staffing Ratio report shows that nationally school districts with between 2,500 and 9,999 students employ an average of one central office professional/administrative staff member for every 440 students (Educational Research Services, 2009). This equates to about eight central office professionals (7.95) in a district of 3,500 students. Our research-based staffing formula of 8 FTE professional staff matches the ERS estimate of 8 FTE central office staff for a school district of 3,500 students nationally.

Because the 3,500 student district size did not readily incorporate the EB model's prototypical schools, over the past few years we increased our prototypical district size to 3,900 students so it would be better aligned with our prototypical school sizes. A 3,900 student district would include four 450 student elementary schools, two 450 student middle schools, and two 600 student high schools. The 3,900 student school district also allowed us to add testing and evaluation, and central office computer staff, which, in our discussions with school districts it became clear are needed today. In recent studies, it was recommended that we add individuals who work with schools to provide first line help for technology – installing computers and their software, insuring that wireless systems operate, keeping printers operating, and related technical assistance to keep all computers operating. The recommendation was one school computer technician for every 600 students. These individuals would work in the schools, but because of the transitory nature of their work would be housed in the central technology office. This adds 6.5 positions to the central office staffing. We were also aware that the EB model has been short on central resources for special education and related services.

As a result of the limitations we identified in our central office model, in the summer of 2015, we asked a group of superintendents to design central office staff for several alternative district sizes. The three consultants we worked with are all former school superintendents and have nearly 100 years of school district administrative experience among them.

We asked them specifically to provide staffing recommendations for school districts with enrollments of 250, 500, 1,000, 2,000, 4,000 and 12,000 or more students. Because the largest district in Vermont has 4,000 students, we limit the discussion here to districts of 4,000 or less. In the discussion that follows, we first describe the approach our consultants took to estimating resources. Following that, we display the central office staffing recommendations that emerged from this process. The result is a staffing recommendation for school districts at each enrollment level.

Approach to Estimating Central Office Staffing

The consultants used their collective experience in school finance and budgets, leveraged their networks and relationships with numerous superintendents and chief business officials, reviewed district organizational studies and budgets, and analyzed district spending patterns to develop a set of templates for central office staffing. Specifically, they undertook the following tasks:

- Reviewed budgets and funding streams for districts of 250, 500, 1,000, 2,000, and 4,000 students (they also considered districts of 12,000, 25,000 and 50,000 students but those findings are not relevant in the Vermont context)
- Scrutinized organizational charts, administrative regulations and Board policies to review staffing needs, patterns and formulas that determine state and district expenditures for central office staff
- Interviewed superintendents and chief business officials to understand their thinking and rationale for organizational staffing and district spending
- Engaged in a two day conference to consider the staffing needs school districts require to successfully support the needs of a district's students at the district and school level
- Identified potential district office staffing templates for school districts that in their professional opinion adequately provide district offices with the necessary staff resources to provide support to their district school sites.

The consultants made a number of assumptions based on school district size. Because of Vermont's unique school district organizational structure (and the need to build a model that will help school districts model alternatives under Act 46), we adjusted their model assuming that very small districts (one or two schools) receive central offices from a Supervisory Union (SU), and that larger districts either are part of SUs, or are individual school districts. Our model will combine schools into their composite SUs, and we will treat central office functions at the SU or district level. The following assumptions were made for the central office staffing models:

- District/SU of 250 students
 - Support services such as special education services including occupational therapy, physical therapy, legal services, facilities support, grounds maintenance and transportation, and food services etc. would be contracted out
 - Instructional services, human resources, curriculum and assessment, special education and professional development would be the responsibility of the superintendent

- District/SU of 500
 - Support services such as some special education services including occupational therapy, physical therapy, legal services, and facilities support, grounds, maintenance, and transportation and food services etc. would be contracted out. However the increase in student enrollment would necessitate the need for some special educational services being provided in house
 - Instructional services, human resources, curriculum and assessment, special education and professional development would be the primary responsibility of the superintendent

- District/SU of 1,000
 - Support services such as some special education services including occupational therapy, physical therapy, legal services, some facilities support, and transportation etc. would be contracted out. However the continued increase in student enrollment would necessitate the need for additional support service services being provided in house both administratively and with clerical support.

- District/SU of 2,000
 - With the increase in enrollment the district now has the opportunity to provide district level resources and support in-house. This includes the sharing of responsibilities across divisions to provide the support schools and employees need. The individual school sites become increasingly autonomous and the superintendent provides both big picture and hands on leadership throughout the district.

- District/SU of 4,000 or greater
 - The size of the district now enables it to become a self-sufficient district that can operate on its own.

Central Office Staffing Recommendation

We asked the superintendent consultants to provide us with staffing recommendations for all of the central office positions a school district would need regardless of variations in state funding laws. Table 3.3 Displays the EB model recommendations for central office staffing for districts up to 4,000 students.

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Table 3.3: EB Model Central Office Staffing Recommendations

Office and Position	FTE							
	250		500		1,000		2,000	
	Admin	Class	Admin	Class	Admin	Class	Admin	Class
Total	3.5	3	4.5	5.5	8	9.75	15	15.25
Superintendent's Office								
Superintendent	1		1		1		1	
Clerk		0.5		1		0.5		1
Secretary/receptionist						0.75		1
Curriculum and Instruction/Ed Services								
Assistant Superintendent							0.5	
Director of Assessment and Accountability							0.5	
Director Early Childhood							1	
Clerk								
Secretary						0.5		1
Instructional Technology and Technology Network and Support								
Director	1		1		1		1	
Network Supervisor								0.5
Systems Supervisor						0.5		0.5
Technician		1		1		1.5		3.25
Secretary				0.5		0.5		0.5
Clerk		0.5						0.5
Human Resources/Personnel								
Assistant Superintendent					0.5		0.5	
Director	0.5		0.5				1	
Credential Specialist								
Personnel Technician				1		0.5		0.5
Secretary						0.5		0.5

Office and Position	FTE							
	250		500		1,000		2,000	
	Admin	Class	Admin	Class	Admin	Class	Admin	Class
Special Education								
Director			1		1		1	
Program Specialists							0.5	
Speech Pathologists							1	
Psychologists					1		2	
Secretary		0.5		0.5		1		1
Clerk								0.5
Business Office/Business Services								
Assistant Superintendent					0.5		1	
Director Fiscal Services	1		1				0.5	
Accounting Technician				1		1.5		1
Risk Manager							0.5	
Payroll/purchasing Clerks						1		1
Warehouse Manager								
Director Child Nutrition/food services					1		1	
Director Transportation					1		1	
Director M & O					1		1	
Clerk		0.5		0.5		1		1.5
Secretary								1

Central Office Non-Personnel Resources

In addition to staffing, central offices need a dollar per student figure for such costs as insurance, purchased services, materials and supplies, equipment, association fees, elections, district wide technology, communications, and other costs. That figures is approximately as \$350 per pupil.

RESOURCES FOR STRUGGLING STUDENTS

The core staffing section of this document contains positions for supporting teachers and students beyond the regular classroom core teacher. Those positions include elective or specialist teachers, tutors and pupil support personnel. However in many instances, *additional* support for struggling students is needed. The programs described in this section extend the learning time for struggling students in focused ways. The key concept is to implement the maxim of standards-based education reform: keep standards high for all students but vary the instructional time so all students can achieve to proficiency levels. The EB elements for extra help are also embedded in the “response to intervention” schema described at the beginning of this chapter.

It is important to note that we use two specific counts of pupils.

1. For programs that use an “at risk” count, the EB model includes an unduplicated count of students eligible for free and reduced meals, i.e., students eligible for free and reduced price lunch but who are not ELL students. All resources provided for at-risk students are also provided for ELL students. The EB model adopted the practice of using an unduplicated at-risk free and reduced price lunch eligible student count to ensure that all ELL students, regardless of poverty status, are eligible for the extra help strategies that most if not all ELL students need as they work to learn both content and a new language – English.
2. For the ELL program, the EB model uses the count of all ELL students regardless of free and reduced price lunch status.

The EB model provides substantial additional resources for students based on the at-risk and ELL student counts including tutoring, extended day, summer school, and pupil support. These resources for students struggling to achieve to academic standards should be viewed in concert with resources for students with identified disabilities. Districts sometimes over identify students for special education services as the “only” way to trigger more resources for some struggling students. The EB goal for a robust set of extra resources for struggling students triggered by at risk and ELL counts is to provide adequate resources for all struggling students, with or without a diagnosed disability, and to reduce over identification in special education.

This section includes discussion of seven categories of services: 1) tutoring, 2) additional pupil support, 3) extended day, 4) summer school, 5) programs for ELL students, 6) alternative schools, and 7) special education.

22. Tutors

The first strategy to help struggling students is to provide additional support as described in Element 8 above. In addition to the one core tutor position provided to every prototypical school discussed above for Element 6, the EB model provides additional tutor positions at the rate of one for every 125 at-risk and ELL students.

Current EB Recommendation

1.0 tutor position for every 125 non-ELL free and reduced price lunch eligible students, and 1.0 tutor position for every 125 ELL students (in addition to the one core tutor position in each prototypical school).
These positions are provided additional days for professional development (Element 14) and substitute days (Element 7) discussed above.

Analysis and Evidence

The most powerful and effective extra help strategy to enable struggling students to meet state College and Career Ready standards, including Common Core standards, is individual one-to-one tutoring provided by licensed teachers (Shanahan, 1998; Wasik & Slavin, 1993). Students who must work harder and need more assistance to achieve to proficiency levels especially benefit from preventative tutoring (Cohen, Kulik, & Kulik, 1982). Tutoring program effect sizes vary by the components of the approach used, e.g. the nature and structure of the tutoring program, but effect sizes on student learning reported in meta-analyses range from 0.4 to 2.5 (Cohen, Kulik & Kulik, 1982; Shanahan, 1998; Shanahan & Barr, 1995; Wasik & Slavin, 1993) with an average of about 0.75 (Wasik & Slavin, 1993).

The impact of tutoring programs depends on how they are staffed and organized, their relation to the core program, and tutoring intensity. Researchers (Cohen, Kulik, & Kulik, 1982; Farkas, 1998; Shanahan, 1998; Wasik & Slavin, 1993) and experts on tutoring practices (Gordon, 2009) have found greater effects when the tutoring includes the following:

- Professional teachers as tutors;
- Tutoring initially provided to students on a one-to-one basis;
- Tutors trained in specific tutoring strategies;
- Tutoring tightly aligned to the regular curriculum and to the specific learning challenges, with appropriate content-specific scaffolding and modeling;
- Sufficient time for the tutoring; and
- Highly structured programming, both substantively and organizationally.

We note several specific structural features of effective one-to-one tutoring programs:

- First, each tutor would tutor one student every 20 minutes, or three students per hour. This would allow one tutor position to tutor 18 students a day. (Since tutoring is such an intensive activity, individual teachers might spend only half their time tutoring; but a 1.0

FTE tutoring position would allow 18 students per day to receive 1-1 tutoring.) Four positions would allow 72 students to receive individual tutoring daily in the prototypical elementary and middle schools.

- Second, most students do not require tutoring all year long; tutoring programs generally assess students quarterly and change tutoring arrangements. With modest changes such as these, close to half the student body of a 400-student school unit could receive individual tutoring during the year.
- Third, not all students who are from a low-income background require individual tutoring, so a portion of the allocation could be used for students in the school who might not be from a lower income family but nevertheless have a learning issue that could be remedied by tutoring. This also is part of the rationale for including 1 tutor in each prototypical school, regardless of the number of at risk students.

Though this discussion focuses on *individual* tutoring, schools could also deploy these resources for small group tutoring. In a detailed review of the evidence on how to structure a variety of early intervention supports to prevent reading failure, Torgeson (2004) shows how one-to-one tutoring, one-to-three tutoring, and one-to-five small group sessions (all Tier 2 interventions) can be combined for different students to enhance their chances of learning to read successfully.

One-to-one tutoring would be reserved for the students with the most severe reading difficulties, scoring say, at or below the 20th or 25th percentile on a norm referenced test, or below basic level on state achievement tests. Intensive instruction for groups of three-to-five students would then be provided for students above those levels but below the proficiency level.

It is important to note that the instruction for all student groups needing extra help needs to be more explicit and sequenced than that for other students. Young children with weakness in knowledge of letters, letter sound relationships and phonemic awareness need explicit and systematic instruction to help them first decode and then learn to read and comprehend. As Torgeson (2004:12) states:

Explicit instruction is instruction that does not leave anything to chance and does not make assumptions about skills and knowledge that children will acquire on their own. For example, explicit instruction requires teachers to directly make connections between letters in print and the sounds of words, and it requires that these relationships be taught in a comprehensive fashion. Evidence for this is found in a recent study of preventive instruction given to a group of high at risk children in kindergarten, first grade and second grade [.....] only the most [phonemically] explicit intervention produced a reliable increase in the growth of word-reading ability ... schools must be prepared to provide very explicit and systematic instruction in beginning word-reading skills to some of their students if they expect virtually all children to acquire work-reading skills at grade level by the third grade Further, explicit instruction also requires that the meanings of words be directly taught and be explicitly practiced so that they are accessible when children are reading text.... Finally, it requires not only direct practice to build fluency.... but also careful,

sequential instruction and practice in the use of comprehension strategies to help construct meaning.

Torgeson (2004) goes on to state that meta-analyses consistently show the positive effects of reducing reading group size (Elbaum, Vaughn, Hughes & Moody, 1999) and identifies experiments with both one-to-three and one-to-five teacher-student groupings. Though one-to-one tutoring works with 20 minutes of tutoring per student, a one-to-three or one-to-five grouping requires a longer instructional time for the small group – up to 45 minutes. The two latter groupings, with 45 minutes of instruction, reduced the rate of reading failure to a miniscule percentage.

For example, if the recommended numbers of tutors are used for such small groups, one FTE reading position could teach 30 students a day in the one-to-three setting with 30 minutes of instruction per group, and 30+ students a day in the one-to-five setting with 45 minutes of instruction per group. Four FTE tutoring positions could then provide this type of intensive instruction for up to 120 students daily. In short, though we have emphasized 1-1 tutoring, and some students need 1-1 tutoring, other small group practices (which characterize the bulk of Tier 2 interventions) can also work, with the length of instruction for the small group increasing as the size of the group increases.

Though Torgeson (2004) states that similar interventions can work with middle and high school students, the effect is often smaller as it is much more difficult to undo the lasting damage of not learning to read once students enter middle and high schools with severe reading deficiencies. However, a new randomized control study (Cook et al., 2014) discussed below found similarly positive impacts of a tutoring program for adolescents in high poverty schools IF it was combined with counseling as well. This is made possible in the EB model as it includes such additional non-academic pupil support resources (see Element 23 discussion).

The rationale outlined above is strengthened by two recent *randomized controlled trials* of the effectiveness of tutoring for struggling students, which support our logic for providing a minimum level of tutor support in all schools as well as additional tutors for schools with greater need. At the elementary level, using a randomized controlled trial, May et al., (2013) assessed the impact of tutors in a Reading Recovery program. In the third year of a five-year evaluation, they found that Reading Recovery tutoring had an effect size of 0.68 on overall reading scores relative to the population of students eligible for such services in the specific study, and a 0.47 effective size relative to the national population of first grade struggling readers. The effects were similarly large for reading words and reading comprehensive sub-scales.

For students in high schools, Cook, et al. (2014) reported on a *randomized controlled trial* of a two-pronged intervention that provided disadvantaged youth with tutoring *and* counseling. They found that intensive individualized academic extra help – tutoring – combined with non-academic support seeking to teach grade 9 and 10 youth social-cognitive skills based on the principles of cognitive behavioral therapy (CBT), led to improved math and reading performance. The study sample consisted mainly of students from low income and minority backgrounds, who generally pose the toughest challenges. The effect size for math was 0.65 and

for reading was 0.48; the combined program also appeared to increase high school graduation by 14 percentage points (a 40 percent hike). The authors concluded that this intervention seemed to yield larger gains in adolescent outcomes per dollar spent than many other intervention strategies.

These studies are highlighted for several reasons. First, they represent new, *randomized controlled trials*, the “gold standard” of research supporting the efficacy of tutoring. Second, they show that tutoring can work not only for elementary but also for high school students, whereas most of the tutoring research addresses only elementary-aged students. Third, they show that tutoring can work even in the most challenging educational environments. And fourth, they bolster the EB argument below that extra help resources in schools triggered by at risk status should also include some non-academic, counseling resources, as the treatment in the second study was tutoring combined with counseling.

In earlier adequacy reports and in the recently published fifth edition of our textbook (Odden & Picus, 2014), we recommended tutor positions be provided only on the basis of at risk student counts. The recommended ratio was one position for every 100 at risk students but with a minimum of one for each prototypical school. As a result, a school without any at risk students would receive the minimum of one tutor position for struggling students, but a school with 100 at risk students would receive the same single tutor, even though it might have more need for tutor resources. Today, educators and policymakers across the country argue that schools with few low-income students still have students who struggle to learn to proficiency and that more rigorous college and career ready standards will lead to greater numbers of struggling students in the future. We find those arguments convincing and have modified the EB recommendations for tutoring resources.

The revised EB model provides one tutor per Tier 2-intervention position in each prototypical school. In parallel with that change, the EB model adjusts the ratio for additional tutor positions to one position for every 125 at risk and ELL students. The new EB recommendation for tutor per Tier 2-intervention positions is more generous than the previous recommendation of 1 tutor per 100 at risk students with a minimum of one for each prototypical school. For example, under the old EB model, a prototypical school with no at risk students would receive one position, as would a prototypical school with 100 at risk students. The revised EB model calls for 1.0 FTE position at a school with no at risk students. For a school with 100 at risk students, the model provides 1.0 FTE tutor position plus an additional 0.8 FTE (100/125) position for the 100 at risk students, for a total of 1.8 FTE positions. Both the old and revised EB models would provide 5 positions for a school with 500 at risk students.

23. Additional Pupil Support

Core pupil support positions for guidance counselors and nurses are discussed above in core resources as Element 10. At risk students, however, generally have more non-academic needs that should be addressed by additional pupil support staff, which could include more guidance counselors, as well as social workers, family liaison individuals, and psychologists. Thus, in addition to the core guidance counselor and nurse positions provided to every prototypical school discussed above for Element 10, the EB model provides additional pupil support position at the rate of one for every 125 at risk and ELL students.

Current EB Recommendation

1.0 pupil support position for every 125 non-ELL free and reduced price lunch eligible students, and 1.0 pupil support position for every 125 ELL students.

Analysis and Evidence

At-risk and ELL students tend to have more non-academic issues for schools to address. This usually requires interactions with families and parents as well as perhaps more guidance counseling in school. The EB model addresses this by providing more staffing resources to meet these needs. Although there are many ways schools can provide outreach to parents or involve parents in school activities – from fundraisers to governance – research shows that school-sponsored programs that have an impact on achievement address what parents can do at home to help their children learn. For example, if the education system has clear content and performance standards, such as the new college and career ready standards, programs that help parents and students understand both what needs to be learned and what constitutes acceptable standards for academic performance have been found to improve student outcomes. Parent outreach that explicitly and directly addresses what parents can do to help their children be successful in school, and to understand the standards of performance that the school expects, are the types of school-sponsored parent activities that produce discernible impacts on students' academic learning (Steinberg, 1997).

At the secondary school level, the goal of parent outreach programs is to have parents learn about what they should expect of their children in terms of academic performance. If either performance on end-of-course examinations or performance on comprehensive high school tests are required for graduation, such as Vermont's proficiency standards for high school graduation, they too should be discussed. Secondary schools need to help parents understand how to more effectively assist their children in identifying an academic pathway through middle and high school, understand standards for acceptable performance, and be aware of the course work necessary for college entrance. This is particularly important for parents of students in the middle or lower end of the achievement range, as often these students know very little of the requirements for transition from high school to post-secondary education (Kirst & Venezia, 2004).

At the elementary level, parent outreach and involvement programs should concentrate on what parents can do at home to help their children do academic work for school. Too often parent programs focus on fundraising through the parent-teacher organization, involvement in decision-making through school site councils, or other non-academically focused activities at the school site. Although these school-sponsored parent activities might impact other goals – such as making parents feel more comfortable being at school or involving parents more in some school policies – they have little effect on student academic achievement. Parent actions that impact learning would include: 1) reading to children at young ages, 2) discussing stories and their meanings, 3) engaging in open-ended conversations, 4) setting aside a place where homework can be done, and 5) ensuring that children complete homework assignments.

The resources in the EB funding model are adequate to create and deploy the ambitious and comprehensive parent involvement and outreach programs that are part of two comprehensive school designs: Success for All and the Comer School Development Program. The Success for All Program includes a family outreach coordinator, a nurse, a social worker, a guidance counselor and an education diagnostician, for a school with about 500 students. This group functions as a parent outreach team for the school, serves as case managers for students who need non-academic and social services, and usually includes a clothing strategy to ensure that all students, especially in cold climates, have sufficient and adequate clothes and coats to attend school.

The Comer Program was created on the premise of connecting schools more to their communities. Its Parent-School team has a somewhat different composition and is focused on training parents to raise expectations for their children's learning, to work with social service agencies, and to work with the school's faculty to raise their expectations for what students can learn. Sometimes the team co-locates on school site premises to provide a host of social services.

A program called Communities in Schools, which now operates in 26 states and the District of Columbia and can be resourced by the resources provided by this model component, has been successful in raising school attendance rates, as students need to attend school in order to learn. The program adds a caseworker, often trained in social work, to a school's pupil support team, to help match social services provided by non-educational agencies to students who need them.

24. Extended-day programs

At both elementary and secondary school levels, some struggling students are likely to benefit from after-school or extended-day programs, even if they receive tutoring/Tier 2 interventions during the regular school day. Extended-day programs are created to provide academic support as well as to provide a safe environment for children and adolescents to spend time after the school day ends during the regular school year.

Current EB Recommendation

1.0 FTE teacher position for every 120 at risk and ELL students.

The allocation of staff for extended-day programs is derived through the following process. We assume that extended day programs offer academic support for two hours a day five days a week for at risk and ELL students. We further assume that half of the eligible students will participate, and classes will be limited to 15 students each. Thus, if there are 120 eligible students, 60 will take advantage of the program, requiring four extended day classes of fifteen students. Teaching two hours a day is approximately 0.25 FTE, and since four classes are required, a total of 1.0 FTE teacher position is needed to serve the 120 eligible students. These positions are provided additional days for professional development (Element 14) and substitute days (Element 7).

Analysis and Evidence

In a review of research, Vandell, Pierce and Dadisman (2005) found that well designed and administered after-school programs yield numerous improvements in academic and behavioral outcomes (see also Fashola, 1998; Posner & Vandell, 1994). On the other hand, the evaluation of the 21st Century Community Learning Centers (CCLC) Program (James-Burdumy et al., 2005), though hotly debated, indicated that for elementary students, extended-day programs did not appear to produce measurable academic improvement. Critics of this study (Vandell, Pierce & Dadisman, 2005) argued that the control groups had higher pre-existing achievement, which reduced the potential for finding program impact. They also argued that the small impacts that were identified had more to do with lack of full program implementation during the initial years than with the strength of the program.

Overall, studies have documented positive effects of extended-day programs on the academic performance of students in select after-school programs (e.g., Takoata & Vandell, 2013; Vandell, 2014). However, the evidence is mixed both because of research methods (few randomized trials), poor program quality and imperfect implementation of the programs studied. Researchers have identified several structural and institutional supports necessary to make after-school programs effective:

- Staff qualifications and support (staff training in child or adolescent development, after-school programming, elementary or secondary education, and content areas offered in the program; staff expertise; staff stability/turnover; compensation; institutional supports)

- Program/group size and configuration (enrollment size, ages served, group size, age groupings and child-staff ratio) and a program *culture of mastery*
- Consistent participation in a structured program
- Financial resources (dedicated space and facilities that support skill development and mastery, equipment and materials to promote skill development and mastery, curricular resources in relevant content areas, and a location that is accessible to youth and families)
- Program partnerships and connections (with schools to connect administrators, teachers and programs; with larger networks of programs; with parents and community), and
- Program sustainability strategies (institutional partners, networks, linkages, community linkages that support enhanced services, long-term alliances to ensure long-term funding).

The resources recommended in the EB model could be used to provide struggling students in all elementary grades and in secondary schools with additional help during the school year but before or after the normal school day. Because not all at risk students need or will attend an after-school program, the EB model assumes 50 percent of the eligible at risk students will attend the program – a need and participation figure identified by Kleiner, Nolin and Chapman (2004). As a result, providing resources at a rate of 1.0 FTE teacher to 30 at risk students will result in class sizes of approximately 15 in extended-day programs.

The state should monitor over time the degree to which the estimated 50 percent figure accurately estimates the numbers of students needing extended-day programs. We also encourage Vermont to require districts to track the students participating in the programs, their pre- and post-program test scores, and the specific nature of the after-school program provided, to develop a knowledge base of which after-school program structures have the most impact on student learning. We recognize that how these extended-day services are provided will vary across Vermont's school districts, and that any monitoring of the impacts of these resources should focus more on impacts on student performance than on the strategy for providing the services. We also found that most of the schools we studied in other states that improved student performance had various combinations of before- and after-school extra help programs.

25. Summer School

Many students need extra instructional time to achieve to the state's high proficiency standards. Thus, summer school programs should be part of the set of programs available to provide struggling students the additional time and help needed to achieve to standards and earn academic promotion from grade to grade (Borman, 2001). Providing additional time to help all students master the same content is an initiative that is grounded in research (National Education Commission on Time and Learning, 1994). It should be noted that summer school services are provided outside of the regular school year.

Current EB Recommendation

1.0 FTE teacher position for every 120 at risk and ELL students

Resources for summer school are funded on the assumption that summer school programs are six to eight weeks long, with four or more hours of academic course work each day. We assume that half of the eligible students (at risk and ELL) will participate in classes of fifteen students. Although the total summer school hours are not equivalent to a 0.25 FTE teaching position, it is funded at this level under the assumption that teaching summer school requires additional planning time outside of class. Thus, 120 eligible students would generate 60 summer school participants in four classes of 15 each staffed by a 0.25 FTE teacher for a total of 1 FTE for each 120 eligible students.

Analysis and Evidence

Research dating back to 1906 shows that students, *on average*, lose a little more than a month's worth of skill or knowledge over the summer break (Cooper, Nye, Charlton, Lindsay, & Greathouse, 1996). Summer breaks have a larger deleterious impact on poor children's reading and mathematics achievement. This loss can reach as much as one-third of the learning during a regular nine-month school year (Cooper et al., 1996). A longitudinal study by Alexander and Entwisle (1996) showed that these income-based summer learning differences *accumulate* over the elementary school years, such that poor children's achievement scores – without summer school – fall further and further behind the scores of middle class students as they progress through school grade by grade. As a result of this research, there is emerging consensus that what happens (or does not happen) during the summer can significantly impact the achievement of students from low-income and at risk backgrounds, and help reduce (or increase) the poor and minority achievement gaps in the United States.

But evidence on the effectiveness of summer programs in attaining these goals is mixed. Though past research linking student achievement to summer programs shows promise, several studies suffer from methodological shortcomings and low quality of the summer school programs (Borman & Boulay, 2004).

A meta-analysis of 93 summer school programs (Cooper, Charlton, Valentine, & Muhlenbruck, 2000) found that the average student in summer programs outperformed about 56 percent to 60 percent of similar students not receiving the programs. However, the certainty of these conclusions is compromised, because only a small number of studies (e.g., Borman, Rachuba, Hewes, Boulay & Kaplan, 2001) used random assignment, and program quality varied substantially. More recent *randomized controlled trial* research of summer school reached more positive conclusions (Borman & Dowling, 2006; Borman, Goetz & Dowling, 2009). Indeed, Roberts (2000) found an effect size of 0.42 in reading achievement for a *randomized sample* of 325 students who participated in the Voyager summer school program.

Researchers (see also McCombs, et al., 2011) note several program components related to improved achievement effects for summer program attendees, including:

- Early intervention during elementary school and a full 6-8 week summer program
- A clear focus on mathematics and reading achievement, or failed courses in high schools
- Small-group or individualized instruction
- Parent involvement and participation
- Careful scrutiny for treatment fidelity, and good instruction in reading and mathematics, and
- Monitoring student attendance.

Summer programs that include these elements hold promise for improving the achievement of at risk students and closing the achievement gap. Indeed, the most recent review of the effects of summer school programs reached this same conclusion (Kim & Quinn, 2013). Their meta-analysis of 41 school- and home-based summer school programs found that K-8 students who attended summer school programs with teacher directed literacy lessons showed significant improvements in multiple areas including reading comprehension, with effects much larger for students from low-income backgrounds.

In sum, research generally suggests that summer school is needed and can be effective for at risk students. Studies suggest that the effects of summer school are largest for elementary students when the programs emphasize reading and mathematics, and for high school students when programs focus on courses students failed during the school year. The more modest effects frequently found in middle school programs can be partially explained by the emphasis in many middle school summer school programs on adolescent development and self-efficacy, rather than academics.

Because summer school can produce powerful impacts, the EB model provides resources for summer school for classes of 15 students, for 50 percent of all eligible students in grades K-12, an estimate of the number of students still struggling to meet academic requirements (Capizzano, Adelman & Stagner, 2002). The model provides resources for a program of eight weeks in length and a six-hour day, which allows for four hours of instruction in core subjects. A six-hour day would also allow for two hours of non-academic activities. The formula would be one FTE position for every 30 at risk and ELL students or 3.33 per 100 such students. Because not all at risk students will need or will attend a summer school program, the EB model assumes 50 percent of the eligible at risk students will attend the program – a need and participation figure identified by Kleiner, Nolin and Chapman (2004). Although a summer school term of 6-8 weeks will have fewer hours than five day a week extended-day programs, the EB resources this at the same rate to allow for teacher planning time for the summer school program – something that is less needed in extended day programs. Simplified, the EB summer school formula equates to 1.0 FTE teacher position for every 120 at risk and ELL students.

26. English Language Learner (ELL) Students

Research, best practices and experience show that in addition to the above resources, ELL need assistance to learn English, in addition to instruction in the regular content classes. This can

include some combination of small classes, English as a Second Language classes, professional development for teachers to help them teach “sheltered” English classes, and “reception” centers for districts with large numbers of ELL students who arrive as new immigrants to the country and the school throughout the year. ELL students also receive the resources described above including tutors, additional pupil support, extended day and summer school.

In addition, ELL students some additional services focused on ensuring their learning English. Funding is provided for *all* ELL students for these additional services regardless of free and reduced price lunch status.

Current EB Recommendation

1.0 FTE teacher position for every 100 identified ELL students.

These positions are provided additional days for professional development (Element 14). This provision is in addition to all the resources triggered by the at risk student count, all of which are also provided for ELL students and include tutors, extended day, summer school and additional pupil support.

Analysis and Evidence

Good ELL programs work, whether the approach is structured English immersion (Clark, 2009) or initial instruction in the native language, often called bilingual education. However, bilingual education is difficult to provide in most schools because students come from so many different language backgrounds. Nevertheless, bilingual programs have been studied intensively. A best-evidence synthesis of 17 studies of bilingual education (Slavin & Cheung, 2005) found that ELL students in bilingual programs outperformed their non-bilingual program peers. Using studies focused primarily on reading achievement, the authors found an effect size of +0.45 for ELL students. A more recent *randomized controlled trial* also produced strong positive effects for bilingual education programs (Slavin, et al., 2011), *but* concluded that the language of instruction is less important than *the approaches taken to teach reading*.

Addressing that important issue in *The Elementary School Journal*, Gerstein (2006) concluded that ELL students can be taught to read in English if, as shown for monolingual students, the instruction covers phonemic awareness, decoding, fluency, vocabulary, and reading comprehension. Gersten’s studies also showed that ELL students benefit from instructional interventions initially designed for monolingual English speaking students, the resources for which are included above in the four at risk student triggered programs: tutoring, extended day, summer school, and additional pupil support.

Beyond the provision of additional teachers to provide English as a Second Language instruction to students or other types of extra help for ELL students, however, research shows that ELL students need a solid and rigorous core curriculum as the basis from which to provide any extra

services (Gandara & Rumberger, 2008; Gandara, Rumberger, Maxwell-Jolly, & Callahan, 2003). This research suggests that ELL students need:

- Effective teachers – a core goal of all the staffing in this report. Moreover, a recent study found that teachers who are effective with non-ELL students are also effective with ELL students, and vice versa. In addition, this study found that effective teachers who are fluent in the ELL student’s native language are even more effective with those students (Loeb, Soland & Fox, 2014).
- Adequate instructional materials (Element 15) and good school conditions.
- Good assessments of ELL students so teachers know in detail their English language reading and other academic skills (Element 16).
- Less segregation of ELL students.
- Rigorous and effective curriculum and courses for all ELL students, including college and career ready, and affirmative counseling of such students to take those courses.
- Professional development for all teachers, focusing on sheltered English teaching skills (Element 14).

Hakuta (2011) supports these conclusions and also notes that English language learning takes time (one reason the EB model includes the above resources for every grade level) and that “academic language” is critical to learning the new Common Core Standards. The new standards require more explicit and coherent ELL instructional strategies and extra help services, if these are to be effective at ensuring that ELL students learn the subject matter English generally, and academic English specifically, i.e., learn how to read content texts in English. While this instruction requires smaller regular classes, those are already provided by the EB model, particularly at the early elementary level.

However, additional teaching staff are needed to provide English as a Second Language (ESL) instruction during the regular school day, such as having ELL students take ESL in lieu of an elective course. Although the potential to eliminate some elective classes exists if there are large numbers of ELL students who need to be pulled out of individual classrooms, it is generally agreed that to fully staff a strong ESL program, each 100 ELL students should trigger one additional FTE teaching position. This makes it possible to provide additional instructional opportunities for ELL students to provide an additional dose of English instruction. The goal of this programming is to reinforce ELL student learning of academic content *and* English so at some point the students can continue their schooling in English only.

Research shows that it is the Limited English proficient or ELL students from lower income and generally less educated backgrounds, who struggle most in school and need extra help to learn both academics and English. The EB model addresses this need by making sure that the ESL resources triggered by just ELL pupil counts are *in addition* to other Tier 2 intervention resources, including tutoring, additional pupil support, extended day and summer school resources as well as pupil support staff (Elements 22-25).

For example, a prototypical school with 125 at risk students and no ELL students would receive 1.0 FTE core teacher and pupil support staff, and in addition, approximately 1.0 FTE tutor

position, 1.0 FTE extended day, 1.0 FTE summer school, and 1.0 FTE additional pupil support resources. But if the 125 at risk children were all ELL students, the school would receive an *additional* 1.25 FTE teacher positions primarily to provide ESL instruction.

Given these realities, it is more appropriate to view the EB approach to extra resources for ELL students as including both resources for students from at risk backgrounds (unduplicated free and reduced price lunch recipients and ELL) and ESL specific resources (Jimenez-Castellanos & Topper, 2012). That is a major reason why the EB model today augments the at risk student count to include the *unduplicated* count of students who are either free and reduced price meals recipients or ELL. This ensures that all ELL students trigger the extra resources for the Tier 2 interventions as well as the resources for ESL instruction.

27. Alternative Schools

Current EB Recommendation

One assistant principal position and one teacher position for every 7 alternative school students.

Analysis and Evidence

A small number of students have difficulty learning in the traditional school environment. The Alternative Learning Environment (ALE) students this report addresses are those who also have some combination of significant behavioral, social, and emotional issues, often also including alcohol or drug abuse. Such students often do much better in *small* “alternative learning environments.” However, we note that this rationale for ALE does not consider alternative schools for students who simply prefer a different approach to learning academics, such as project-based learning, or more applied learning strategies that can be deployed in new career technical programs such as computer assisted engineering. The EB concept of alternative schools, which we believe is also the state’s concept, is for “troubled” youth who need counseling and therapy embedded in the school’s instructional program.

The Institute for Education Sciences at the U.S. Department of Education published statistics on Alternative Schools and Programs for the 2007-08 school year (Carver & Lewis, 2010). That study identified 558,300 students in 10,300 districts that administered alternative education schools and programs across the United States. Although the report did not provide data on the size of these schools or on staffing ratios, the data above suggest an average alternative school size of 54 students. Most of the programs served students in grades 9-12. The main reasons students were enrolled in alternative programs – all of which meet our initial definition of severe emotional and/or behavioral problems – included:

- Possession or use of firearms or other weapons
- Possession, distribution, or use of alcohol or drugs
- Arrest or involvement with the criminal justice system;
- Physical attacks or fights
- Disruptive verbal behavior

- Chronic truancy
- Continual academic failure
- Pregnancy/teen parenthood, and
- Mental health needs.

One of the major issues states face in creating funding programs for alternative schools, is defining them. Our 2010 review of literature and state practice on alternative education provided little guidance for developing a clear definition of alternative education. More recently, and as part of implementing its compulsory attendance laws, Maryland commissioned a study to review state definitions of alternative education programs (see Porowski, O’Conner & Luo, 2014). Maryland needed a definition, because attendance in an alternative education program was an exemption in its compulsory attendance law and the state did not have a clear definition of such programs. The study found great variation across the states in both defining and structuring alternative education programs. Because individual states or school districts define and determine the features of their alternative education programs, they tended to differ in key characteristics, such as target populations, setting, services and structure.

A formal definition of an alternative education program would need to consider the target population (including both grade levels served and types of students), program setting (within a public school or outside such a structure), program offerings (academic, behavioral, counseling, social skills, career counseling, etc.), and structure (how programs are scheduled, staff responsibilities, etc.). The Porowski, O’Conner & Luo (2014) study found wide variation across states (and districts) for all of the four elements.

We have concluded that the 2006 Urban Institute (Aron, 2006) definition of alternative education closely follows our understanding of such programs, and we believe this definition is aligned with the intent of such programs in Vermont:

Alternative education refers to schools or programs that are set up by states, school districts, or other entities to serve young people who are not succeeding in a traditional public school environment. Alternative education programs offer students who are failing academically or may have learning disabilities, behavioral problems, or poor attendance an opportunity to achieve in a different setting and use different and innovative learning methods. While there are many different kinds of alternative schools and programs, they are often characterized by their flexible schedules, smaller teacher-student ratios, and modified curricula.

There is also the issue of standards for alternative education programs. Most states use definitions similar to that of the Urban Institute, but we are aware of only one state, Indiana, that has actually established standards for what an alternative education program might look like. The Indiana Department of Education’s (2010) web site states that:

While each of Indiana’s alternative education programs is unique, they share characteristics identified in the research as common to successful alternative schools.

- Maximum teacher/student ratio of 1:15
- Small student base
- Clearly stated mission and discipline code
- Caring faculty with continual staff development
- School staff having high expectations for student achievement
- Learning program specific to the student's expectations and learning style
- Flexible school schedule with community involvement and support
- Total commitment to have each student be a success.

We conclude that these characteristics align with the EB view of alternative education programs. From work in other states, we have found that funding formulas for alternative schools differ substantially. In a few states, the typical staffing ratio for an alternative school is one administrative position for the school plus one teacher position for every 7-10 students. Because alternative high schools are generally designed to serve students who are severely at risk, we recommend they remain relatively small. As a result of the small size of alternative schools, staff at these schools often must fill multiple roles. Many teachers in alternative schools provide many different services for students, including instruction, pupil support, and counseling services. This suggests that the staffing structure and organization for instruction in alternative high schools is usually quite different from that found in typical high schools.

Though Vermont could launch a process to more formally define alternative education programs as well as set standards for them, it might also want to simply adopt the above definition. It could also include a maximum size for any alternative education programs that would trigger alternative education funding. The EB model staffs alternative education programs with 1.0 FTE assistant principal position and 1.0 FTE teacher position for every 7 alternative students, and assumes the programs enroll fewer than 100 students.

28. Special Education

Providing appropriate education services for students with disabilities, while containing costs and avoiding over-identification of students, particularly minority students, presents several challenges (see Levenson, 2012). Many mild and moderate disabilities, often those associated with students learning to read, are correctable through strategic early intervention. This intervention includes effective core instruction as well as targeted Tier 2 intervention programs, particularly one-to-one tutoring (Elements 6 and 22). For those with mild and moderate disabilities who require special programs as identified through an IEP, the EB model relies on a census-based, or as Vermont terms it, mainstream funding formula that provides additional teaching resources based on the *total* number of students in a school. As described below, these resources are expected to meet the instructional needs of children with mild and moderate disabilities. For children with severe and profound disabilities, the EB model recommends that the state pay the entire cost of their programs, minus the cost of the basic education program for all non-public placements, up to 2 percent of all students. This section also addresses the issue of related services: speech and hearing disabilities, and the need for Occupational and/or

Physical Therapy (OT and PT). Finally, the recommendation in Vermont is for these resources to be provided at the district, supervisory union or supervisory district level, not the school level.

Current EB Recommendation

7.1 teacher positions per 1000 students
for services for students with mild and moderate disabilities and
the related services of speech/hearing pathologies and/or OT PT.
This allocation equals approximately 1 position for every 141 students.
1.0 psychologist per 1,000 students to oversee IEP development and ongoing review
Full state funding for students with severe disabilities, and state-placed students, minus the
cost of the basic education program and Federal Title VIB,
with a cap on the number covered at 2% of all students.

Provided at the District or Supervisory Union level.

Analysis and Evidence

In their book on the best approaches to serve students with disabilities, Frattura and Capper (2007) conclude that both research and most leading educators recommend that educating students in general education environments results in higher academic achievement and more positive social outcomes for students with and without disability labels, as well as being the most cost effective way to educate students. Thus, they recommend that school leaders focus their efforts on preventing student underachievement and alter how students who struggle are educated. Doing so, they argue, will overcome the costly and low performance outcomes of multiple pullout programs. Further, fewer students will be inappropriately labeled with a disability, more students will be educated in heterogeneous learning environments, and higher student achievement and a more equitable distribution of achievement will result (Frattura & Capper, 2007). Vermont has implemented this philosophy for several years and it is the philosophy behind the Evidence-Based model as well.

The core principles of such a proactive approach to teaching students with disabilities are that the education system needs to adapt to the student; that the primary aim of teaching and learning is the prevention of student failure; that the aim of all educators is to build teacher capacity; that all services must be grounded in the core teaching and learning of the school and particularly skilled teachers; and, that to accomplish this, students must be educated alongside their peers in integrated environments (Frattura & Capper, 2007).

Supporting this argument, research shows that many mild and moderate disabilities, particularly those associated with students learning to read, are correctable through intensive early intervention. For example, several studies (e.g., Borman & Hewes, 2003; Landry, 1999; Slavin, 1996) have documented that through a series of intensive instructional interventions (e.g., preschool, small classes, rigorous reading curriculum, 1 to 1 tutoring), nearly 75 percent of struggling readers identified in kindergarten and grade 1 can be brought up to grade level without

the need for placement in special education. Other studies have noted decreases in disability labeling of up to 50 percent with interventions of this type (see for example, Levenson, 2011; Madden, Slavin, Karweit, Dolan & Wasik, 1993; Slavin, 1996).

That is why the EB recommendations for extended learning opportunities (Elements 22, 24 and 25) are so important. They, along with core tutoring and pupil support services, are the series of service strategies that can be deployed *before* IEP specified special education services are needed. This sounds like a common sense approach that would be second nature to educators, but often educator practices have been rooted in a “categorical culture” that can be modified through professional development and leadership from the district office and the site principal. Using a census approach to providing most of the extra resources for students with disabilities, an approach increasing in use across the country, works best for students with mild and moderate disabilities, but only if a functional, collaborative early intervention model (as outlined above) is also implemented. At the same time, it is perfectly legal for a student’s IEP to call for tutoring, extended day help or summer school services that are part of the EB model, even though the services may not be provided by a person with a special education certification.

This proactive approach to special education is evident in the Individuals with Disabilities Education Act (IDEA) of 2004, which changed the law about identifying children with specific learning disabilities. The reauthorized law states that schools will “not be required to take into consideration whether a child has a severe discrepancy between achievement and intellectual ability ...” (Section 1414(b)). Instead, in the Commentary and Explanation to the proposed special education regulations, the U.S. Department of Education encourages states and school districts to abandon the IQ-achievement discrepancy model and adopt Response to Intervention (RTI) models, also discussed above, based on recent research findings (Donovan & Cross, 2002; Lyon et al., 2001; President’s Commission on Excellence in Special Education, 2002; Stuebing et al., 2002). An RTI model, what we call a proactive approach above, identifies students who are not achieving at the same level and rate as their peers and provides appropriate interventions, the first ones of which should be part of the “regular” school program and not funded with special education resources (Mellard, 2004).

The core features of RTI, which is a critical part of the EB approach, include:

- High quality classroom instruction
- Research-based instruction
- Classroom performance
- Universal screening
- Continuous progress monitoring
- Research-based interventions, that would include 1-1 tutoring
- Progress monitoring during interventions, and
- Fidelity measures (Mellard, 2004).

Common attributes of RTI implementations are: a strong core instructional program for all students; multiple tiers of increasingly intense student interventions; implementation of a differentiated curriculum; instruction delivered by staff other than the classroom teacher; varied

duration, frequency, and time of interventions; and categorical or non-categorical placement decisions (Mellard, 2004). This proactive model fits seamlessly into the EB broader approach to helping all struggling students through early interventions.

In many instances, this approach requires school-level staff to change their practice and cease functioning in “silos” that serve children primarily in “pullout” programs identified by funding source for the staff member providing the services (e.g. General Fund, Special Education, Title I). Instead, all staff would team closely with the regular classroom teacher to identify learning challenges and work together to address them as quickly as possible.

For children with more severe disabilities, clustering them in specific schools or at the SU/district level to achieve economies of scale is generally the most effective strategy and provides the greatest opportunity to find ways to mainstream them (to the extent feasible) with regular education students. Students in these categories generally include: severely emotionally disturbed (ED), severely mentally and/or physically handicapped, and children within the autism spectrum. The ED and autism populations have been increasing dramatically across the country, and it is likely that this trend will continue in the future. To make the provision of services to these children cost-effective, it makes sense to explore clustering of services where possible and design cost parameters for clustered services in each category. In cases where students need to be served individually or in groups of two or three because of geographic isolation, it would be helpful to cost out service models for those configurations as well, but provide full state funding for those children. This strategy would reduce the likelihood of overwhelming the financial capacity of a small school district that happens to be the home of a child with a severe disability.

The census approach to funding core special education services, called the mainstream approach in Vermont, can be accomplished by providing additional teacher resources at a fixed level. The census approach emerged across the country for several reasons:

- The continued rise in the number and percentage of “learning disabled” students and continued questioning by some of the validity of these numbers
- Under-funding of the costs of severely disabled students
- Over-labeling of poor, minority, and ELL students into special education categories, which often leads to lower curriculum expectations and inappropriate instructional services, and
- Reduction of paperwork.

Often, the census or mainstream approach for the high-incidence, lower-cost students with disabilities is combined with a different strategy for the low-incidence, high-cost students, whose costs are funded separately and totally by the state (with the exception of basic education funding), as these students are not found proportionately in all districts. This is the catastrophic funding for school districts that provides resources for special education students who require services exceeding some figure (after Medicaid, federal special education grants, and other available third-party funding are applied).

Today, diverse states such as Alabama, Arkansas, California, Montana, North Dakota, Pennsylvania, and the New England states of Massachusetts and Vermont all use census-based special education funding systems. Moreover, all current and future increases in federal funding for disabled students are to be distributed on a census basis.

The issue then becomes the staffing standards for the various categories in special education:

- Students with mild and moderate disabilities
- Students with severe and profound, and high cost-to-serve, disabilities
- Related services, and
- Costs associated with developing and continually reviewing IEPs.

Each of these is addressed below.

As background, however, we accomplish this task by making an assumption that 25 percent of the 16 percent incidence of students with disabilities in Vermont could be serviced by the EB model's extra help resources: core tutors and guidance counselors, and additional tutors, pupil support, extended day, summer school and ESOL resources. This would bring the percentage of students needing and triggering additional special education resources to 12 percent.

Mild and moderate Disabilities

At an incidence rate of 12 percent, it would be reasonable to assume that 1 to 2 percentage points of that total would be for children with severe and profound disabilities. That would leave 10 percent with mild and moderate disabilities. Although the previous EB provision for resources for students with mild and moderate disabilities was 1 teacher and 1 aide for every 150 regular students, we are changing that via the following analysis.

The service load for special education teachers for mild and moderate disabilities ranges widely across the country, with some school districts setting the load at 15 and others at 30. And there is no national legal requirement for service loads, or to our knowledge, a national standard. In the following analysis, we will assume special education teachers service an average of 20 students with mild and moderate disabilities, which is at the lower end of the range. If the incidence of such students is 10 percent, that means about 15 students of the 150 would have a mild or moderate disability. The EB formula then needs to be modified to provide 0.75 (15/20) teacher for every 150 which is equivalent to one teacher position for every 200 students to align the teacher allocation to a 10 percent incidence, or five positions for every 1000 students.

Nate Levenson, a national expert on effective special education servicing, also recommends, as does the above discussion, that most of the services needed by students with mild and moderate disabilities should be provided by skilled teachers, not by less skilled special education aides. In fact, he argues that places with many special education aides serving students with mild and moderate disabilities usually work in educational sites that have few preventive services like the EB model provides. Thus, the argument is that few – if any – aides are needed for students with mild and moderate disabilities.

Moreover, many of the aides used by many if not most schools across the country focus on behavioral issues. But rather than having aides working individually with students on behavioral issues, what is needed is a teacher behaviorist, who works with teachers to develop their skills to manage classrooms even with student with behavior challenges, including students with autism. Indeed, some of the best private schools for students with autism do not have any aides in the classroom, but the teachers are skilled in classroom management and behavior strategies. The proposal is to provide one teacher behaviorist for every 5 special education teachers. This equates to a formula of one behaviorist teacher for every 1000 students.

In comparison to the current Vermont formula of 9.75 teachers per 1000 students, the above formula equates to 5 special education teachers and 1 teacher behaviorist, or a total of 6 teacher positions, for every 1000 students, but funded at 100% in the EB model, and not funded at 60% per the current Vermont approach.

Related Services

Related services include the need for speech/hearing pathologists and OT and PT services. The incidence of related services are generally half of that for mild and moderate disabilities, or 5 percent in this case. Further, related service personal usually service 45 students needing these kinds of related services.

Thus a group of 1000 students, at an incidence of 5%, would have 50 students needing related services, or 1.1 related services staff.

This brings the total special education services staff for 1000 students to 7.1, the sum of 6 positions for severe and moderate disabilities and an additional 1.1 for related services.

Severe and Profound Disabilities

The proposal here is for the state to fund 100% of the costs for students with severe and profound disabilities, minus federal Title VIb and the cost of the basic education program. In order to control costs for this recommendation, the EB model would limit the number of students so covered to 2 percent of students in the district or SU.

Psychologists

Finally, districts need psychologists for the primary role of overseeing the development and continued review of Individual Education Programs, which must be reviewed and reassessed every three years. A typical standard for psychologists is 75 IEPs a year. At a special education incidence rate of 16%, a group of 1,000 students would have 160 who needed an IEP. As IEPs are reviewed every three years, that reduces the burden to 53. On the other hand, for every 1,000 Prek-12 students there typically would be the need to go through the IEP review process for an additional 20 or so students for incoming preschoolers, kindergartners and first graders, many of whom would need the review but most of whom would not actually receive an IEP. This adds to

the 53 another 20 IEP reviews for a total of 73. At a typical load of 75, a group of 1000 K-12 students would trigger the need for an additional 1.0 psychologist.

Total EB recommendation for special education:

- 7.1 positions per 1,000 students for services for students with mild and moderate disabilities and for the related services of speech/hearing pathologists and/or OT PT, which equals approximately 1 position for every 140 students.
- 1 psychologist for every 1,000 students.
- 100 percent state funding of services for students with severe and profound disabilities, minus federal Title VIb funds and the basic education program, capped at 2% of all students.

ADDITIONAL ISSUES

29. Staff Compensation⁸

As is usually done in most adequacy studies, the EB approach – as well as the successful schools and professional judgment methods – to costing out the above recommendations is to use the average of the previous year’s staff salaries to put a salary “price” on each staff element of the funding model. Staff would include the major certified categories such as teacher, principal, superintendent, assistant superintendent, as well as the major classified categories such as secretary, custodian, maintenance worker, groundskeeper, and supervisory aide.

In some cases, adequacy studies explicitly include a market analysis of salaries, for example, comparing teacher salaries to salaries of workers in other occupations with similar skills and competencies to teaching. These market analyses, however, are not part of the current study. Therefore, average salaries from the preceding year will need to be used as the salary price to cost out the various elements of the model in the process of identifying both a new base per pupil figure and appropriate pupil weights.

However, benefits present a set of issues that need to be addressed in more detail. Benefits generally include:

- Social Security and Medicare
- Worker’s Compensation Retirement or pension costs
- Unemployment Insurance, and
- Health Insurance.

⁸ We will include more details on compensation levels and benefit rates as those data become available from Vermont.

These are usually calculated as a percent of salary. For example, today Social Security and Medicare costs are 7.65 percent of salary. Actually, Medicare is 1.2 percent of salary with no maximum. Social security is 6.45 percent of salary up to a maximum salary of \$118,500.

Retirement costs generally are set by the state. In some cases, the state pays pension costs directly to the retirement fund, and that cost is not included in local district costs. Vermont pays the state cost of teacher pensions “off the top,” or directly to the teacher retirement fund, and thus there is no district cost for teacher pensions.

Health care costs need to be directly addressed in an adequacy study, to ensure that this part of the compensation is “adequately” reflected in any cost figure. In a recent study in North Dakota, we found that the state average cost for health insurance for all *state* employees was about \$12,000. The cost is \$15,000 in Wyoming. Though the state had not explicitly adopted a policy of health care coverage for school district employees, the decision was made, with the assent of the legislative committee for which the study was conducted, to use the figure used for state employees as an “indirect” indicator of how the state would recognize health insurance costs in the school aid formula. This decision was bolstered by a previous state policy that allowed school districts to “opt into” the state health care program. Thus, in calculating a new per pupil figure for North Dakota, the \$12,000 state figure was used for all staff categories. Wyoming similarly uses a state health insurance cost figure in its school aid formula; the figure is approximately \$15,000 per employee and covers 85 percent of insurance costs.

We received information on the cost of health insurance for Vermont educators from the VEHI. The “standard” plan for most employees has been the VHP Plan; higher cost plans require more employee contribution and lower cost plans can be covered with the employer paying the amount it pays for the VHP plan. About 38% of participating employees have single coverage, 25% two-person coverage, and 36 percent family coverage, with the annual cost of the single, two-person and family plans being \$8,370, \$16,453 and \$22,057, respectively. This produces a weighted average health insurance cost of \$15,399 a year. If that figure is multiplied by 80 percent, which is the amount the state covers for state employees, the health insurance cost figure would be \$12,320. If the figure is multiplied by 85 percent, which is the standard across school districts, the health insurance cost would be \$13,090, which is the figure we initially will use in determining employee compensation for the costing model.

The same agency provided figures of 0.82 percent for worker’s compensation and \$102 per school employee for unemployment insurance.

Glossary of Funding Model Elements

Model Element	Page Number	Definition
Core Teachers		Core teachers are the grade-level classroom teachers in elementary schools and the core subject teachers in middle and high schools (e.g., mathematics, science, language arts, social studies and world language, including such subjects taught as Advanced Placement in high schools).
Elective Teachers		Elective teachers are all teachers for subject areas not included in the core, including such classes as art, music, physical education, health, and career and technical education, etc. However, some career technical classes can substitute for core math and science classes.
Instructional Coaches		Instructional coaches-- sometimes called mentors, site coaches, curriculum specialists, or lead teachers -- coordinate the school-based instructional program, provide the critical ongoing instructional coaching and mentoring that the professional development literature shows is necessary for teachers to improve their instructional practice, do model lessons, and work with teachers in collaborative teams using data to improve instruction.
Tutors		Tutors, or Tier 2 Interventionists, are licensed teachers who, during the regular school day, provide 1-1 or small group (no larger than 5) tutoring to students struggling to meet proficiency in core subjects.
Extended-day Programs		Extended-day programs provide academic extra help to students outside the regular school day before and after school.
Summer School		Summer school includes all programs provided during the summer months, i.e., outside the regular school year, largely focusing on academic deficiencies of students but includes a wider array of classes for high school students.
At risk Students		The unduplicated count of students eligible for free and reduced meals (FARMS) who are not ELL students. The resources triggered by at risk student counts include all resources for tutors (Tier 2 Interventionists), summer school, extended-day programming, and additional pupil support.
English Language Learner services		ELL students are those who come from homes where English is not the native language and

		who perform at Levels 1, 2 and 3 in English; in addition to the at risk resources of tutoring, extra pupil support, extended day and summer school, the model also provides resources to provide English as a Second Language or other extra help services for ELL students. The model provides resources for all ELL students regardless of Free and Reduced Price Meal eligibility.
Special Education		Programs for all students with disabilities.
Alternative Schools		Alternative schools provide services, usually outside of the regular school environment, to students who have some combination of significant behavioral, social and emotional issues, often including alcohol or drug addiction. These students are different from at risk students and require a different set of services.
Gifted, Talented		Gifted and talented students are those who perform in the very top levels of performance, and can handle much more than a year of academic work in a regular school year.
Substitute Teachers		These are regular substitute teachers.
Student Support, Guidance Counselors, Nurses		These include guidance counselors, social workers, psychologists, family outreach workers, nurses, etc. Guidance counselors and nurses are provided for all students, and additional student support staff are provided in the struggling student section.
Duty/Supervisory Aides		These are non-licensed individuals who help students get on and off buses, monitor the hallways, doors and playgrounds, and supervise the lunchroom.
Librarians		These are regular school librarians.
Principal, Assistant Principal		These are regular school principals and assistant principals.
Professional Development		Professional development includes all training programs for licensed staff in schools, including professional development for implementing new curriculum programs, sheltered English instructional strategies for ELL students, gifted and talented, etc. It also includes assistance to teachers working in collaborative groups and ongoing coaching of teachers in their individual classrooms. Resources include instructional coaches, 10 pupil-free days for training, and additional per pupil funds for trainers and other expenses.
School-Based		These include within school technology such as

Technology and Equipment		computers, servers, network equipment, copiers, printers, instructional software, security software, some curriculum management courseware, etc.
Instructional Materials		These include textbooks, consumable workbooks, laboratory equipment, library books and other relevant instructional materials.
Interim-, Short-Cycle Assessments		These include benchmark, progress monitoring, formative, diagnostic and other assessments teachers need in addition to state accountability assessment data.
Student Activities		These include non-credit producing after-school programs, including clubs, bands, sports, and other such activities.
Central Office Administration		Resources for central office staff including administrative and classified personnel charged with managing the instructional programs and operations of the school district.
Operations and Maintenance		Covers functions such as custodial services, grounds maintenance and facilities maintenance, and minor repairs.

DRAFT

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(Those with an asterisk * refer to randomized controlled trials.)

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