



WHITE PAPER:

A Clear and Sharp Focus

What Technology Should Do for 21st Century Learning



Written by Debbie Tschirgi
Director of Educational Technology Programs
Educational Service District 112
Vancouver, Washington

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Executive Summary

In this day of **No Child Left Behind**, where accountability is cornerstone and stakes are high, there is a myth that the use of technology should improve student achievement. School districts write goals about improving test scores with the use of technology. School boards approve technology budgets for purchasing technology to improve learning. And technology companies promise to increase student achievement with their solutions. Three to five years later, there is often great surprise and disappointment when the technology “has not delivered” and the goal of improving student achievement with technology has not been met. **Perhaps, this is the wrong goal.**

This paper examines a different philosophy about the role of technology in schools, and identifies three measurable technology goals that can achieve results and that won't disappoint the stakeholders. Also included is a discussion on obstacles that districts face in embracing and adopting technology. The paper continues with a suggested roadmap that districts may wish to consider as they phase technology into their schools, and closes with a post-paper interview for the purpose of clarification.



Background

For years, school administrators and technology companies have been trying to connect the dots between technology and student achievement. Many school boards will not approve technology expenditures without having evidence that their investment is going to result in improved student achievement. And in response to that obstacle, oftentimes district leaders will hunt for the research that documents technology's role in improving test scores.

The Wrong Goal

It's time that district leaders examine the lens that they are using for identifying the value of technology in education. Certainly, in today's high-tech world, there's no question that teachers and students should be using technology for teaching and learning. 21st Century classrooms require the use of technology to prepare today's students for tomorrow's workforce. But should districts be turning to technology to increase student achievement? Is it appropriate for districts to write technology goals that identify improved test scores as the intended outcome?

District leaders and educators should exercise extreme caution about their expectations of using technology to specifically increase achievement. There are a couple of reasons for this:

- **Technology as a Term and a Solution**
According to the Miriam-Webster dictionary, the term *technology* is defined as “a manner of accomplishing a task.” In this respect, a pencil is a technology that is used to accomplish the task of writing; a chalkboard is used to display information; a desk is used to seat a student; etc. These items are not used to “increase student achievement;” rather, the use of these solutions help to overcome a specific barrier to learning. In the same manner, the role of computers, interactive whiteboards, clickers, document cameras, probeware, and other electronic or digital technologies should be clearly stated in terms of the tasks they are meant to accomplish and the obstacles to learning that they are helping to overcome.
- **Technology Integration with Other Changes in Practice**
When schools are realizing the full potential that technology has to offer, there are always other interventions being made in addition to technology

integration. These interventions include, but are not limited to:

- A shift of the teacher's role from *director* to *co-learner*;
- The use of authentic learning activities, where *authentic* means *meaningful* and *reflective of the real world*;
- A shift from *isolation* and *individual learning* to *collaborative learning* in the classroom;
- A move from rote, production-line learning toward problem-based learning where students are seeking answers and solutions to a deep, essential question.
- New assessment strategies that measure a student's performance or attainment of the learning targets.

If student achievement increases as measured by test scores, the total effect of all of these changes makes it unwise to single out technology as the silver bullet that led to a positive result or the demon that caused the failed outcome. At the very least, school leaders should conclude that it was the **totality** of all of the changes or interventions that led to increased student achievement or the lack of it.



Achievement vs. Learning

If it is unwise to perceive technology's value in terms of increased student achievement (as measured by test scores), what then, can we reasonably expect technology to do in education? The answer to that lies in the definition of the term *learning*.

Too often, schools and companies try to connect the dots between **technology** and **increased student achievement**, and are often disappointed with the results. Student achievement is measured and reported as an outcome **at the end of learning**, to determine whether the learning targets were met. However, the American Heritage Dictionary defines the term **learning** as **the act, process, or experience of gaining knowledge or skill**. To make this distinction between **learning** and **achievement** is significant; it is possible to use technology to carry out tasks that will **accelerate learning**, but more difficult, if not impossible, to measure its impact on **achievement**.



Three Measurable Goals for Technology

By referring back to the definition of *technology* and using it to accomplish a task, consider three tasks that are appropriately addressed with technology:

1. Technology Should Optimize the Physical Learning Environment

The physical classroom faces many logistical and environmental barriers to learning. For example, teachers have no control over the size of their classrooms or where the front of the room is. The real estate and footprint of the classroom have both been determined long before any student set foot in the room. Students in the back of the room must be able to see the lessons as well as the students in the front. And **all** students must be able to hear at all times, regardless of noisy buses lined up outside the classroom, noisy hallways, buzzing lights and banging radiators.

In this scenario, then, the tasks become very clear, and can be used as a basis for writing goal statements, where technology is used as a strategy to accomplish each task. Consider the following:

- **Task #1:** To remove acoustical barriers to sound perception in all learning spaces.

Goal Statement:

By <a specific date>, all learning spaces will achieve a signal-to-noise ratio of 30 dBA or less.

Strategies:

- To install sound amplification systems into all learning spaces.
- To install sound treatment materials into learning spaces.
- To evaluate alternatives to the bus-loading location.

- **Task #2:** To remove visual barriers from all learning spaces so that all students can see at all times, under all conditions.

Goal Statement:

By <a specific date>, all learning spaces will be set up and configured to accommodate visibility by all students, as measured by the achievement of an average score of 4 (out of 5) on a student survey.

Strategies:

- To install document cameras and projectors into all learning spaces.
- To install variable lighting solutions in all learning spaces.

As noted above, the technologies listed for each of the goals above include sound amplification solutions to remove the three acoustical barriers to sound perception in the classroom, and document cameras and projectors to remove the visual barriers to learning.



Document cameras and projectors allow all students in the classroom to view the teacher's lessons and/or materials from anywhere in the classroom. The document camera can be used to display 2-D and 3-D items to the students in the class through the use of an LCD or DLP projector.



At any given time, three out of seven students attend school with a temporary hearing loss, due to colds, allergies, fluid in the ears, or ear infections. Sound amplification solutions help to overcome those health conditions, as well as the three acoustical barriers to sound perception in a classroom: (1) Signal to Noise Ratio; (2) Distance as a factor; and (3) Sound reverberation. (Tschirgi, 2009)

2. Technology Should Engage Students in the Learning Process

Engaged students feel a deep and personal commitment to their own learning. They make a psychological investment in learning, and take pride not only in earning a good grade, but in developing a deep understanding of the material. In this sense, the term *engaged* means *involved* or *greatly interested*.

Student engagement can be increased in a number of ways. Many schools start by improving the *teacher-student relationship*. Other steps to increasing engagement include giving all students *a voice* in their education (including those that are shy, lack confidence, or don't understand the learning material as well as they should), and by providing them with *immediate feedback*.

• **Task:**

To provide students opportunities to engage in learning by giving them a chance to voice their opinions, respond to questions more frequently without the risk of embarrassment, and to get feedback about their learning.

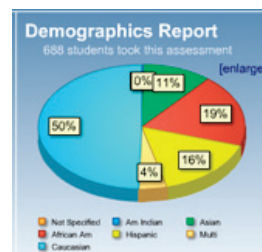
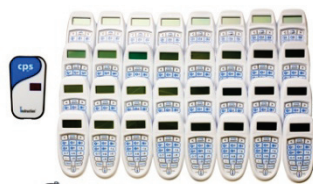
Goal Statement:

By <a specific date>, 80% of all students will be fully engaged in their learning experiences, as measured by lower student absentee rates, higher graduation rates, and/or an average rating of 4 (out of 5 possible points) on a student survey.

Strategies:

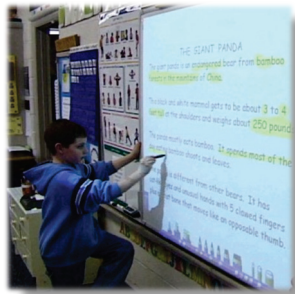
- To provide professional development to teachers on improving the teacher-student relationship.
- To incorporate clickers into the learning activities to give students voice and immediate feedback.
- To increase authentic learning experiences that require the use of digital technologies for the research, analysis and production of their own learning projects.
- To offer alternative learning experiences, such as online courses, to high school students.

There are several good technologies that will help engage students in the learning process and will give them opportunities to express themselves, respond to questions without embarrassment, and to get immediate feedback.



*Wireless response systems (aka **clickers**) allow all students to respond to a question to get immediate feedback without the risk of embarrassment.*

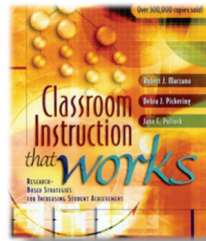
Document cameras and projectors provide students with the opportunity to get immediate feedback from the teacher, as well as to share their own work and give each other immediate feedback.



Interactive whiteboards provide students with opportunities to “become the expert” and present a visually-rich report or hypothesis to the other students. Because the images and data on an interactive whiteboard are dynamic, the presenting student can manipulate the elements in his/her presentation, adding interest to the report for the remaining students.

3. Technology Should Support Research-Based Instruction

All too often, districts embark upon a process to prove that the integration of technology is the silver bullet that leads to improved test scores. Finding good, empirical research that supports this hypothesis is like looking for a needle in a haystack. However, a substantial body of research is available that identifies the **instructional strategies** that do increase student achievement.



In the book, *Classroom Instruction That Works*, (Marzano, Pollock and Pickering, ASCD, 2001), Robert Marzano, a leading researcher in education and the lead author of the book, identifies nine research-based instructional strategies that are empirically proven to increase student achievement.

The instructional strategies include:

- *Identifying similarities and differences*
- *Summarizing and note taking*
- *Reinforcing effort and providing recognition*
- *Homework and practice*
- *Nonlinguistic representations*
- *Cooperative learning*
- *Setting objectives and providing feedback*
- *Generating and testing hypotheses*
- *Cues, questions, and advance organizers*

That’s a good place to start, **because the work of identifying effective strategies for increasing achievement has already been done and documented**. It would follow, then, that the task for a school would be to incorporate those strategies into lessons and activities, and to use technology when and where it can support those strategies.

- **Task:** To incorporate research-based instruction into daily lessons and activities.

Goal Statement:

By June 30, 2013, all teachers at XYZ school will incorporate research-based instructional strategies into their daily lessons, as measured by the lesson plan reports submitted to the principal on a weekly basis.

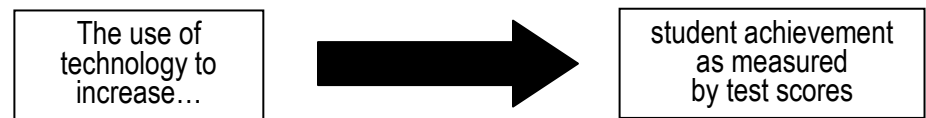
Strategies:

- To utilize professional learning communities to engage teachers in a study of the book **Classroom Instruction That Works**.
- To allow teachers time to visit each other's classrooms to observe the use of research-based instruction and to dialog with each other about the results.
- To use instructional technology to carry out and support research-based instruction.

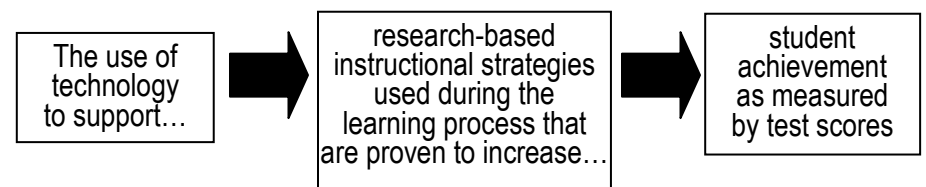
It's important to **clearly understand** that the use of the technology in the third bullet above is for the expressed purpose of **supporting the proven strategies**, and **not** to tie its use **directly to student achievement**.

Another way to consider this is through the diagrams below:

Be cautious about connecting these dots...



...and consider connecting these dots:



Many of the technologies already mentioned in this paper will support research-based instructional strategies. However, two technologies that have already been discussed require clarification about their role in the learning process: the document camera, and the interactive whiteboard.

Presentation Technology: Document Cameras and Interactive Whiteboards

Interactive whiteboards and document cameras allow teachers to use and manipulate text, images and objects in a real-time manner. Their use supports non-linguistic learning, as well as several other proven instructional strategies. The ability of these technologies to combine words with diagrams, drawings, pictures and 3-D objects strengthens the learning experience for the students.

*Obstacles to
Implementation*

*Schools that identify interactive whiteboards and document cameras in their strategic plans for supporting research-based instruction are cautioned about using these technologies to support outdated, traditional learning models where instruction is delivered in a teacher-directed classroom. While these technology solutions are very powerful when used by teachers as they teach skills and conduct demonstrations to their students, **their greatest benefit is realized when the students are using these solutions to compare and contrast objects or ideas, generate and test their hypotheses, and engage in other research-based strategies.***

Please refer to the table at the end of this paper to view how each of the technologies can be used to support each of the nine research-based instructional strategies.



So, if these technologies are so wonderful, what keeps some schools from adopting them? Following is a list of hurdles that need to be overcome for schools and districts to use technology to accelerate learning:

1. Lack of vision or awareness:

School districts need leaders who have a clear and sharp vision for using technology for learning. And school leaders need to be kept abreast current and emerging technologies that can help their schools and/or district achieve one of the three goals listed above.

2. Misperceived value:

Some decision-makers are cautious about embracing technologies such as interactive whiteboards and clickers, because they think that they promote traditional, teacher-centered learning. For example, some school leaders don't like clickers, because they think that they only promote low-level thinking skills (multiple choice answers). Schools need help in learning that this technology can be used to promote deep thinking among students. Unless there is a plan to help develop student-centered classrooms with these solutions, these fears about supporting traditional teaching models may well come true.

3. High cost:

It has been said that "...a good technology solution allows you to do what you need to do better, faster and cheaper." There are a few technology solutions that allow a teacher to teach better and faster, but not cheaper, although as time passes and competition increases, the cost of these solutions is coming down.

4. Training and technology support:

Some of these technology solutions are not tools that you give to a teacher and say, "You now have technology to use to accelerate learning. Now, go forth and teach with it." They are complex tools that require (1) an understanding of their capabilities, (2) training, and (3) more technical support than the average technology. Many teachers have these technologies in their classrooms, and they are sitting in their closets because of these reasons.

5. Change in instructional practice:

The power of technology is in its ability to change the way teachers teach

and students learn. But, that means teachers have to do the hard work of:

- examining their learning goals;
- re-designing their lessons;
- considering their instructional strategies; and
- changing their assessment strategies.

This all may be overwhelming to an elementary teacher who teaches 14 subjects a day, or a secondary teacher who teaches 150 students daily.



If districts can overcome the obstacles to adopting technology for learning, then they might benefit from having a master plan in their hands that will assist them in prioritizing their purchases. The author has identified five mainstream technologies for a *phased-in approach* that might help districts when they don't know where to start...or...when they are on tight budgets.

Phase 1: Classroom Amplification Systems



Yes, these should take precedence even over computers, because amplification systems are the great equalizers. Whether students have normal hearing or are suffering from a temporary hearing loss...whether they are in a classroom with a low signal-to-noise ratio or have to contend with busses lining up outside their classroom window... amplification systems help to remove the acoustical barriers to sound perception **for all students**.

Phase 2: Computer, Document Camera and Projector



This combination scores very high in *sustainability*. (Tschirgi, 2010)

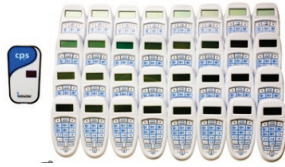
Phase 3: Streaming Media



While streaming media isn't a hardware solution, a subscription to (or purchase of) this service provides **all students** in a school with access to high quality, safe content that engages them in the learning process. It equalizes the playing field for high-achievers, average students, and at-risk students who may be non-readers, but must still learn the content. And, a quality solution will provide students with access to the media from both school and at home, and is one of the few

technologies that actively support the research-based instructional strategy **homework and practice**. See the table on page 11.

Phase 4: Classroom Response Systems



This proposal suggests this solution even before an interactive whiteboard, because while an interactive whiteboard increases visual learning, a response system does more to change instructional strategies, improve assessment strategies, and increase student engagement, all of which will accelerate learning.

Phase 5: Interactive Whiteboards



Interactive whiteboards are very effective tools to support research-based instruction, but teachers need to be careful that they are not using this technology as a glorified chalkboard in a teacher-directed classroom.

The suggested order of solutions included in the phased-in approach above will not meet the needs of all districts. Certainly, district leaders should examine their organization's learning goals and then consider whether they would adopt these phases, re-arrange them, or replace them with other solutions.

The significance of providing a suggested order of adoption is to encourage district leaders to:

1. get very clear in their approach to bringing technology into the learning environment;
2. articulate its value in the learning process; and
3. prioritize the solutions in relation to the goals they are meant to help achieve.



In Conclusion

While some school leaders have a good grasp on the way in which technology can change learning, others need help with knowing where to start. By carefully considering their learning goals for technology, overcoming obstacles, and using a phased-in approach to procurement and implementation, schools and districts will be better prepared to answer the question from any stakeholder, "So, what does technology do for learning in *your* school district?"

On the Internet

This white paper can be downloaded from the Internet at
<http://www.esd112.org/digitaledge/wa/about/whitepapers/>



About the Author

Debbie Tschirgi is the Director of Educational Technology Programs and Media at Educational Service District 112 in Vancouver, Washington. Every year, she reads books and articles on teaching, learning and assessment topics. She also reviews the research on current and emerging instructional technologies, and helps districts **connect the dots** between learning and the technology. Her goal is to provide a context for using technology in schools in a way that clarifies its role and then helps districts address the question, **“So really, what does technology really do for learning?”** with their stakeholders.

In addition, she works with technology directors and audio-visual specialists in her region and state to identify the recommended criteria for classroom technology solutions. As a result, Debbie advises the ESD 112 Purchasing Manager in identifying the kinds of classroom instructional products to solicit through the DigitalEdge competitive bid program at ESD 112. For more information on the DigitalEdge, please go to **digitaledge.esd112.org**.

Finally, Debbie develops classroom models of technology integration that are grounded in research-based instructional strategies, and has shared her expertise with school district leaders and company executives around the country and at state and national conferences. She is available to consult with districts regarding their technology plans and implementations. She can be reached at **debbie.tschirgi@esd112.org**.

Lining up Classroom Technology Solutions with Sustainable Research-Based Instructional Strategies

	Identifying Similarities and Differences	Summarizing and Note-Taking	Reinforcing Effort and Providing Recognition	Assigning Homework and Practice	Using Nonlinguistic Representations	Incorporating Cooperative Learning	Setting Objectives and Providing Feedback	Generating and Testing Hypotheses	Using Cues, Questions, and Advance Organizers
Document camera and projector	X	X	X		X		X	X	X
Interactive whiteboard and projector	X	X			X		X		X
Probeware	X				X	X		X	
Response system and projector	X	X			X	X	X	X	X
Streaming media	X	X		X	X			X	X
Student laptops or netbooks	X	X	X	X	X	X	X	X	X
Web 2.0 tools	X	X	X	X	X	X	X	X	X
Wireless digital microscope and personal device	X				X	X		X	

A Post White Paper Interview with the Author of This White Paper

Interviewed by a marketing manager from an audio solutions company

December 8, 2010

Question:

In your opinion, why is it in the best interest of a Technology Director to choose classroom amplification above other technologies?

Answer:

*It's **not** in the best interest of the Technology Director. It's in the best interest of the **students**. That is of paramount significance. However, what **IS** in the best interest of the Technology Director is to be very clear about the larger goals that the district (or organization) is trying to achieve, and how sound amplification supports those goals.*

Question:

When deciding on the technology to invest in, what product features or benefits should a Technology Director consider most?

Answer:

*We can't compare the product features of a document camera with that of an interactive whiteboard or a digital camcorder. I think the better question is...**what criteria should be considered in prioritizing those purchases?** If you think about that, the proposed question is much more philosophical in nature, and will result in a much different kind of response than the original question. If we are in agreement about the actual nature of the question, then here is my response:*

- 1. Will this technology help the district achieve **its learning goals**? If so, how?*
- 2. Is the purchase of this technology sustainable? (Read the section of my white paper called **A Clear and Sharp Focus: What Technology Should Do for 21st Century Learning**. It defines **sustainability** and lists its characteristics.) If so, in what way?*
- 3. Does the adoption of this technology **benefit the greatest number of students possible**? Provide the data to show this.*
- 4. Will the purchase and implementation of this technology create **optimal learning environments**? If so, in what way?*
- 5. Will the integration of this technology increase **student engagement**? If so, how?*
- 6. Does the use of this technology by teachers and students support the **research-based instructional strategies** identified in the book, **Classroom Instruction That Works** (Marzano, Pickering and Pollock, ASCD, 2001)?*
- 7. Does the planned implementation of this technology promote **anytime, anywhere, anyplace learning**? (This is relevant only if this is one of the district's learning goals.)*

Question:

Do you think that some schools may not place classroom amplification at the top of their priority list because it's not as "glamorous" as other technologies (i.e. you can't always see it working the same way you can see interactive whiteboards – and other devices - working)?

Answer:

Yes, I think this is the primary reason. If sound amplification is being used seamlessly in a classroom, you'll hardly notice it's there.

Secondly, I don't think that most school leaders understand the research that **clearly** supports the use of sound amplification in schools.

Finally, I don't think that most school leaders have connected the dots between a young learner's likelihood of a temporary hearing loss due to a cold or ear infection, their lack of life experience, and the ways in which sound amplification can help to overcome those barriers to sound perception in the primary classroom.

Question:

Can you provide a bit more insight as to why you gave sound amplification the highest priority in procuring technology for schools?

Answer:

Yes, I can. But first, let me say that **the only one that I am certain belongs in its place of priority in this white paper is sound amplification**, for the reasons I outline below. Other technologies, such as document cameras, projectors, interactive whiteboards, and response systems, are all negotiable in terms of where a district places them in priority. Some districts may choose to place interactive whiteboards before document cameras or response systems. Other districts may prioritize student laptops over interactive whiteboards. And some districts will give streaming media priority over the other solutions.

Regardless of where those other technologies end up on the list of their priorities, those technologies, in my opinion, require a much more planned implementation, such as an analysis of readiness to benefit, a plan for training and professional development, a teacher's willingness to do the hard work of figuring out how to integrate them into their lessons, higher level of tech support, a schedule for refreshing them, a budget for replacing supplies, and a more involved method of evaluating their instructional effectiveness. That's not to say that they shouldn't be adopted, because I am a **major supporter** of all of those instructional technologies, and all of those challenges can be overcome with careful planning and analysis.

Having said that, I put sound amplification at the top for the following reasons:

- Sound amplification is foundational to creating **an optimal learning environment**. In the same way that lighting in a classroom helps the students to see, sound amplification eliminates the acoustical barriers to sound perception in a classroom so that all students can hear the teacher and each other.
- Sound amplification is **sustainable**. Refer to my definition of sustainable technology in my white paper on document cameras. (Tschirgi, 2010).
- The benefit of sound amplification is **research-based**. (Tschirgi, 2009.)
- Sound amplification, if installed in all learning environments, **benefits the greatest number of students**, including those with temporary hearing losses, as well as students with normal hearing.

Final Response to Nicole from the Author:

The questions you raised are very important questions to wrestle with, Nicole. Good questions always inspire me. Thanks for your inspiration.

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