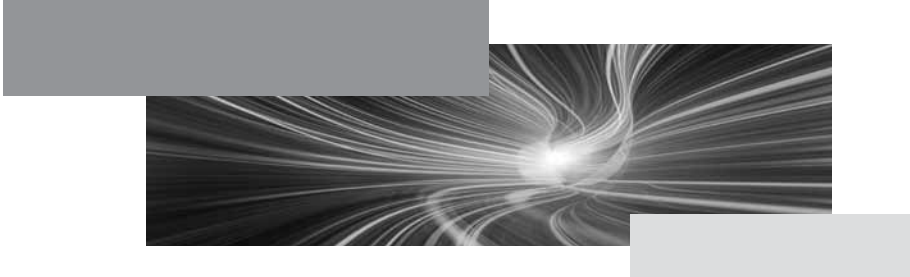


CHAPTER 2



The Major Findings of Project RED

We launched Project RED because we were curious. We knew that some schools were having amazing results with their technology implementation programs, while others were experiencing nothing but frustration and disappointment. The following inquiries informed the direction of our research:

- We set out to identify the technology implementation strategies that can successfully transform American schools.
- We isolated the variables that were having the greatest impact in order to create impactful guidelines for schools.
- We researched the potentially positive financial impact of successful technology implementations in schools.
- We specifically looked at the impact of 1-to-1 computing on student performance and education budgets.

Many studies, including earlier research by Project RED team members, have addressed district-level activities and the importance of district-level leadership. However, with Project RED we deliberately adopted a school-level focus in order to observe principal, student, and teacher behaviors as closely as possible; correlate student performance to

school-level activities; and ensure that school-to-school implementation variances did not mask correlations to student performance.

An analysis of the Project RED data revealed seven major findings of interest to schools embarking on or already administering a technology implementation.

- Proper implementation of technology is linked to education success.
- Properly implemented technology saves money.
- 1-to-1 schools that properly implement technology outperform all other schools, including all other 1-to-1 schools.
- A school principal's ability to lead is critical to the success of an implementation effort.
- Technology-transformed intervention improves learning.
- Online collaboration increases learning productivity and student engagement.
- Daily use of technology delivers the best return on investment (ROI).

Let's take a closer look at each of these findings.

Proper implementation of technology is linked to education success.

Educational technology best practices have a significant positive impact on improvements in student achievement, and must be widely and consistently practiced.

Effective technology implementation in schools is a complex puzzle. Hundreds of interrelated factors play a role. The presence of computers in a school does not guarantee improved student achievement. Indeed, providing every student a computer is the beginning, not the end, of improving student performance. In fact, schools with a 1-to-1 student-computer ratio that address only a few of these key factors perform only marginally better than non-1-to-1 schools.

Ultimately, the implementation of best practices is as important as the technology itself; and the value of technology in terms of student achievement depends on the quality of its implementation. In Chapter 3 you'll find a list of some of our most important recommendations that correlate with success, the Project RED Key Implementation Factors.

Properly implemented technology saves money.

The richer the technology implementation, the more positive the direct cost reductions and indirect revenue enhancements.

The education sector has often failed to experience transformation through the use of technology. This failure is due, in large part, to the challenge—real or perceived—of allocating the necessary initial capital budget to start such initiatives.

An understanding of the financial benefits of technology is surprisingly absent in schools. The prevailing wisdom is that educational technology is an expensive proposition. However, Project RED data support the business case that there is enough money in the system at a macro level to properly implement technology and positively impact many Education Success Measures (ESMs), from high-stakes tests to disciplinary actions.

The incremental cost of a ubiquitous technology implementation, including hardware, software, professional development, and training and support, is roughly \$100 to \$400 per student per year, depending on the school's starting point. The positive impact could be as high as \$56,437 per student per year, depending on the school and state, after accounting for the full impact of a career lifetime of increased tax revenues. This number is based in large part on schools as we know them. In second-order change schools, it is likely that the impact would be higher.

Under today's system, if money is saved via technology, the dollars saved will not go to the school's bank account. Given the significant shortfalls in school funding today, schools spend all the money they get. But the savings earned through properly implemented technology initiatives will allow schools to move the dollars closer to students and moderate the effects of economic downturns. The challenge is to encourage schools to adopt cost-saving measures along with mechanisms for capturing the savings, so that the savings do not disappear into the system.

Properly implemented educational technology can be revenue positive at all levels—national, state, and local. For best results, stakeholders need to invest in the re-engineering of schools, not just in technology itself.

The financial impacts of properly implemented technology include direct cost reductions as well as indirect revenue enhancements that are only realizable at the state level. Examples of state-level costs that can be saved include moving from paper-based to electronic high-stakes tests, and the reteaching of students who fail courses.

Project RED estimates that 1-to-1 high schools with a properly implemented learning management system (LMS) could cut their copy budgets in half. Labor accounts

for roughly 50% of the total cost for copying. Assuming the cost of operating and maintaining a copy machine is \$100,000 per year for a 1,500-student high school, on a national basis this equates to a savings of \$739 million per year for high schools alone.

The economic cost of student dropouts is well known. An individual's lifetime tax revenues track with his or her level of education. Nationally, if 25% of dropouts graduated from high school, and 25% of those individuals then graduated from college, the increase in tax revenue would be \$77 billion per year per graduating class. In this scenario, the aggregate positive financial impact of all students after 40 years would be \$3 trillion per year.

1-to-1 Schools that employ the Project RED Key Implementation Factors outperform all schools, including all other 1-to-1 schools.

A 1-to-1 student–computer ratio has a higher impact on student outcomes and financial benefits than higher ratios.

A bleak long-term economic outlook may have an impact on the adoption of educational technology, which is considered by many to be an expensive proposition for schools. Certainly, 1-to-1 computing is more expensive than a 3-to-1 deployment in terms of initial outlay. This cost barrier for a 1-to-1 deployment, while very real, is only one consideration. Device costs and total costs of ownership are declining, and it can be argued that connectivity, application availability, community of practice, and the knowledge base in schools for successful implementation provide benefits far beyond the costs associated with an initial outlay for a 1-to-1 deployment.

Interestingly, the data show that 2-to-1 schools resemble 3-to-1 or higher-ratio schools more closely than 1-to-1 schools. Schools with a 1-to-1 student–computer ratio may be fundamentally different in a pedagogical sense. Indeed, a 1-to-1 student–computer ratio has a greater impact on student outcomes and financial benefits than other ratios, and the Key Implementation Factors detailed in the first finding increase both benefits. In general, schools with a 1-to-1 student–computer ratio outperform non-1-to-1 schools on both academic and financial measures. Moreover, a number of positive financial implications that are attached to 1-to-1 computing, particularly when properly implemented, reveal that 1-to-1 adoption rates should increase, especially as costs come down and more schools become comfortable with technology.

Project RED has selected four of 11 Education Success Measures to illustrate the impact of 1-to-1 deployments. The accompanying table shows the percentage of Project RED respondents reporting improvements in ESMs from technology deployments.

1-to-1 Works When Properly Implemented

Education Success Measure (ESM)	Properly Implemented 1-to-1 Schools (%)	All 1-to-1 Schools (%)	All Other Schools (%)
Reduction: Disciplinary action	92	65	50
Increase: High-stakes test scores	90	70	69
Reduction: Dropout rate	89	58	45
Increase: Graduation rate	63	57	51

Source: Project RED (www.projectred.org)

Schools with a 1-to-1 student–computer ratio that practice the top four implementation factors identified by Project RED experience the most positive improvements. The top four implementation factors are intervention classes that use technology every class; principal leads change management training at least monthly; online collaboration among students daily; core curriculum using technology at least weekly. (See Chapter 3 for a discussion of all nine of the Key Implementation Factors.)

- 92% report disciplinary action reduction
- 90% report high-stakes test scores increase
- 89% report dropout rate reduction
- 63% report graduation rate increase

All 1-to-1 Schools

Schools with a 1-to-1 student–computer ratio without proper implementation of technology experience positive results, but those results significantly lag behind those 1-to-1 schools with proper implementation.

- 65% report disciplinary action reduction
- 70% report high-stakes test scores increase
- 58% report dropout rate reduction
- 57% report graduation rate increase

Non-1-to-1 Schools

Schools without a 1-to-1 student–computer ratio benefit from the use of technology, but the benefits lag behind 1-to-1 schools.

- 50% report disciplinary action reduction
- 69% report high-stakes test scores increase
- 45% report dropout rate reduction
- 51% report graduation rate increase

These data make it clear that 1-to-1 is the way to go, and 1-to-1 is leveraged fully only when Project RED’s Key Implementation Factors are present.

The principal’s ability to lead is critical to the success of an implementation effort.

Change must be modeled and championed at the top.

Strong, district leadership is essential for successful schools. All levels of district leadership are important, individually and collectively, including school boards, superintendents, and assistant superintendents for curriculum, instruction, technology, finance, and operations. However, the principal is the primary influence of professional development within a school. The quality of a principal’s leadership has a major impact on education technology usage, leading to improved student outcomes. Many educators agree that it is impossible for their school to rise above the capabilities of the principal. Key measures of principal effectiveness in terms of technology use include the following:

- Skillful change leadership
- Conceptual and tactical understanding
- Real system reform versus tinkering around the edges
- Communication about best practices
- A shared and inspiring vision
- Stakeholder buy-in
- Consistent, open communication with and among stakeholders
- Planning for technology acquisition, implementation, and assessment

How well principals guide the professional learning process of education technology use has consequences in terms of time, cost, and results. A principal must effectively perform the following:

- Model technology use
- Enable teacher collaboration time
- Enable online professional learning
- Use change management strategies
- Enable regularly scheduled professional learning opportunities for teachers

Project RED data show that, within schools, the principal is one of the most important variables across the 11 Education Success Measures. Principals have a major impact on technology use in schools, and hence student outcomes. This finding suggests that change leadership training for principals is of paramount importance.

The accompanying table shows the percentage of Project RED respondents who reported benefits of a technology implementation, in this case in terms of disciplinary action reductions.

Example of Improvement Attributed to Technology and Principal Leadership

Measure	All Schools (%)	All 1-to-1 Schools (%)	1-to-1 Schools with Principal Change Management Training (%)
Reduction: Disciplinary action	50	65	73

Source: Project RED (www.projectred.org)

Principals must lead the change management that is required to transform a school. Principals must also lead in the use of data to inform instruction, and must champion the movement from teacher-led to student-centered instruction. These skills may be new to principals who, in traditional industrial-age schools, have long served primarily as managers.

In decentralized school systems, principals are also important in terms of financial improvement. As the trend to decentralization continues, teachers may continue to use, for example, traditional paper-intensive copier-based solutions unless the principal models desired technology-use behaviors. Technology-forward principals lead by sending out meeting notices via email instead of hard copy, host online collaborative

discussions and communities of practice, and perform classroom observations to ensure technology is being properly used.

Thus, while all schools benefit from a technology implementation, when principals receive specialized training, and technology is properly implemented, the benefits increase even more.

Technology-transformed intervention improves learning.

Technology-transformed intervention classes are an important component in improving student outcomes.

Project RED defines technology-transformed intervention classes as those in which technology plays an integral role in learning. Generally, it is a learning environment in which every student has a computer and the curriculum is delivered electronically. The teacher spends most of his or her class time in one-on-one interactions with students, or conducts class in small-group mode. Each student progresses at his or her own pace.

Project RED found that technology-transformed intervention classes, including English language learners, Title I, special education, and reading intervention programs, are the top-model predictor of improved high-stakes test scores, dropout rate reduction, course completion, and improved discipline. No other independent variable is the top-model predictor for more than one Education Success Measure.

This finding illustrates the power of the student-centric approach enabled by technology. In a setting in which each student works at his or her own pace, each student can take the time required to complete the course with demonstrated achievement. A few students will take longer than the traditional semester timeframe to complete the work, but not many.

Individualized instruction is perhaps the most important use model of technology in education. Whether advanced or remedial, individualized instruction allows students to learn at their own pace and engage in learning at exactly the right entry point. Technology-based learning solutions provide almost limitless opportunities for personalization. If one approach is not working for a student, alternatives can easily be tried that are better suited to a student's individual learning style or experiences. Because students are in active control of their learning, they are more likely to stay on task.

In the technology-transformed classroom, the teacher has more time for one-on-one instruction to address more difficult educational challenges. The effect of a

technology transformation is similar to that of a class size reduction from 30 to 10 students, when measured by student–teacher face time.

Project RED data reveal that schools with 1-to-1 implementations tend to use technology frequently, across the entire range of subject areas, which is an indication that they may be experimenting with second-order change strategies enabled by the 1-to-1 student–computer ratio. By showing greater daily and weekly use of technology, the data suggest that the amount of time per subject per week is far greater in 1-to-1 schools than in others, which correlates to educational benefits. In addition, we find that 1-to-1 schools tend to encourage greater parental involvement, which is a key factor in student engagement.

This finding has significant financial implications. The improved course completion rate in technology-transformed interventions mitigates the direct cost of a repeated class, which is approximately \$1,000 per student per class. Moreover, in schools with technology-transformed interventions, the repeat failure rate is far below the repeat failure rate of schools that re-teach in the traditional lecture mode.

The accompanying table shows the percentage of Project RED respondents reporting improvements in Education Success Measures from a technology deployment.

Technology-Transformed Intervention Classes Lead to Education Success

Education Success Measure (ESM)	Tech-Transformed Classes Daily (%)	All Other Schools (%)
Increase: High-stakes test scores	81	65
Reduction: Disciplinary action	63	51
Reduction: Dropout rate	59	45

Source: Project RED (www.projectred.org)

Online collaboration increases learning productivity and student engagement.

Online collaboration contributes to improved graduation rates and other academic improvements.

Collaboration and interaction among students have long been viewed as important factors in improving student achievement. Indeed, a student’s participation in study groups is a good predictor of success in college. In the past, collaboration and study groups were generally limited to face-to-face interactions, but with the advent of

the Internet many new technology-based collaboration experiences exist. Students quickly adopt them to reach out to peers.

Many students say that if they are having trouble with a particular concept, they use technology-based collaboration to query a peer for help. Social media substantially enhances collaboration productivity because it erases the barriers of time, distance, and money. Collaboration conducted through technology can extend beyond an individual’s immediate circle of friends to become a worldwide network that includes mentors, tutors, and experts. Rapid technological advances in the fields of hardware and collaborative and social media will no doubt expand the benefits and options for participation available to users.

The accompanying table shows the percentage of Project RED respondents reporting improvements in Education Success Measures from online collaboration.

Online Collaboration Increases Student Engagement

Education Success Measure (ESM)	Using Online Collaboration (%)	All Other Schools (%)
Reduction: Disciplinary action	69	47
Reduction: Dropout rate	62	42

Source: Project RED (www.projectred.org)

Daily use of technology delivers the best return on investment (ROI).

To realize the benefits of technology, schools must incorporate technology into teaching on a daily basis.

The daily use of technology in core curriculum classes correlates highly to Education Success Measures, and hence return on investment. Daily technology use is a top-five indicator of better discipline, better attendance, and increases in college attendance.

Conversely, if a student spends only 30 minutes a week on a computer, the maximum productivity benefit is less than 2%. If technology use is an afterthought in the classroom, then even daily use of it may not produce dramatic improvements in student achievement, especially if students must constantly start, stop, and reacquaint themselves with the technology. Ultimately, schools that embed technology produce results in student achievement beyond those expected by chance.

In 1-to-1 schools—schools where every student has a computing device—daily use of technology in core curriculum classes ranges from 51% to 63%. Unfortunately,

many 1-to-1 schools report using technology on a weekly basis, or less often, for many classes. Moreover, 40% of 1-to-1 schools report that students do not use technology on a daily basis. This is a surprising finding, but anecdotal evidence suggests a few reasons for it:

- Some schools move to 1-to-1 computing by way of top-down directives. These schools do not have critical stakeholder buy-in.
- Many schools do not have adequate levels of professional development.
- Schools buy the hardware but no courseware. In one large-scale implementation, the hardware vendor that won the bid allocated only 50 cents per machine per software application, which required the schools to purchase supplemental software.
- The laptops are used for less transformative activities. For example, students may be asked to use their computers to view a single website and then write a two-page report by hand on lined paper.
- Computer use is limited to tool use, such as presentation or word-processing applications, with some limited web browsing. Broader educational uses that include meaningfully integrated digital content are not employed.

Again, proper implementation (see Chapter 3) is the foundation for successfully deploying technology in schools, regardless of student–computer ratio. In the next chapter we will discuss the Education Success Measures that Project RED focused on and the Key Implementation Factors that were revealed to us by our research.