Introduction

In the six years since Project RED published *The Technology Factor*, with the exception of declining hardware and Internet service provider costs, not much has changed regarding educational technology costs and benefits.¹

From *The Technology Factor*

Education has often failed to replicate the success of other industry sectors in automating and transforming through technology, in large part due to the challenge—real or perceived—of allocating the necessary initial capital budget to start such initiatives.

Very few substantial research efforts have examined the cost savings and revenue enhancements (increased tax revenues) that can be directly attributed to educational technology. Most deal with only one aspect of cost savings. Preliminary Project RED research, undertaken before the survey began, indicated that 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, the 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. (p. 112)
This chapter will address the following topics related to the financial aspects of digital conversions:

- Digital conversion costs
- Digital conversion savings
- Financial considerations
- Pitfalls
- Recommendations

One of the most important, and surprisingly most overlooked components of a successful digital conversion, is the financial aspect. The financial aspect has three primary subcomponents, some of which are frequently ignored. These include:

- **Total cost of implementation:** A comprehensive budget which outlines all relevant costs is essential. The hardware budget, which is frequently carefully prepared, constitutes only half or less of the total implementation cost.

- **Capturable savings:** A plan to identify, capture, and repurpose savings is essential to long-term sustainability.

- **Positive financial impacts at the district, state, and federal level, as well as positive economic impacts:** These are attributable to business development, social cost savings, and increased taxes attributed to a higher paid workforce.

Public support is important for any technology initiative. If the public thinks their tax dollars are not being wisely used, there are serious consequences.

Initiative sustainability is also crucially important. It would be hard to argue that any initiative is a success if it lasts only one or two school years, or until a superintendent is replaced, or one-time money runs out.

All of these factors point to the need for a strong and sustained focus on all financial aspects of any initiative.

### Cost Updates from Project RED Phase I

*The Technology Factor* compared the cost of two scenarios. The first scenario involved a computing device for each student and the second scenario involved a computing device for every three students. In both cases, an attempt was made to be very comprehensive and include all costs required for a successful implementation.

This cost comparison is now updated for Project RED Phase III. In the intervening five years, many costs have changed. The biggest change is in the cost of hardware, which has declined substantially. Between...
2011-2017, the average cost of student devices dropped 55%. Since the start of laptops in classrooms in 1996, device costs have dropped 80%. Between 2013-2016, the cost of bandwidth has dropped 70%.²

In 2017, the average number of students per computer has moved closer to 2:1, versus 3:1 in 2011. In this case, averages may be deceiving because the average is composed of many 1:1 schools and many 3:1 schools. While there are some 2:1 schools, the cost benefit ratio is not ideal. The use model for 2:1 does not support personalized learning. The pay phone model is still a good analogy for 2:1 or greater, rather than the cell phone model. The public pay phone is a shared resource that one hopes to be able to access when needed. The cell phone becomes a game changer because of the ubiquitous relationship that can develop between the user and the device. Also, it may be used anywhere and at any time.³

Other significant changes since 2011 include:

- Internet bandwidth requirements (per student) have gone up substantially, but the dropping costs per megabit more than compensate for these increases. Many local education agencies (LEAs) have implemented Metropolitan Area Networks (MANs) that significantly reduce bandwidth costs. Also, state-level procurements and E-Rate have driven down the cost per student.

- Additional funds have been allocated to the section on annualized software costs to improve implementation and fidelity.

- A line item was added in the professional development area to fund leadership and change management training and coaching that was found to be of such vital importance in the original research.
The total cost of moving from a traditional 3:1 ratio, with limited capabilities, to a full digital conversion is now less than two percent of a district operating budget. This can be more than offset by savings if the LEA implements the proper savings protocols. See Table 1 for sample implementation costs.

### Table 1: Sample Implementation Costs (conservative)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Hardware</strong></td>
<td><strong>Hardware</strong></td>
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<tr>
<td>$400        Cost of student computer with 4-year warranty</td>
<td>$400          Cost of student computer with 4-year warranty</td>
</tr>
<tr>
<td>$800        Cost of teacher computer with 4-year warranty</td>
<td>$800          Cost of teacher computer with 4-year warranty</td>
</tr>
<tr>
<td>$5,100      Total cost of 1 printer per classroom plus 2 for common areas</td>
<td>$6,100        Total cost of 1 printer per classroom plus 4 for common areas</td>
</tr>
<tr>
<td>$202,100    Total cost over 4 years</td>
<td>$234,850       Total cost over 4 years</td>
</tr>
<tr>
<td>$48         Cost per student per year</td>
<td>$118          Cost per student per year</td>
</tr>
<tr>
<td><strong>Servers, router, firewall, and related software</strong></td>
<td><strong>Servers, router, firewall, and related software</strong></td>
</tr>
<tr>
<td>$20,000     Cost of servers, router, firewall, and software</td>
<td>$40,000       Cost of servers, router, firewall, and software</td>
</tr>
<tr>
<td>$10         Cost per student per year</td>
<td>$20           Cost per student per year</td>
</tr>
<tr>
<td><strong>Annualized software costs</strong></td>
<td><strong>Annualized software costs</strong></td>
</tr>
<tr>
<td>$40         Cost per student per year for instructional software</td>
<td>$40           Cost per student per year for instructional software</td>
</tr>
<tr>
<td>$10         Cost of productivity tools per student computer</td>
<td>$30           Cost of productivity tools per student computer</td>
</tr>
<tr>
<td>$20         Cost for LMS, assessment, etc.</td>
<td>$20           Cost for LMS, assessment, etc.</td>
</tr>
<tr>
<td>$26         Project management, installation and customization costs per student</td>
<td>$38           Project management, installation and customization costs per student</td>
</tr>
<tr>
<td>$96         Cost per student per year</td>
<td>$128          Cost per student per year</td>
</tr>
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Research on Savings

Research on digital transformation costs and savings is very sparse. A 2012 meta-analysis of more than 100 research reviews focusing on 1:1 programs found that “regarding digital content instead of textbooks or written materials, deployment costs, and sources of funding, almost no information is available from focused systematic reviews to address many of these funding issues” (p. 22).  

Project RED Phase III gathered financial information from multiple sources, including our unique Signature District surveys, publicly available information, district interviews, and supplier interviews. The Project RED Phase III surveys showed three statistically significant

<table>
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<tbody>
<tr>
<td><strong>Wireless network</strong></td>
<td><strong>Wireless network</strong></td>
</tr>
<tr>
<td>$1,500 Cost per classroom/common area, includes POE</td>
<td>$2,000 Cost per classroom/common area, includes POE</td>
</tr>
<tr>
<td>$37,500 Total infrastructure</td>
<td>$50,000 Total infrastructure</td>
</tr>
<tr>
<td>$11 Cost per student per year</td>
<td>$14 Cost per student per year</td>
</tr>
<tr>
<td><strong>Telecom (100 Kilobits/sec/student average)</strong></td>
<td><strong>Telecom (200 Kilobits/sec/student average)</strong></td>
</tr>
<tr>
<td>$2 Cost per megabit at 1Gbps rate</td>
<td>$2 Cost per megabit at 1Gbps rate</td>
</tr>
<tr>
<td>$100 Cost per month</td>
<td>$200 Cost per month</td>
</tr>
<tr>
<td>$1200 Cost per year (12 months)</td>
<td>$2400 Cost per year (10 months)</td>
</tr>
<tr>
<td>$2 Cost per student per year</td>
<td>$5 Cost per student per year</td>
</tr>
<tr>
<td><strong>Tech support (0.25 dedicated tech support person, presumes 4-year hardware warranty)</strong></td>
<td><strong>Tech support (0.5 dedicated tech support person, presumes 4-year hardware warranty)</strong></td>
</tr>
<tr>
<td>$75,000 Cost of tech support person plus overhead</td>
<td>$75,000 Cost of tech support person plus overhead</td>
</tr>
<tr>
<td>$38 Cost per student per year</td>
<td>$75 Cost per student per year</td>
</tr>
<tr>
<td><strong>Professional development (0.25 trainer year 1, 0.125 trainer years 2-4)</strong></td>
<td><strong>Professional development (0.50 trainer year 1, 0.25 trainer years 2-4)</strong></td>
</tr>
<tr>
<td>$100,000 Cost of PD person, fully burdened</td>
<td>$100,000 Cost of PD person, fully burdened</td>
</tr>
<tr>
<td>$62,500 Total PD cost</td>
<td>$125,000 Total PD cost</td>
</tr>
<tr>
<td>$90,000 Leadership, Change Management and Program Management</td>
<td>$140,000 Leadership, Change Management and Program Management</td>
</tr>
<tr>
<td>$76 Cost per student per year</td>
<td>$133 Cost per student per year</td>
</tr>
<tr>
<td>$281 Total cost per student per year</td>
<td>$493 Total cost per student per year</td>
</tr>
</tbody>
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areas of cost reduction potential.

- **Printing supplies** (ink cartridges, toner, etc.): *Seven* districts reported a decrease in expenditures and only *three* districts reported an increase in expenditures. The other six districts did not report expenditures for printing supplies in Year 1 or Year 3.

- **Copy machine and printer maintenance**: *Seven* districts reported a decrease in expenditures and only *four* districts reported an increase in expenditures. The other five districts did not report expenditures for copy machine and printer maintenance in Year 1 or Year 3.

- **Textbooks and all other technology expenditures** (network, bandwidth, tech staff, etc.): *Nine* districts reported a decrease in expenditures and only *seven* districts reported an increase in expenditures.

Four other areas showed statistically significant changes that can lead to direct savings that can offset costs, or can create positive financial impacts at the district, state, or federal level.

- **Documented disciplinary actions**: *Eleven* districts reported a decrease in the number of disciplinary actions, with only *two* districts reporting an increase in the number of disciplinary actions. The estimated savings across the districts ranged from $4/student/year to $21/student/year, with an average of $14.80/student/year.

- **Dropout rate**: *Nine* districts reported a decrease in the dropout rate and *five* districts reported an increase in the rate. The costs of dropouts will be discussed separately.

- **Number of students enrolled in AP courses**: *Eight* districts reported an increase in the number of students in the courses and *five* districts reported a decrease in the number of students in the courses.

- **Graduation rate**: *Eleven* districts reported an increase in the rate and *three* districts reported a decrease in the rate.

### Digital Conversion

#### Financial Considerations

In addition to the raw cost savings and the indirect financial impacts, other financial impacts loom over digital conversions. There are several areas where we believe states and LEAs should spend time focusing when planning and implementing a digital conversion.

#### Sustainability - State Level

States have (or should have) a particular interest in seeing that technology initiatives are sustained. The cost of restarting an initiative is very high. Amazingly, the actual impact on students is frequently not a high priority, based on how much it is discussed in public meetings. But an initiative that is not sustained generally leads to lower levels of student performance. In more blunt terms, students fail classes. Students who fail too many classes drop out of school. Students who drop out of school are doomed to lower
income jobs and all that that entails.

If there is the specter of hundreds of thousands of students being consigned to misery, then a state should consider the economic impacts of failing students. On average, each student who drops out of high school pays $600,000 less in taxes over their work career, as compared to that same student who graduates from high school and goes on to graduate from college. Doing the math, a state makes $600,000 on a maximum incremental investment of $2,400. This is a 250:1 payback. Where else could a state make $250 on every dollar invested?6

**Sustainability - District and School Level**

Sustainability of any initiative, including technology-based initiatives is extremely important. The adoption of technology is less successful if students, teachers, and parents believe the program will end. Why spend time learning about what might be a new fad? To a large extent, sustainability is in the hands of the LEA. Many LEAs do not want to phase an implementation. They prefer to do an entire district, or to not do it at all. We recommend that if future funding is in doubt, then scale the implementation down until a more secure source of long-term funding is available.

**Dealing with Difficulties and Implementation Pitfalls**

School districts have great difficulty in realizing the savings resulting from properly implemented educational technology. This is true of high-performing Project RED Signature Districts, as well as other districts. There are few incentives or controls that assist in the process. A school has a budget. The budget has only a few categories of expenditures. If savings do happen to occur, then schools usually find ways to spend the money on non-priority expenses rather than give it up.

It may be useful to divide the process into steps and look at the difficulties by step. Step one is to identify potential areas of savings. A Google search will not turn up much to help the district. One way to start is to look at *The Technology Factor*, Chapter 9, which lists 13 candidate areas where savings are possible. The district or school can review the list and make an educated guess on which suggestions best fit their situation. A committee may be appointed to do brainstorming and prioritizing. The committee could reach out to other districts that are further down the path. Generally, if you dig hard enough, almost every district will know of ways they have saved money, or where they could have saved money. The district needs to look at potential areas of savings to see what fits their situation. For example, one district was able to eliminate computer labs when they went digital. This produces tremendous savings, as computers do not have to be refreshed. There are power savings. If there was a lab manager, there may be substantial personnel savings. If the district has growing enrollment then the value of an additional classroom is high. If the district has stable or shrinking enrollment, then there may be no value attached to freed-up space.7

Once the list of target savings areas has been identified, a plan must be developed to capture the savings. Otherwise they are very ephemeral.
“On the Fence Costs”
A digital transformation brings many new capabilities to the classroom. Some are new, and others replace an incumbent. Prime examples are curriculum software replacing textbooks and Internet resources replacing supplemental materials. It appears that many districts are loath to sunset current expenditures. The result is high program costs. Districts should strongly consider a process to identify potential areas of cost reduction that are associated with any new technology-related purchase, and may consider incentivizing employees who share ideas for potential savings that are credible.

Digital Conversion
Financial Pitfalls

K-12 education is the largest remaining industry that has not embraced technology as a way to save costs, as well as a way to improve productivity and outcomes. These reasons include:

Political and Policy Level. There are two distinct issues:

1. Measurement: K-12 education is a highly regulated public sector enterprise. As with most organizations, the education sector focuses on what is measured.

2. Incentives: In most states, there are few incentives to actively save money. For example, if a student fails a class, there are no financial penalties. The state gives the LEA the same amount of money to repeat the failed activity the same way. A notable exception is Florida and the Florida Virtual Academy. The state will not reimburse the academy unless a student passes. This mentality is pervasive. At all levels there is very little discussion about how to be more cost effective. And, as mentioned earlier, research on this topic is almost non-existent.

Identification: If an LEA does have the interest in saving money, the first step is to identify potential candidate areas to explore. With the exception of Project RED, there are no comprehensive (or even simple) lists of target areas. LEAs will need to take the initiative and convene a task force to brainstorm and qualify opportunities.

Capture: Once target areas are identified, savings must be captured. This takes planning and effort. Some questions will need answers such as: Who is responsible for this? Is it in their official job description or does it fall under “other duties as assigned?” Are targets set for expected savings? Are there baseline data? Or is the proposed savings area lumped into a large category and not separately tracked? Are actual savings levels regularly reported on? Is there a process defined for the above and other required elements? Are the staff trained on the savings initiative? Do they know the objective? Do they know their role?

Repurposing: Assuming savings are actually captured, what is the process to isolate the savings and repurpose them? Unless there are policies and processes, it

“From a policy perspective, it is imperative that district and state education leaders be properly trained to lead the effort to make properly implemented education technology revenue positive at the state and district level.”

~ Dr. Rich Thome
Former SoCal Superintendent of Schools
is far too easy for the savings to be lost in the system and go for unintended purposes. An LEA’s CFO should consider how best to do this. What if a savings line item were added to the LEA chart of accounts? Is the entire process institutionalized and sustainable?

Digital Conversion
Financial Implications by Audience

Policy Level

Clearly, policy-level players should have a strong interest in the financial implications of digital conversions. Most policy-level players came to their offices before the world moved to a digital world. They may or may not have a strong background in this area and may not recognize the opportunities and issues. We recommend the following:

- **Require financial accountability:** If money is authorized, it needs to be spent wisely, with fidelity, and not wasted. Imagine if an interstate highway bridge were funded. The bridge was so poorly built that it could only handle foot traffic. Cars and trucks were banned, and when one tried to cross the bridge, it collapsed and killed the car occupants. Would this be acceptable to the legislators or governors who authorized the bridge? Of course not. Then why is it acceptable to authorize money for a digital conversion and allow 1% fidelity and no improvement in academic outcomes?

- **Look to the future:** The U.S. has a serious problem with stagnated academic performance across the board at all levels. In most states, half the students are struggling below expectations. Why not raise the stakes, similar to when President Kennedy pledged to go to the Moon by the end of the decade. We have the knowledge and capabilities to double the rate of learning. It is time for true leaders to take on this challenge.

LEA Level

The LEA is where the real action is. The superintendent should consider the following if he/she wishes to dramatically improve student achievement:

- **Vision:** Is the LEA vision clear? Does it articulate a vision that is realizable and has the support of all stakeholders?

- **Organization:** Is the LEA organized properly to be successful? In particular, does the technology department really understand and implement their role to improve student achievement? Should the LEA consider placing technology under the curriculum and instruction department? Is the right staffing in place to be successful?

- **Leadership:** Given the complex nature of the problem, has the LEA moved from hierarchical to distributed leadership?

- **Budgeting:** Are all digital conversion costs included as a line item in the budget, as opposed to dependence on bonds or other one-time money?

- **Planning:** Digital conversions are
complex. The program management and project management should be done by experts. Consider that a digital conversion that is capable of getting academic results is at least as complex as building a new high school. Would you give the job of architecting and building a new high school to the district maintenance director?

Industry Level

LEAs are dependent on industry partners in many ways. While there are thousands of industry partners, they have yet to make it easy for an LEA to acquire all needed services and products for a successful digital conversion. Some advice for industry includes:

- **Systems approach:** A successful digital conversion requires a systems approach. Almost every one of the thousand suppliers supplies a point solution. Their point solution has to interface with many other point solutions. There is an immense need for systems integrators and for providers of enterprise-class solutions.

- **Terms and conditions:** Supplier terms and conditions are not conducive to successful implementations. One example is assumption of risk. Suppliers are too quick to shift all risk to the LEA. LEAs would benefit from contracts that limited LEA risks. Since the LEA have encumbrance accounting systems, they need fixed prices. Another major need is for pricing that is supportive of line item budgeting. This might take the form of a fixed annual per student cost that includes hardware, software, services, required refreshes, etc.

- **Truly innovative products:** Despite the fact that the electronic technology revolution in the classroom is more than 30 years old, and that the trend towards ubiquitous technology is 20 years old, software publishers have just scratched the surface in exploiting the value of technology. The refrain of doing old things in new ways is as valid today as it was in 1996. With a few notable and excellent exceptions, publishers have not taken advantage of a large opportunity to develop breakthrough products that drive dramatic improvements in student performance.

State and Federal Implications

As reported in *The Technology Factor*, the positive financial impact of improved educational outcomes is enormous and well documented. The documented savings are in excess of a hundred billion dollars annually. The potential increases in tax revenues from a better educated and higher paid work force is in excess of one trillion dollars a year.

**Summary**

Project RED III provides further valuable evidence that money is no longer the limiting factor in realizing improved educational outcomes. Through the wise, and high-fidelity implementation of technology, which encompasses hundreds of important factors (only one of which is the device), there are short-term and long-term savings that far exceed the costs.
References & Notes


See previously cited Greaves et al.

3 Data compiled from http://www.futuresource-consulting.com/reports/search/r/educationtechnology as well as industry expert interviews

4 See previously cited Greaves et al.


7 See previously cited Greaves et al.

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