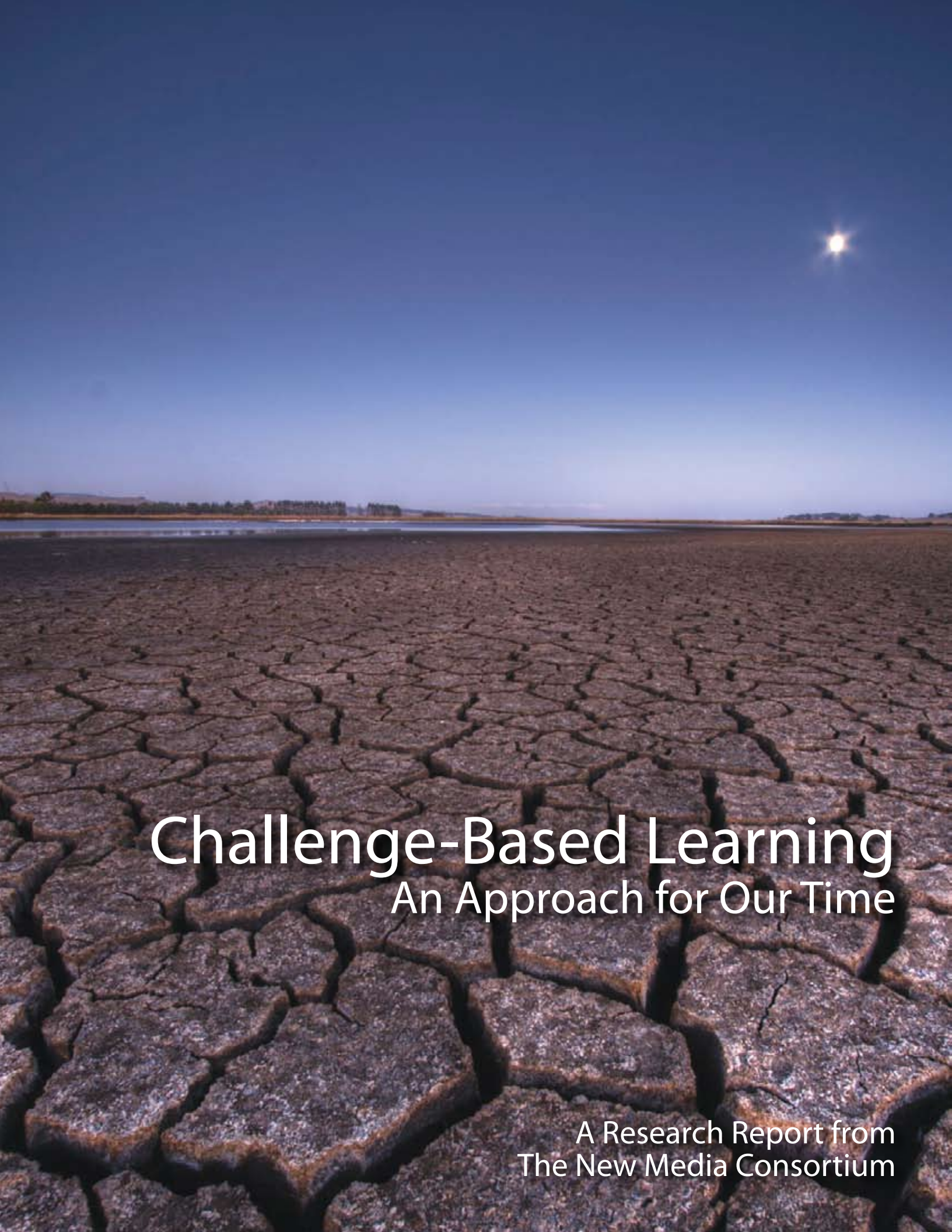

Challenge-Based Learning

An Approach for Our Time

A Research Report from
The New Media Consortium

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Executive Summary

Public education in America is in trouble.

We've known about it for more than 25 years now, since the publication of *A Nation at Risk* in 1983, and despite billions of dollars of investment and massive reform projects like No Child Left Behind (NCLB), we still find that three of ten kids drop out of school without a diploma.[1] Each year the US sees its children do worse in math and science than countries such as Kazakhstan, Latvia, and Lithuania.

The most recent study of global math and science performance[2] shows US students making some gains in the last four years, with fourth graders moving from 12th to 11th place, and eighth graders in from 15th to 9th place in math results, but what the rankings do not show is that that is largely due to erosions in performance around the world, not in the US making great strides. In fact, there is no significant difference in science performance among US students in the last four years at all.

At the same time, the world has never had a greater urgency in ensuring that our children are equipped to tackle the serious challenges that lay before them. The world, to a teenager, is a place rife with serious issues — a global financial meltdown, planetary warming, dependence on fossil fuels, wars on two continents. When polled, dropouts report that they leave school because it has no relevance in their lives. Employers sponsor study after study documenting the skills the American workforce needs to stay competitive in a global marketplace, yet increasingly employers are left looking overseas for those skills, as US schools are by and large not cultivating them.

1 See Barton (2005) *One Third of a Nation: Rising Dropout Rates and Declining Opportunities.* Educational Testing Service Policy Information Report

2 *Trends in International Mathematics and Science Study, 2007 Results.* See the full study at http://nces.ed.gov/timss/

It is not that we don't know we have a problem. It is not that plenty of good people are not working on the challenges. And we are not alone. Most of the industrial world is experiencing many of the same issues. We have seen some gains in the quarter century this problem has been in the public eye, but they have not been nearly enough.

We need to think differently.

What if we focused our energy not on test scores and rankings but on engaging students in their work? What if their work was more than facts and formulas as presented in books, but relevant to the world they see? What if rather than trying to teach them problem solving, we actually encouraged them to take on problems that needed solving? Rather than teaching them a science curriculum, what if we opened the door for them to do science?

Imagine a class where that sort of thing was the central focus. A class organized on solving real-world issues, in the spirit of the exhortation made famous by John Lennon to "think globally, act locally." A class where the goal was to reach out to any discipline that could provide a piece of the solution, where kids helped steer other kids to useful resources and knowledge. A class where the outcomes would be absolutely authentic. A class that would touch on all the essential 21st century skills listed recently by over 40 leading companies.[3] Imagine further that in this class, more than 95% of the kids would self-report that they were deeply engaged, and that they routinely worked in groups, accessed the Internet for just-in-time tools and resources, and used the web and digital media to richly communicate their solutions.

That is just what a group of 29 teachers did in December 2008, working with a visionary team of educators from Apple, Inc. The concept they all embraced was called challenge-based learning,[4] and by any measure it was a fresh approach. It called for a new way of thinking about the role of the teacher, one in which he or she had to be comfortable as the students struggled and wrestled with a meaningful challenge, letting them choose their own path to understanding within a clearly global issue like sustainability, global warming, or war, and ultimately allowing them to come up with both questions and answers as they directed the course of their own learning.

In a pilot of the approach that ran in a variety of formats in six schools across the US, fully 97% of the 321 students involved found the experience worthwhile. Students self-reported that they were learning and refining skills that closely matched those identified by the Partnership for 21st Century Skills, even though they were never shown that listing. Initially unsure their efforts would matter, by the end of their respective projects 80% of participating students reported that they had made a difference in their schools or communities by addressing their challenge. Students strongly endorsed challenge-based learning, with four out of five saying they would definitely recommend the approach to other students.

3 Partnership for 21st Century Skills. (2009) http://www.21stcenturyskills.org/

4 Apple Education wrote a concept piece on the topic in 2008 that describes the method in considerable detail. See http://images.apple.com/education/docs/teachers/Apple-ChallengedBasedLearning.pdf

Teachers were surprised by the time and energy expended by their students, and at how they found ways to address group communication issues and work together, and at how they so enthusiastically embraced their challenges.

This white paper tells the story of their efforts, and how the results of this pilot show that there is indeed room in public education for fresh thinking. Kids are clearly engaged when they are allowed to craft creative solutions — and the evidence from this pilot shows that when given the room and flexibility to tackle things they see as not only relevant, but critical to their lives, they are not only engaged, but they bring the learning to themselves.

The story begins as it did in real life, with an assessment of the reality faced by our public schools, and an acknowledgement both of the work that has been done to this point and the work that remains to be done. Challenge-based learning builds on a longstanding stream of solid educational thinking, and it is clear not only from this pilot, but also from the literature that it works, so the case for change is something we will touch on, but not dwell upon. Most of this story begs to be told via the voices of the students and teachers who participated, and it is in their excitement and their passion that the true success of this pilot can be felt.

The hope of everyone involved in the project is that these ideas will take root and generate more fresh thinking, and new ways of bringing kids to the knowledge and skills they will need in a dangerously challenging world. What we know will not work are short-sightedness, bolt-on marginal approaches, or strategies that put too much distance between the world kids see before them and the material they are asked to master.

Challenge-based learning puts that world in center focus, and surfaces the essential relevance of their core subjects at the same time, as the six remarkable case studies we present make powerfully clear.

The Case for Challenge-Based Learning

Although the news about American public education is dire, it is not new. It has been evident for some time that our schools are in trouble. In 1983, the National Commission on Excellence in Education published *A Nation at Risk,*[5] an open letter to the American people and a call to action. *A Nation at Risk* made it clear that the United States had lost the advantage it briefly held in the world in science, commerce, technology, and industry; that as custodians of the education of the young, we were failing; that without immediate, conscious, and focused effort, that failure would only compound itself; and that in countries all around the globe, students were being better prepared to take part in a rapidly flattening marketplace than our own students were.

> **If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war.**
>
> *— A Nation at Risk*

No such immediate, conscious, and focused effort has taken place. The reform efforts that have been implemented have not served to rectify the situation; some have arguably made it worse. The most recent and, possibly, infamous of these, No Child Left Behind (NCLB),[6] has resulted in a severely restricted curriculum, greater use of test preparation drills in place of instruction, and channeling of services away from students at the top and bottom of the achievement scale in favor of those who are closer to the "pass/fail" cutoff for high-stakes tests.[7] To make matters worse, some feel that the harsh penalties for failing to meet the standards set forth in NCLB have drawn schools' focus away from deeper, more endemic problems.[8]

5 National Commission on Excellence in Education. (1983). *A Nation at Risk: The Imperative for Educational Reform.* Retrieved from http://www.ed.gov/pubs/NatAtRisk/index.html

6 2002 reauthorization of the Elementary and Secondary Education Act (ESEA), known as No Child Left Behind (NCLB).

7 See Laitsch (2006).

8 Chapman (2007) makes this point, as well as pointing out that educational testing experts state that the 2014 standards goals set for schools are utterly unattainable as set forth in NCLB.

The reality remains that 25 years after *A Nation at Risk,* high school achievement for American students has not improved.[9] Even in the first five years under NCLB, American students showed no gains whatsoever in reading, and very small ones in math.[10] While students in other nations enjoy rising scores and better preparation for a global workforce, our students suffer under a system that is known not to support their needs, stifled by a crippling inertia that limits new ideas.

> **…the stress on rewards and punishments based on test scores forces schools to consider the data generated as evaluative rather than as useful for informing instruction. The result is a system that appears coordinated, but results in a number of unintended—although not unpredictable—negative consequences.**
>
> ***— Laitsch, D. Assessment, High Stakes, and Alternative Visions***

Further, American students have a lower graduation rate compared to students in other industrialized nations.[11] According to the National Center for Education Statistics (NCES), the proportion of American students who leave school before completing their degrees is increasing — and in recent years, researchers have reported that the figures may have been even higher than suspected due to inconsistent measurements. In his report, *One Third of a Nation: Rising Dropout Rates and Declining Opportunities* (2005), Paul Barton describes the situation as an underreported problem and voices his suspicion that there is a tendency for schools to avoid classifying non-degreed high school students as dropouts in order to avoid penalization by national accountability standard requirements. This likely results in inflated graduation numbers as well as underreported dropout rates.

Barton's are not isolated observations.[12] Although the situation has drawn considerable attention and political focus to public education in the United States, teachers are still frustrated and we are still losing 30% of our students; it was only recently that we could even agree how to count dropouts. Students are also leaving school earlier: in the past, students who left high school before graduation typically left between their junior and senior year. More recently, the majority of dropouts leave high school between grades 9 and 10.[13]

Legislative efforts, then, have not only failed to improve performance, but are also failing to keep kids in school. The evidence shows that one of the main reasons students are leaving is because they are

9 Strong American Schools. (2008).

10 Sanchez, C. (2007). U.S. Test Results Show Growth in Math, Not Reading. *All Things Considered, National Public Radio.* See http://www.npr.org/templates/story/story.php?storyId=14698611

11 See Strong American Schools (2008).

12 Studies conducted by four other independent researchers during roughly the same time period (1998-2000) reported similar findings. Each study indicated that as many as a third of high school students do not complete high school (Barton, 2005). The most recent NCES findings for the 48 states for which comparisons between 2002–03 and 2005–06 could be made found that dropout rates increased for 26 states and decreased for the remaining 22 (NCES, 2008).

13 See Haney (2004). Haney and others interpret these findings to be an indication that more students are being flunked to repeat grade 9, possibly in an effort to avoid passing students who are not likely to score well on 10th grade accountability tests and to keep reported passing numbers higher.

disengaging from school.[14] While some factors leading to disengagement are related to their home life and family issues, it is becoming clear that an important factor is that students feel very strongly that what they are learning in school is not relevant to their lives.[15] Surveys of students who have left school have revealed that a lack of perceived connection between the curriculum and their everyday life or future work was a key factor, and many former students felt that more could have been done to keep them engaged through the type of schoolwork they were asked to do.[16]

Clearly, something has to change. If the reason students are leaving school is disengagement and a feeling that the work is irrelevant, clearly the solution is not to mandate higher test scores. Rather, let us consider for a moment the implications of addressing the dilemma students are actually having.

> **The time to begin is now. There is not one moment to waste.**
>
> *— A Stagnant Nation*

Young people are not blind to the world's problems. They are aware that the world economy is in a dangerous and delicate condition, and they have a clear sense of what a collapse would mean — to themselves, their families and friends, and to people across the country and around the globe. They realize that the planet's temperature is climbing, slowly but perceptibly, and that they may see the effects of that change in their lifetime. They understand that their lifestyle is built upon nonrenewable energy sources and they know some of what that implies.

There are real problems that need solving, and young people understand that no less than adults do. They see these important issues taking the international stage and they know that school is not preparing them to address challenges of this level. And one in three makes the choice to leave.

It is time to try a new approach. As the scope and potential causes of the nation's dropout problem are more fully realized, school reformers are attuned to innovative ways to help keep student engagement high. Connecting class work to the real world is one obvious way to attain this goal.[17]

> **The educator by the very nature of his work is obliged to see his present work in terms of what it accomplishes, or fails to accomplish, for a future whose objects are linked to those of the present.**
>
> *— Experience and Education*

14 See Alspaugh (1998); Hernandez Jozefowicz-Simbeni (2008); Neild et al. (2008).

15 United States General Accounting Office (2002).

16 See Bridgeland, et al. (2006), in which 71% of respondents reported losing interest in their freshman or sophomore year; 47% reported that they left school because the class work was uninteresting.

17 Varied opinions on what defines a problem-based learning project make it difficult to research its effectiveness beyond non-comparative, anecdotal recommendations, of which there are many (Thomas, 2000). Several comparative studies, however, have generally validated problem-based learning's impact on student achievement. See Boaler (2002), Vanderbilt University (1992), and Ward and Lee (2004), for example.

The same theme has appeared over and over in educational literature for many, many years, but has never entered the mainstream. In 1938, John Dewey argued for teaching practice that brought students together to work on real problems using real resources.[18] Through the years, similar approaches including project-based learning and contextual teaching and learning have been attempted, evaluated, and enjoyed by teachers and students alike; student learning in problem-based courses has been documented; yet the norm continues to be lecture-based instruction focused on what will be on the test.[19]

None of these approaches have taken hold in K-12 education, partly because they are bolted on to the curriculum in addition to everything else that must be done. Other drawbacks are that it can be difficult to identify appropriate candidates for projects, since not all topics lend themselves to being framed as problems; and teachers must become project managers as well as guiders of learning. Within a teaching environment that is heavily influenced by the demands of standardized testing, it can be very difficult for problem-based learning approaches to take root and flourish.

Instead, what is needed is a new teaching model that incorporates the best aspects of problem-based learning, project-based learning, and contextual teaching and learning while focusing on real problems faced in the real world. This model must engage students' curiosity and desire to learn. It must make the solving of real problems the center of the curriculum, give students access to 21st century tools, and require them to work collaboratively and manage their own time. It must allow students to direct the course of their learning and engage teachers in a supportive, very necessary role as guides.

Challenge-based learning is such a model. As the teachers and students found who participated in this pilot project, challenge-based learning brings relevance to class work. By giving students the opportunity to focus on a challenge of global significance, yet apply themselves to developing local solutions, challenge-based learning creates a space where students can direct their own research into real-world matters and think critically about how to apply what they learn. The result, as this study shows, is increased engagement, extra time spent working on the challenge, creative application of technology, and increased student satisfaction with schoolwork. Not incidentally, students also mastered the subject-area content and developed many of the skills identified as vital for 21st century learners.

Challenge-based learning builds on the successes of problem-based learning models where students engage in self-directed work scenarios (or "problems") based in real life. In challenge-based learning, as

18 Dewey (1938) held that it is the responsibility of the educator to present students with problems that have some bearing on their current experience, and to make the problem sufficiently interesting to engage learners and arouse their curiosity and natural desire to learn.

19 See, for instance, Pearlman (2006); Saye and Brush (2004); Ward and Lee (2004); Maxwell et al. (2001); and Berns and Ericson (2001).

in problem-based learning, the teacher's primary role shifts from dispensing information to guiding the construction of knowledge by his or her students around an initially ill-defined problem. Students refine the problem, develop research questions, investigate the topic using a wide variety of primary source material, and work out a variety of possible solutions before identifying the most reasonable one. Documentation of the process and a high-quality production of findings further serve to give the process relevance to the world of actual work.

Challenge-Based Learning – Framework

A unique feature of challenge-based learning is that problems are tied to an idea of global importance (war, say, or the sustainability of water). Students are able to research the area of the challenge in terms of events taking place in the world around them, strengthening the connection between what they learn in school and what they perceive outside it. They then work in teams of co-learners, further increasing their interest in the process and giving them valuable experience in team dynamics and collaborative work. Teachers act as coaches to the student-centered communities of practice, addressing individual questions and concerns and stepping in to help the students retain their focus if the problem seems too large.

Because challenge-based learning takes its ideas from real-world issues that students then must translate into solutions of local applicability, a very wide range of curricular areas can be addressed. When integrated as a regular part of the curriculum, challenge-based learning practices naturally lead to discovery of relevant subject matter in many areas. Because problems do not need to be invented — the challenges are real — students connect what they are learning with their own experiences.

> **I am looking forward to taking a break from the traditional learning and being able to try something new. I want to help to try to prove the idea of traditional learning being the only way wrong.**
>
> *— 9th grader, O'Neill Junior Senior High School*

Access to technology, an integral part of challenge-based learning, can help teachers overcome some of the other constraints of problem-based learning. Ubiquitous Internet access in a one-to-one setting opens the door for students to use online tools for collaboration and communication, often the same tools that are used in the modern workplace. Students have access to a wider range of resources, including current news articles, research, and even experts around the world.

A key feature of challenge-based learning is that it appropriates the networking tools and media production techniques already being used in daily life by many 21st century learners. In preparing the final products of their research — presentations of their chosen solutions — students draw upon photography, videography, audio recording, and writing skills that they may already be using as web content producers. If they are not already doing those things, challenge-based learning provides an engaging opportunity for them to hone these kinds of high-level communication skills.

As will be seen from the research findings, challenge-based learning motivates students to come to class and do well. It leverages technology tools to put the daily experiences of students in the service of their education. It focuses learning on real-world issues, gives students a chance to work on important problems, gets their voices heard, and empowers them to influence their community for the better. Challenge-based learning has real potential to reverse the slipping trend of poor retention, low scores, and disengagement, turning learning into an exciting, meaningful experience — as it is meant to be.

Challenge-Based Learning in Practice

Challenge-based learning builds on the practice of problem-based learning, in which students work on real-world problems in collaborative teams, but with key distinctions that add a great deal of relevancy for students. At the center of challenge-based learning is a call to action that inherently requires students to make something happen. They are compelled to research their topic, brainstorm strategies and solutions that are both credible and realistic in light of time and resources, and then develop and execute one of those solutions that addresses the challenge in ways both they themselves and others can see and measure. The concept is detailed in a white paper produced by Apple, Inc.:

> *Challenge-based learning is a collaborative learning experience in which teachers and students work together to learn about compelling issues, propose solutions to real problems, and take action. The approach asks students to reflect on their learning and the impact of their actions, and publish their solutions to a worldwide audience.*[20]

While the potential benefits of challenge-based learning present a persuasive case for its use, the details of implementation and the actual effects on student learning, teacher planning, and curriculum integration had not been tested and thus were largely unknown. In the fall of 2008, Apple, Inc. decided to put challenge-base learning to the test, in a pilot study that could not only inform practice, but also be replicable across a wide variety of school settings. Six schools from across the country, all schools with one-to-one laptop initiatives in place, were chosen to participate.

20 http://images.apple.com/education/docs/teachers/Apple-ChallengedBasedLearning.pdf

School Snaphots

Manor New Technology High

Located in Manor, Texas, Manor New Technology High is a public high school that opened in fall 2007 with 160 ninth- and tenth-graders, expanding to 250 students in grades 9-12 in the 2008-09 school year.

Manor is considered part of the Austin-Round Rock metropolitan area. The small community school focuses on collaborative, problem-based learning. The student body is primarily multi-ethic, with 44% considered low socio-economic. ***http://www.manorisd.net/newtech/***

Big Idea **Sustainability of Food**
Question **What are the effects of your food consumption?**
Challenge **Inspire positive change in food consumption choices**

The 37 students and five teachers involved spent one week researching how food is produced, the impact of production and distribution on the environment, how different foods contribute to or detract from a person's health, and how to make appropriate food choices. They created a Mythbusters-like video to explain what they learned and to encourage healthy choices.

Mooresville Graded Schools

Mooresville High School, located in Mooresville, North Carolina, enrolls 1,400 students in grades 9-12. The student body is fairly homogeneous, with about 78% identifying themselves as white, non-Hispanic.

Located about 25 miles north of Charlotte, Mooresville has a population of about 20,000, and is the home to the corporate headquarters of Lowe's Home Improvement Warehouse. It is perhaps best known as the home of many NASCAR racing teams, which have earned the city the nickname "Race City USA." ***http://www.mcsc.k12.in.us/mhs/***

Big Idea **War**
Question **What is war and how does it affect society?**
Challenge **Using WWI as a reference point, tell the story of war and its impact on society.**

The 49 students who participated in this project researched World War I and created a multimedia website, including movies and podcasts, to tell the story of war. The site includes a Webquest to help visitors learn more on their own as they complete activities designed by the students. The students also created a video to promote the website. The site can be found at http://www5.mgsd.k12.nc.us/staffsites/worldwarone

Moreau Catholic

Moreau Catholic High School in Hayward, California is a Holy Cross college preparatory high school serving 1,030 students in grades 9-12.

Located in Alameda County, the school is primarily multi-ethnic, with 52% of the student body identifying themselves as Asian or Pacific islander. ***http://www.moreaucatholic.org***

Big Idea **Sustainability of Resources**
Question **What is Moreau's paper footprint?**
Challenge **Reduce Moreau's paper footprint, reduce waste, and save paper**

Each of the three participating classes (64 students total) researched the question and prepared presentations for administration and staff to propose ways to reduce the school's paper footprint. One group created a recycling awareness video, and another created a rap video to encourage the school community to use less paper.

O'Neill Junior-Senior High School

O'Neill Junior-Senior High School in rural O'Neill, Nebraska enrolls 400 students in grades 7-12. The school serves a community of about 4,000 people, and is essentially homogenous in makeup, with 94% of students identifying themselves as white, Non-Hispanic.
http://www.oneillschools.org/

Big Idea **Apathy**
Question **What is apathy and how does it affect our school community?**
Challenge **Transform apathy into engagement in our school community**

Students worked in small groups to identify issues in the school community that students, staff, or others were apathetic towards; developed a plan for increasing engagement in their chosen issue; and created a video to explain the issue and propose their plan. For example, one group chose to focus on student apathy towards grades. Other groups identified apathetic attitudes towards animal abuse, caring for school-issued laptops, doing homework, school spirit, and other issues and created proposals to address those. The project website is at http://oneillcbl.ning.com/

Pratt High School

Pratt High School, located in rural Pratt, Kansas (Pratt USD 382) serves 450 students in grades 9-12. The school serves a community of about 7,000 people, and is essentially homogenous in makeup, with 86% of students identifying themselves as white, Non-Hispanic.
http://www.usd382.com/vnews/display.v

Big Idea **Sustainability of Energy / Group Identity**
Question **How would the use of alternative energy sources impact my life? / Who am I and what do I want to be?**
Challenge **Make Pratt High School more energy efficient / Design your Dream Team for success**

Two teachers and 96 students participated in the pilot, with each teacher's students choosing a different big idea, essential question and challenge. Students in the English class created an introductory video describing the big idea and the challenge they took on; working in small groups, they researched the essential questions and proposed solutions.

Punahou School

Punahou School, located in Honolulu, Hawaii, is a private coeducational college preparatory day school serving 3,750 students in grades kindergarten through 12, divided into the Junior School (kindergarten through grade 8) and the Academy (grades 9 through 12). Known as the high school attended by President Obama, Punahou enjoys an excellent reputation. ***http://www.punahou.edu***

Big Idea **Cultural Identity**
Question **What is cultural identity and how does it define me?**
Challenge **Create a way to increase cross-cultural connections at Punahou.**

Five teachers and 52 students participated, and the students explored the ways that cultural is understood and projected. One group chose to share favorite ethnic foods in a video, describing why the food was important in the cultural tradition and even showing how to prepare it; another group's video included a cultural map of the school campus indicating where different groups of students spend their time. A third group examined the kinds of activities and behaviors that show cultural ties between people.

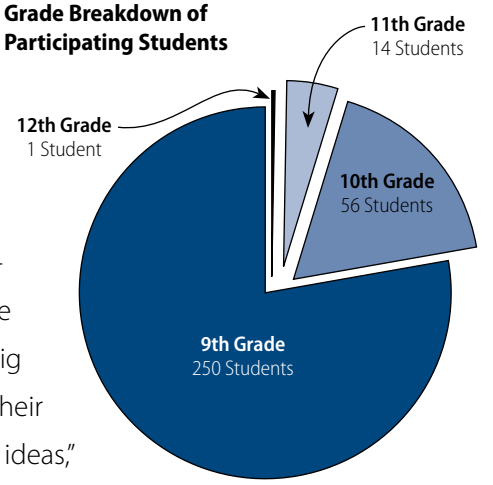
Numbers of Students, Teachers, and Professional Staff in Project, by School

School	Students	Teachers	Professional Staff
Manor New Tech High	37	4	1
Mooresville Graded Schools	48	1	2
Moreau Catholic	51	4	1
O'Neill Public Schools	40	3	1
Pratt USD 382	93	2	1
Punahou High School	52	5	1
	321	**29**	**7**

Twenty-nine teachers and seven professional staff, and 321 students agreed to help conduct the first major test of challenge-based learning and for their experiences to be exhaustively chronicled and researched. The students, primarily 9th and 10th graders, were chosen based on the desire to represent not only a variety of urban, suburban, and rural settings, but also private, public, and magnet schools, richly diverse schools and relatively homogeneous schools, and both affluent and low socio-economic status schools.

Seventeen disciplines were represented among the teachers, who universally expressed excitement about the opportunity to put these new ideas into practice. Students were excited, as well, both for the chance to do something related to a genuine issue, but also to be part of educational innovation at work.

Grade Breakdown of Participating Students



To prepare for the pilot, the teachers and staff attended a two-day workshop at Apple's headquarters in Cupertino, where working in school-based teams, they selected one or more "big ideas" as the focus of the projects that would take place on their campuses,[21] identified a local challenge related to those "big ideas," and planned how the projects would play out at their schools.

Comparative Race/Ethnicity

Category	All US	Project Schools
White	63.5%	54.8%
Black	15.7%	5.2%
Hispanic	14.9%	8%
Asian/Pacific Islander	4.7%	17.9%
American Indian/Alaska Native	1.2%	1%
Multi-Ethnic		11.4%
Unreported		1.7%
	100%	**100%**

US categories and local and national data from National Center for Education Statistics (NCES) http://nces.ed.gov/programs/digest/d07/tables/dt07_097.asp

Each teacher was interviewed individually at the meeting to record his or her initial feelings about the project. Teachers expressed apprehension, excitement, and enthusiasm at the thought of working with their students on a project as open-ended as a challenge-based learning project is. They recognized that the projects would be challenging to lead, but felt that they would be effective and that the students would find both the challenges and the process engaging.

Once the working groups returned to campus, the project moved very quickly. Two schools, Manor New Technology High and Punahou High School, elected to implement their challenges in just five days. Moreau Catholic spread their work over two weeks, allocating every other day to the effort. The remaining three schools chose a three-week window.

21 The big idea was meant to be a concept with far-reaching significance that impacts humanity. The essential questions created a more specific focus for the big idea and guided the students toward one aspect of the larger concept. The challenge brought the big idea and essential question home with a local call to action. The big ideas, essential questions, and challenges tackled in the pilot projects were all identified by the teachers during the December planning meeting

> **I think this project will require a different kind of thinking than we normally do in school. It will require everyone collaborating and coming up with ideas as a group, rather than individually… No matter what, I will be able to make a difference and have an impact on the outcome.**
>
> ***—10th grade student, Punahou School***

The first task was for the teachers to explain the process to their students and present the big idea, the essential question, and the challenge. The students' task was to define guiding questions — smaller pieces of the essential question that could be researched to increase their understanding of the big idea — and brainstorm solutions to the challenge, finally choosing one to plan and implement locally. Each group was to create a video or a website describing the results of their research and promoting their solution to the challenge. While not every group produced the same level of quality, it was clear that across the board, the students gave much of themselves to the work, and some of the materials are extraordinary.[22]

The journals — in both written and video form — describe the experience from the point of view of the teachers, students, administrators, and staff at points throughout the process as they were immersed in the project. All in all, students submitted more than 1200 written journal entries. Dozens of hours of teacher interviews were captured, along with pre- and post-data on the impressions of all participants in the project, and of course all the effort produced a rich treasure trove of student-produced content related to their projects.

Subject Disciplines Represented

Asian History	History
Biology	Mathematics
Chemistry	Multimedia
Computer Animation	Physical Science
Graphic Design	Social Studies
Earth Science	Study Skills
Engineering	Theatre
English	World Studies
Health & Physical Ed	

Collectively, these materials richly describe the six unique approaches taken at each of the pilot schools, with frank clarity about using challenge-based learning, which participants found at times daunting, at times puzzling, but always challenging and engaging.

These interviews, journal entries and other materials produced as part of the six implementations, comprised the primary research materials used in this study.[23] Data was captured on virtually every aspect of the process, with perspectives representing faculty, support staff, administration, and of course, students.

> **I think it's going to be scary, and I think it's going to take people out of their comfort zone. I think that's going to be important, because too often we get stuck in that rut. My brain keeps racing about all the different ways that I could use it in different classes. I'm ready to go back and do this in every one of my classes.**
>
> ***— Teacher, Pratt High School***

22 To see the student-produced materials, see the Challenge-Based Learning website, at http://www.challengebasedlearning.org

23 The primary qualitative analysis techniques employed were cross-case analysis and clustering. For an excellent discussion of these and other qualitative analysis techniques, see Miles and Huberman (1994).

Overall Outcomes

By any measure, the data are clear. Both teachers and students found challenge-based learning effective and engaging. Fully 97% of the 321 students involved found the experience worthwhile. More so, when the data are disaggregated by teacher, 73% of the faculty were able to engage every single student in their classes; the data for those classes shows student satisfaction rates of a remarkable 100%.

Major Outcomes of the Pilot

- ✓ Both teachers and students overwhelmingly found challenge-based learning effective and engaging
- ✓ 100% of teachers reported that student work exceeded their expectations
- ✓ 97% of teachers felt students learned more than expected, and in some cases much more
- ✓ Students self reported learning skills that aligned remarkably with the 21st Century Skills
- ✓ 80% of students reported that they felt they and their project had made a difference
- ✓ There was no apparent relationship between the total time allotted to the project and the quality of or presence of final products.
- ✓ The number of students reporting the experience as poor dropped by more than half from the first week of the pilot to the end. Most of the poor ratings were isolated to just a handful of teachers, with half of the final 3.4% rating attributable to just two teachers.
- ✓ Projects which the students felt were highly relevant were most likely to have high quality final products. The two least relevant challenges were not completed by the students.

Teachers unequivocally also rated the experience as positive, with every one of the 29 pilot faculty reporting that work of the students exceeded their expectations. All but one faculty member reported that the kids embraced the topic eagerly and worked well together and almost three-quarters noted positive changes in student attitude and behaviors.

Students self-reported that they were learning and refining skills that closely matched those identified by the Partnership for 21st Century Skills,[24] even though they were never shown that listing. All but three of the critical skills identified by that group were reported as part of their own learning by the students.

24 For the complete list of these skills, see http://www.21stcenturyskills.org/

Initially unsure their efforts would matter, by the end of their respective projects 80% of participating students reported that they had made a difference in their schools or communities by addressing their challenge. Students strongly endorsed challenge-based learning, with four out of five saying they would definitely recommend the approach to other students.

One of the key concerns of teachers in the pre-project interviews was how they would ensure that students mastered the required material for their classes. By the end of the projects, teachers (with just one exception) felt that by and large, students learned more than they expected — in some cases much more. Several commented that students really engaged with the content and worked very hard — harder, in fact, than expected, and showed good critical thinking and collaboration skills. Both teachers and students reported that the kids learned things that mattered to them. Global and community engagement was also broadly perceived to be an outcome, even when its presence was ostensibly unrelated to the content of the class.

Student-reported skill development mapped to 21st Century Skills

21st Century Skills	Skill development reported by CBL students in three or more projects
Core Subjects	Yes
21st Century Content	
Global awareness	Yes
Financial, economic, and entrepreneurial literacy	—
Civic literacy	Yes
Health and wellness awareness	Yes, in one project
Learning and Thinking Skills	
Critical Thinking and Problem Solving Skills	Yes
Communication Skills	Yes
Creativity and Innovation Skills	Yes
Collaboration Skills	Yes
Information and Media Literacy Skills	Yes
Contextual Learning Skills	Yes
Life Skills	
Leadership	Yes
Ethics	—
Accountability	—
Adaptability	Yes
Personal Productivity	Yes
Personal Responsibility	Yes
People Skills	Yes
Self Direction	Yes
Social Responsibility	Yes

Source: Partnership for 21st Century Skills http://www.21stcenturyskills.org/

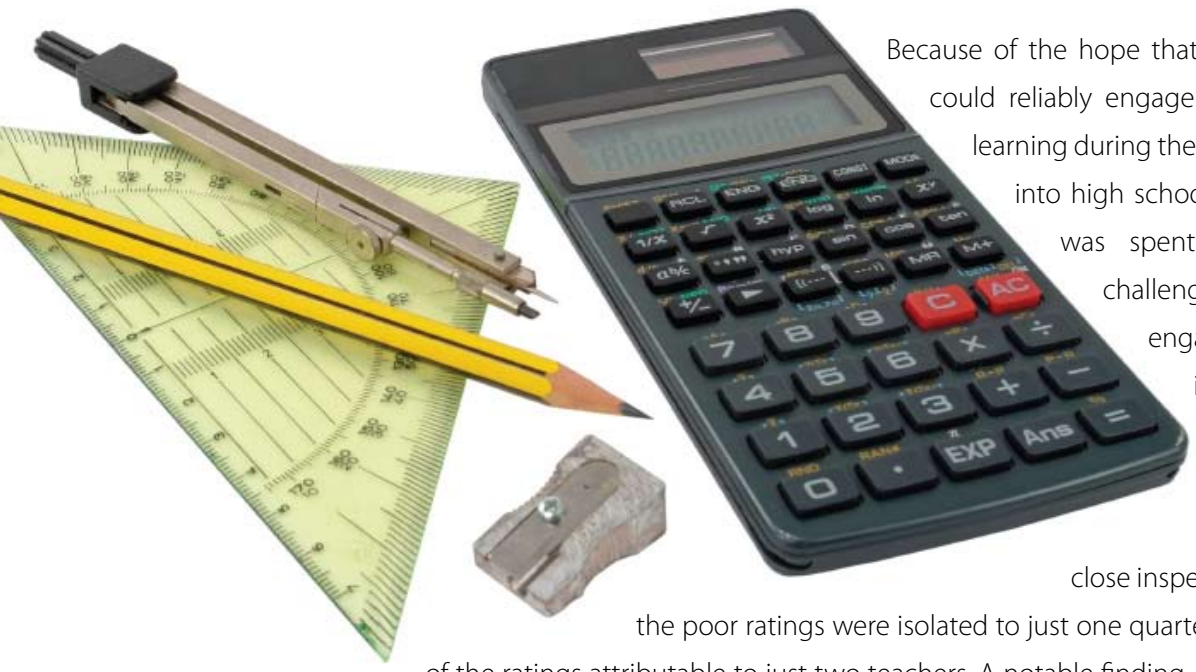
The end results of the seven challenge-based projects exhibited a range of quality and depth, and the researchers spent some time analyzing why some projects went so much farther than others. Given the concerns expressed by teachers about time and scheduling, the expectation was that schools who devoted less class time to the effort would see end products of lesser depth or quality, but that was not the case. Schools used a variety of time frames in structuring their projects. Two chose a five-day model, one an every-other-day model that ran two weeks, and three devoted an entire three-week period to the projects.

None of the difference in outcomes or quality of student work, however, could be attributed to time allotted or scheduling. One of the one-week schools had several of the most creative projects; one of the three-week schools was not able to complete their final projects.

> **"Personally, I got quite a bit out of this project. I feel like our team's work really helped to get kids thinking about their grades, and when our solution is implemented, I believe it will be very successful!"**
>
> *—9th grade student, O'Neill Junior-Senior High School*

Furthermore, no relationship could be found between concerns about time and the length of time allowed for the project. Whatever the time allotted, it appears that challenge-based learning creates a wish that more time could be spent on it. While time concerns were common among teachers, they were more strongly expressed by students in classes where some students reported a poor experience. Generally, as would be expected, time concerns loomed larger in the earlier phases of the project and faded as the project neared completion.

What appeared to be the most critical factors related to quality and depth of the final outcomes were first the degree to which the students felt the work was meaningful and could actually make an impact on the challenge. This dynamic appeared to energize the students to devote considerable extra effort to the outcome. The second factor that emerged from the analysis was how the available time was used. Students seemed to flounder when too much of the allotted time was devoted to "big picture" brainstorming, and they then found themselves running out of whatever time they had, with the result either being a simply "doable" solution that was not perceived as terribly worthwhile or impactful, or one so large it could not be completed.



Because of the hope that challenge-based learning could reliably engage highly at-risk students in learning during the critical 9th grade transition into high school, a good amount of time was spent in understanding why challenge-based learning did not engage the 23 students who initially rated the experience as less than positive, and the 11 that rated it poorly upon completion. Upon close inspection, it was clear that all of the poor ratings were isolated to just one quarter of the teachers, with half of the ratings attributable to just two teachers. A notable finding, attributed to the engaging

nature of the approach, was that the group of disaffected students was reduced by half over the course of the pilot to just 3.4%.

When the specifics related to the two classes that accounted for most of the poor ratings were examined, it was found that one of the teachers had had a bumpy start with her class, but that by the middle of the second week, the class was back on track. By the end of the project, all of that teacher's students had ranked the overall experience as positive. In the other case, the students' satisfaction ratings worsened slightly over the course of the work, before improving significantly by the end of the project.

In both cases, the conclusion drawn was that a greater degree of prior understanding of the challenges and the process on the part of prospective teachers would likely increase the likelihood of things running more smoothly. There were no obvious patterns among the other poor ratings, and over all, just 11 students in seven classes ultimately ranked the experience as less than positive.[25]

25 That figure is equivalent to 3.4% of students. More than 75% of the teachers saw positive ratings of 100%.

The Student Experience

To capture the student experience, the students themselves were asked to submit journal entries in response to specific questions at five points in the project, and more than 1200 entries were collected and analyzed. Additionally, most schools also interviewed students about their projects. A video team was sent to four schools to capture on-the-ground video as the project unfolded, and of course, the final projects detail quite a bit of the student experience as well.

From the very start, students were excited about being involved in a national pilot of this scope. Because they knew they were being studied, the Hawthorne Effect[26] cannot be discounted. The allure of being videotaped, with their activities regularly chronicled and knowing that there was an audience beyond the classroom and even their community cannot be discounted as a motivator. Many spoke explicitly about their hopes that the pilot project itself would lead to changes in schools.

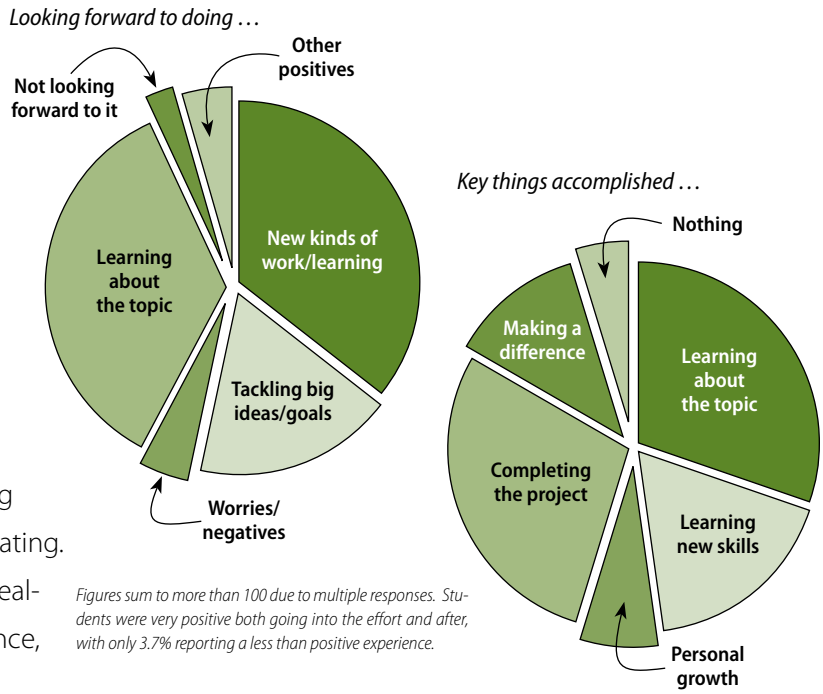
> *I think that schools today need to change . . . if teachers would focus on more than one teaching styles then less people would drop out and everyone would get better grades. And I think that it will help us prepare for the real world. In school things are different, they give us papers and we fill in the blanks. We never problem solve. I also hope that we can maybe change the way the rooms set up, because as small of a thing as it is, it affects us. A lot of people give up just walking in the door and seeing the rows of desks.*
>
> **9th grade student, Pratt High School**

26 The Hawthorne Effect is a term coined by Henry Landsberger in his 1958 book that looked at the results of several landmark studies of industrial management at the Hawthorne Works factory between 1928-34. The term refers to a measureable effect caused by the act of observation that in and of itself has been shown to cause statistically significant improvements in outcomes. See Landsberger, H. (1958). *Hawthorne Revisited,* Ithaca, New York: Cornell University Press.

Whenever possible, both teachers and researchers worked to minimize the impact of observation and to keep students focused on their own outcomes.

When asked to speak specifically about their own parts of the effort, students mentioned the prospect of doing something new, including working in teams, collaborating with other students, working with their computers, and learning on their own. Similar number of students felt that the idea of working on a challenge-based project, learning about their topic, doing research, and coming up with a solution was stimulating. A significant number anticipated enjoying the real-world aspects of problem solving, making a difference, thinking creatively, and teaching their peers.

The Student Experience: Pre and post impressions

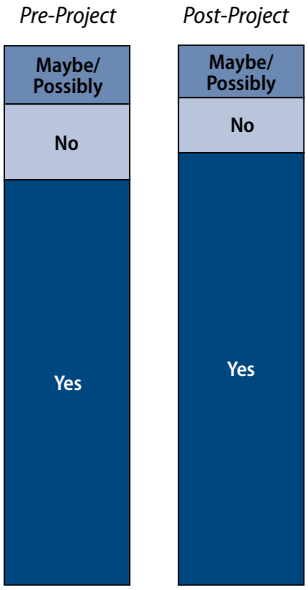


Figures sum to more than 100 due to multiple responses. Students were very positive both going into the effort and after, with only 3.7% reporting a less than positive experience.

Student Outcomes. One of the key attributes of a successful challenge-based learning project is the sense that the work is real, that it will make a difference. As the pilot projects got underway, nearly 86% of students felt they would be able to or possibly could make a difference in their community as a result of working on this project; by the end of the effort, 80% were certain it did, and another 10% thought it could. In the analysis, a clear relationship was found between those classes in which students felt that their ideas could make an impact and the successful completion of their final deliverables.

As noted in the overall outcomes, a two-thirds majority looked forward to learning new skills or information, citing technical, critical thinking, communication, research, leadership, and presentation skills among those they expected to improve, all skills noted as critical by the Partnership for 21st Century Skills.[27] Nearly a third anticipated personal growth in areas like confidence, personal fulfillment from making a difference, learning about themselves, and cultivating a sense of accomplishment.

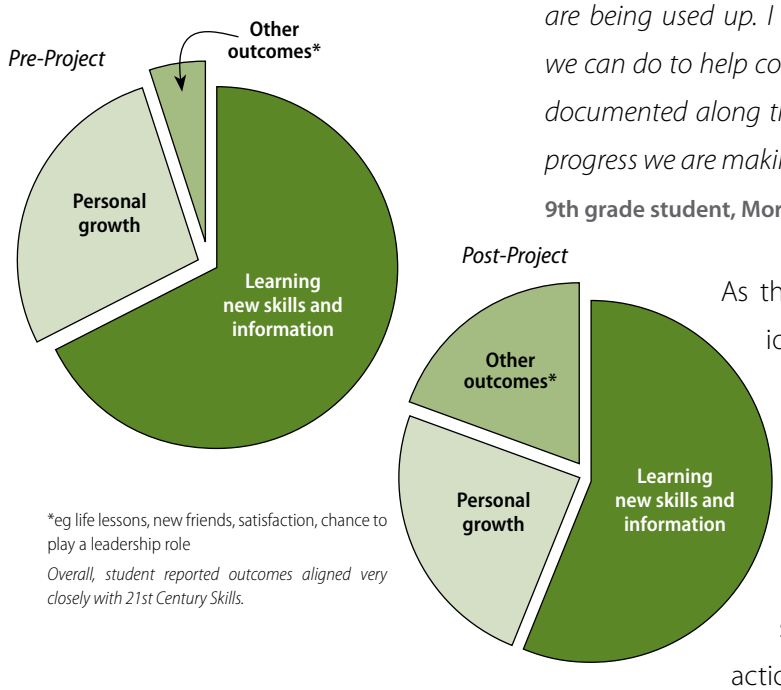
The Student Experience: Do you think you can/did make a difference?



Students were strongly optimistic that they could make a difference through their projects, and that feeling increased somewhat after the projects were completed.

27 Partnership for 21st Century Skills. (2009) http://www.21stcenturyskills.org/

The Student Experience: What you think you would/did you get out of the project?



*eg life lessons, new friends, satisfaction, chance to play a leadership role

Overall, student reported outcomes aligned very closely with 21st Century Skills.

I am looking forward to doing research on this subject. I am really interested in how much paper is used per year and how many trees are being used up. I also am really interested in learning what else we can do to help conserve trees. I am also looking forward to being documented along the way because then we will be able to see the progress we are making.

9th grade student, Moreau Catholic High School

As the projects unfolded, the students' first task was to identify the guiding questions that would direct their research, brainstorming ideas, and planning their teamwork. Asked what they felt they had accomplished, a majority noted that their teams had made progress narrowing down and researching their topics; most of these reported learning something new. Well over a third named specific actions related to the process of challenge-based learning, such as framing their guiding questions, brainstorming ideas, planning, or completing a project task. Nearly one-fifth felt they had improved corollary skills such as teamwork and facility with technology.

At the mid-point of each project, students were clearly engaged and excited. Journal entries and videos both document that kids were busily researching topics, refining solutions, and beginning to prepare media projects and final presentations.

I love this project. I am learning more than I could have ever expected. Gathering information is going very well. I never knew how big of an event World War I was, and I have never heard about it.

9th grade student, Mooresville Graded Schools

This week we made a survey and had people answer some of our questions about grade apathy. We also did many interviews of teachers and students, to see if [what] we thought really was apathy actually was. Right now we are tying our information together and trying to figure out a solution. I think we are going to interview a principal from another Nebraska school where they have teams and get "points" for getting good grades and going out for activities. We think this could be a good idea in our school.

9th grade student, O'Neill Junior-Senior-High School

Students found group dynamics to be a hurdle; almost a quarter cited group issues as among the problems they encountered. The self-directed nature of the project was problematic for some, and about a fifth encountered difficulties with researching or preparing the final product. Lack of time and technical problems accounted for a few more issues.

When asked how they managed these challenges, it was clear that students were solution-oriented, and overcame challenges by applying extra effort or time, working through things in their groups, being persistent, and maintaining a positive attitude.

> *It was very hard at first because this project was self-directed. My group and I had never experienced a self-learning project so it was difficult to know how and where to begin. I didn't like how you weren't able to ask the teacher for an answer, or how you weren't able to answer the teacher. Instead you had to do both the asking and the answering which was very difficult … [but] as we worked through it, it became easier and started to come more naturally. We divided up the work so that we could compile everyone's ideas into one. We also documented our work, which helped us to understand what to do next …*
>
> **10th grade student, Punahou School**

By the final third of their projects, students were deeply involved in the multimedia presentations describing their solutions.

When their projects were completed, students were asked to complete post-project surveys. The vast majority of students (96.7%) felt the project turned out positively overall; only eleven students (3.3%) felt it went fairly poorly or poorly. Students took away improved skills in teamwork, technology, critical thinking, research, communication, and presentation (a third cited these) as well as personal growth and impact on their peers and community (a quarter noted gains in these areas). Topic area learning was noted by one in five as a positive gain.

The main accomplishment in the eyes of many students was the presentation they created. A similar number noted the learning that occurred as they researched their topics. Improved skills were cited here again; a quarter felt a sense of accomplishment in technology, teamwork, communication, and other skills that correlated highly with the listing compiled by the Partnership for 21st Century Skills. Significant numbers commented that they felt that they had an impact on their peers, school or community.

A key global indicator about the quality of the student experience is the degree to which students would recommend the approach to their peers who might be considering such a class. Significantly, four of five students said they would definitely recommend a challenge-based learning project to their peers; another almost 10% reported that they might, depending on circumstances.[28]

28 For more on the student experience, and to hear students talking about their projects in their own voices, see http://www.challengebasedlearning.org

The Teacher Experience

Capturing the experience for teachers was an explicit outcome of the pilot, as it was felt that precisely understanding the realities of how challenge-based learning might work in actual schools would be critical in helping others decide if the approach was right for them.

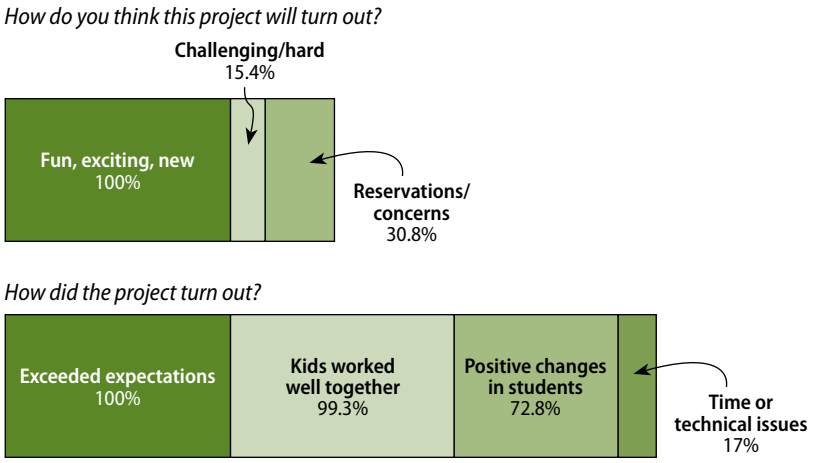
In terms of background, the teachers involved in the project were very typical of the field. The group included first year teachers and some with a great depth of experience; the average was 10.1 years in the classroom, and seventeen subject areas were represented. While a technically savvy group overall, with over two years experience working in a one-to-one laptop environment, there was also a range of capability in technical background among the teachers involved.

The teachers were formally interviewed on video at five points during the project, but informal interactions also were captured, and researchers spent a good deal of time simply listening as teachers worked through the initial planning and throughout the project. All of the teachers were interviewed during the kickoff meeting; as the project was underway, each teacher was interviewed at least once. Teachers were asked what students were learning and how they were doing; how the project was unfolding; what surprises they had encountered so far; and what was working well, and what was not.

> *One of the things that really struck me … was the challenge-based approach of having a topic, asking a question, then asking further questions, refining… the whole process [is reflective of] the scientific method, exactly how you would go about doing the research and writing for a paper traditionally … this is a great way to go about doing that. I think it's going to really affect who I am as a teacher.*
>
> **Teacher, Punahou School**

Early Impressions. At the project kickoff meeting, every one of the teachers reported a palpable excitement about embarking into challenge-based learning, expressing feelings such as hope, a feeling that it would be interesting, rewarding, and engaging, and a sense that the project could very well make a difference. The teachers also acknowledged that it would be a new experience for them and for the students. Some indicated that they were feeling scared, uneasy, or skeptical about how the project would work. A few expressed reservations about whether the students would be comfortable with the open-ended method and the lack of directed activity.

The Teacher Experience: Pre and post impressions

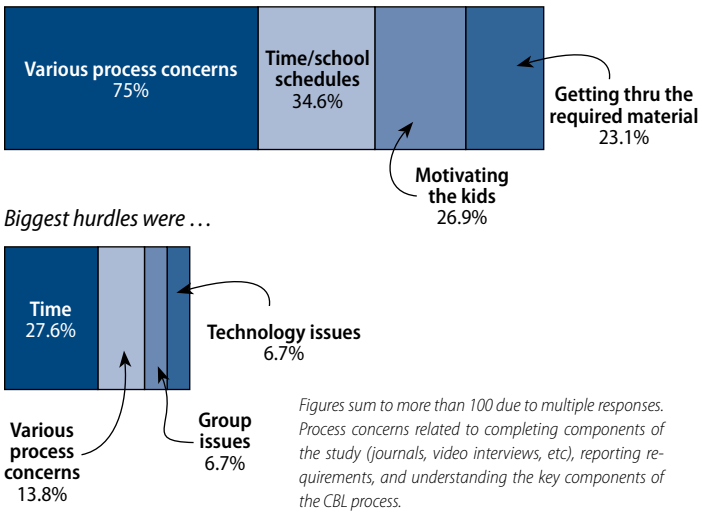


While teachers expressed strong reservations about whether the students were up to CBL, citing concerns about process, group dynamics, technical skills, and mastering the content, every single teacher reported that the results exceeded their expectations. In the end, only time and technical issues remained significant concerns. Figures sum to more than 100 due to multiple responses.

> *In terms of student reward, I think the project is going to be fantastic. If student engagement is the problem … then getting them projects where they get to be active in class is definitely the key to the solution. I mean, think about how many hours students spend in a classroom in a week, and how many of those hours are spent sitting, physically sitting, just listening? I couldn't sit still and listen for that long. … I think [it's] going to be great.*
>
> **Teacher, Punahou School**

The teachers anticipated a variety of obstacles to overcome and the need to work around important constraints in order for the project to be successful. Chief among these were a variety of concerns about the process of challenge-based learning, which was understood post-project to be part of their own learning and preparations. The most often mentioned constraint was the tight time schedule (noted in 34.6% of the responses). Motivating students and getting them interested in the project was seen as another potential challenge, as was the need to align the project with the required curriculum so that they could ensure that the required material was covered.

The Teacher Experience: Perceived hurdles, pre vs post project



Figures sum to more than 100 due to multiple responses. Process concerns related to completing components of the study (journals, video interviews, etc), reporting requirements, and understanding the key components of the CBL process.

You want that creativity… but at the same time, you're held to the content requirements… that's going to be on your statewide test, by which your school is going to be measured. …

Teacher, Mooresville Graded Schools

Interim Observations. Fourteen teachers completed interviews during the first phase of their projects, another dozen at the midpoints, and the remainder as their projects wound down. Their comments and observations reflect the actual experiences they were having in real time as the projects unfolded.

From the moment the projects began, the teacher comments reflected surprise on a number of levels. Teachers noted that students that typically did not engage were diving into project work; students were eagerly researching and collecting data, working on their guiding questions, sorting out their teams, and getting their arms around the challenge. Most of the teachers observed new forms of thinking in their students, including learning about themselves, learning to ask good questions, becoming more aware of their environment, and struggling not to jump directly to solutions. While some occasionally referred to the process as chaotic at times, they also all observed that something new was happening.

The Teacher Experience: Typical surprises expressed

Students who typically did not participate were engaged and involved
Attendance was higher than usual during the project
Students and teachers alike learned a lot of new technology
Students showed noticeably positive changes in attitude and skills

Student changes occurred on dimensions such as taking on leadership roles, pride in work, and showing positive feedback and support for other students.

It is the questions that they ask. When they ask a question that I didn't even think of myself. Or when they find a resource or figure out to use a resource that I didn't even think of. I am having these moments where I am like, "man, what a good idea!"

Teacher, Mooresville Graded Schools

I have been amazed at how engaged they are in what they are doing. You don't very often walk into a classroom and see the whole class totally engaged in what they are dong and these kids are. Everyone is working on their computer and doing what they are supposed to.

Teacher, Pratt High School

Once we started talking about the activities aspect of it… once I said, "Looking at the questions you came up with, what are some activities you could do that could address some of those questions?" that's when they started really getting into it, and the energy in the room went from just like "blllleh" [deflates] to like "wooooo" [sits up very straight and excited] because they started thinking about "Okay, what could we do [snaps fingers] to get people out of their cliques on the campus? How can we get them interacting in a more direct way outside of their normal social, cultural boxes?" And their ideas are really things I never would have thought of, and I'm really curious to see if they can pull it off [laughs]!

Teacher, Punahou School

Asked to comment on what was not working early on, one-fifth said everything was working well. Another fifth encountered process issues, such as students trying to jump right to the solution or failing to understand the challenge, and the difficulty of guiding students without giving out answers. Time constraints were causing some strain to others, while a few cited the formation of teams as a trouble spot. Other issues were more local, such as a difficult trip to the library or student absences, but with very few exceptions, all more at the group than the class level, these sorts of concerns disappeared as the projects unfolded.

By the end of the second class, I'm feeling pretty optimistic.

Teacher, Punahou School

In the middle of the program, twelve more interviews were collected. Teachers reported that as students continued to work on their projects, they were focusing on refining their guiding questions, conducting research and collecting data, designing solutions, and developing their multimedia pieces.

When a student came back from Thanksgiving, and I had said, "See who you can contact," and [this] kid comes back with contact information from a professor who teaches in London…Talk about taking this to an international level, this girl. I can't believe she had the guts to do that as a 14-year-old kid. She just wanted a good resource, even if it was across the ocean.

Teacher, Mooresville Graded Schools

Asked about how the program itself was unfolding, the majority (74.9%) were very positive, noting that the project was going "extremely well," student engagement was high, and things were "taking off."

> *The level of engagement is so much higher. Think of it as an s-curve and there was a lull and everyone was confused and not sure what was going on. The it just spiked in terms of what was going on, activity levels. Now we are still at the top of that curve and everyone is working hard.*
>
> **Teacher, Mooresville Graded Schools**

Many teachers (83.3%) expressed surprise at the high levels of student enthusiasm they were seeing; one teacher noted that a student who was out sick connected through video chat to take part in class from home.

> *One of the biggest surprises for me was the enthusiasm from one of the particular classes of students. They are the ones that have the most trouble academically. They are a class specifically for learning study skills. But this particular research, and topic, and brainstorming they seem to really be enjoying. So it is bringing out a creative side of them that they might not have been aware of.*
>
> **Teacher, Moreau Catholic**

> *…[the] kids have made connections with resources in the community, human resources, experts, local people that know more about the subject area than us … People in our community are seeing what kids care about and what they are doing in the school. I think that is going to be a huge byproduct of challenge-based learning.*
>
> **Teacher, O'Neill High School**

The amount and quality of work being done, and the skills students were developing also came as a surprise; many teachers commented on this. In particular, teachers noted that students were mastering the technology quickly and rapidly becoming creative with it. By mid-project, over ninety percent of the teachers felt that one of the aspects of the project that was going especially well was the students' attitudes and their involvement in the work. The use of technology and community resources was cited as a positive factor by a third.

Eleven teachers recorded interviews toward the end of the projects, when students were primarily working on their media presentations. Teachers observed that students were still very enthusiastic and their solutions looked promising. Students were developing practical skills such as teamwork and time management. By this point, the great majority of the teachers (81.9%) felt the projects were unfolding well, but time remained an issue throughout the program.

By the last class, when I was looking around the room, I was thrilled, actually, because the students were really engrossed, engaged. They were doing the project for the sake of doing the project, not because of all of the different external motivators that we have in the school. I saw the potential of this curriculum model and I saw the potential of technology in the classroom. I felt like this was the best use of technology I had seen in my classroom.

Teacher, Punahou School

The Teacher Experience:
Common meaningful outcomes mentioned

Having the chance to work with other teachers
Allowing and encouraging cross-grade-level interactions
Seeing the kids get so excited
Giving students the freedom to come up with their own ideas
Seeing students naturally use math skills from the normal parts of the class
Emulating real world problem solving
Seeing kids learn things they can then teach adults
Seeing kids create a meaningful product about people in their community
Having the chance to be creative
Forming new bonds with kids and other faculty

Teacher Outcomes. Clearly the teachers felt that challenged-based learning was an effective strategy. Fully 100% of the teachers said that their students exceeded their expectations in terms of quality and quantity of work. Nearly all (99.3%) of the teachers noted that the student teams worked well and that students were collaborating and learning from each other. A majority (72.8%) also observed positive attitudes and growth in the students over the course of the project.

After the projects were completed, respondents felt the project turned out well and was a valuable experience that students will remember; they were pleased with the content that was created and excited to see what the students came up with. Teachers were stuck as much as the students were with the engaging nature of the challenge-based learning process; fully half of the teachers expressed a wish for more time to implement the ideas that their students developed. Many singled out the benefits for students, including increased motivation, taking ownership of their learning, and directing their own activities.

… there was a day when the kids had been out and about in the campus and had interviewed some students. They came back and they were all excited and interested, and clearly their interest in the project had increased. Then I read some of the journals they had done, and it was clear to me that there was some thinking going on in the students that I hadn't realized.

Teacher, Punahou School

Serendipitous opportunities were plentiful, although they varied from teacher to teacher, as might be expected. One teacher found that the work merged well with her curriculum standards; another picked up ideas for future practice from the work her students did. Another appreciated the opportunity to see students working in a new environment.

Challenges, too, varied; while two teachers reported the time crunch as a significant challenge, others struggled with managing groups of students working in different directions, or with accepting student solutions that took a different tack than expected.

… A lot of students struggled to define the challenge… students also, at times, wanted more guidance from me… so seeing their frustration, seeing them trying to figure out what they ought to be doing at any given point, and then knowing myself that I really had to let them work their way through that frustration… it was not easy.

Teacher, Punahou School

The Teacher Experience: Top comments related to student mastery of content

Students learned more than was expected; most mastered the content
Students really engaged with the content and worked very hard
Students learned things that mattered to them
Students showed good critical thinking and collaboration skills
Global and community engagement was a focus, even when not content-specific

Two teachers commented on the need for formal assessment, but generally teachers could see the learning taking place.

Ultimately for teachers, however, the true measure of success cannot be assessed without considering if the learning that occurred met the requirements of the required curriculum. When asked about students' mastery of the content, all the teachers (100%) felt that students had either mastered the content or gained other valuable skills, such as critical thinking, collaboration, or global and community engagement. In general, students learned more than was expected, and most students mastered the content.

The biggest hurdle we ran into was the actual tech skills of our kids. Their skills I thought were a little stronger than they were. They use it for a lot of different things but all of the sudden, they fell back into their comfort zones [of] writing a paper or doing a PowerPoint or keynote presentation… It was a challenge to push them past their comfort zone.

Teacher, Pratt High School

Some teachers had difficulty adjusting their teaching practice to the challenge-based learning model; 50% felt that planning and structuring class time, remaining hands-off, and not pushing the students one way or another were very challenging.

The teachers were united in feeling that the most meaningful outcomes related to the student experience. All of the respondents noted benefits such as cross-grade interactions, real world problem solving, student freedom and excitement, creativity, community involvement, and students teaching their peers and adults what they had learned. Additionally, many teachers identified benefits to themselves, in the form of opportunities to work with their colleagues and to form new bonds with both students and faculty.

The most meaningful outcome was a group of students put together a podcast of the people that they looked up to. They used key figures in history, or from a particular sport and then they used people who were actually in their everyday lives. And it was really neat to see them speak highly of people that you sometimes don't hear them speaking highly of or that you didn't even know that they thought that way about someone and that they actually look up to this person as a role model was just awesome.

Teacher, Pratt High School

In the final analysis, most teachers had similar responses to the approach as their students. They found it fresh, exciting, and new. The learning felt real, meaningful, and authentic to everyone involved. The open-ended process was challenging at times, because it required critical thinking and action to move forward, and there were moments when both teachers and students felt the stress of evaporating time.

The aspects of the approach that offer the most promise also require careful planning. Teachers found that engaging students in learning and asking them to set their own directions within a larger framework meant shifting the locus of control, placing everyone in a new context. Understanding and planning for that was thought to be key.

As the pilot was finished, the projects put away, and the analysis of the data completed, the overarching feeling of everyone involved was that this was by any measure a most successful pilot. Not only was challenge-based learning shown to work, and work effectively in populations of some of the most at-risk kids in American schools, it was also clear that it can be done more effectively. That is the point upon which this report will end — with a look to next steps and continuing efforts.

Recommendations for Practice

The project team believes very strongly in the efficacy of challenge-based learning and anticipates that other schools will want to include it in their curriculum planning. To that end, the following recommendations have been drawn from our experiences — and those of the teachers and students who participated in the pilot — and are presented here to assist in the planning process.

Prepare teachers by introducing them to challenge-based learning in a retreat or workshop setting. Use this time to answer questions about the process, share examples from this pilot and similar projects, and help teachers understand their role, which may be very different from what they are used to doing. Set expectations about what teachers will do and what students will be asked to do so that students hear a clear, consistent message throughout the project from everyone involved. A full-scale offsite retreat is not necessary; the key components are a dedicated time and place, someone to explain the process and answer questions, a chance for teachers to express their concerns and be heard, and an opportunity for them to collaborate on designing the challenges.

> **"It's going to be exciting to be able to work with other teachers on a project that we haven't really taken the time or effort to do before. We should have been doing this all along. This is just sort of the added boost that we need to do it, to get started."**
>
> *— Teacher, O'Neill Junior-Senior High School*

Bring teachers together in multidisciplinary teams to plan and carry out the project. Participating teachers were enthusiastic about the opportunity to work directly with their peers at their own schools, not only in conceiving the challenge, but also all throughout the project. They found the connection with other teaching professionals to be very valuable in terms of sharing ideas and resources, helping one another through tricky or uncomfortable spots, and helping students make connections between

different subject areas.[29] Extending the challenge across disciplines opens the door for students to look for solutions that touch on more than one area, and both teachers and students commented on how much they appreciated working in teams.

Select the challenge carefully, and make it a real one. It is crucial for the challenge to actually relate to the real world and for it to have an impact on the students' families, local communities or school. Student comments indicate excitement and engagement around the idea of being able to personally have an impact, and a majority of students both anticipated that they would be able to make a difference and felt that they had afterward.[30] It is also important that the size of the challenge be in line with the time and resources available for the project; if the challenge is too big, kids do not know where to start and will feel stressed and pressured for time at the outset. The teacher's guidance is extremely important both in selecting appropriate challenges and in framing them in such a way that students can get their arms around what is being asked of them.

Build 21st century skills into the project right from the start. While nearly every skill identified by the Partnership for 21st Century Skills emerged naturally from the types of activities students engaged in as they worked on the challenges, it would be very easy to hit them all. Teachers who are aware of the list of skills can incorporate specific project components to build on them, such as the health awareness component of the project on food sustainability at Manor New Technology High. Skills like financial and economic literacy are a natural fit for challenges related to the economy, but almost any topic could have a financial component. Teachers can plan final project requirements that incorporate subsets of the 21st century skills, or encourage exploration and research that helps students develop certain skills.

Whatever the timeframe, teachers need to budget project time wisely. The pilot demonstrates that outcomes are independent of the length of the project; challenge-based learning projects can be designed to take place in a single day or last an entire school year. The critical issues around time are to allocate it in proportion to the scope of the challenge, and to help students break down the overall project length into reasonable segments. Enough time must be allowed for students to work through the big idea and brainstorm research questions, but there is a point of diminishing returns when brainstorming must end and research must begin. Likewise, students need plenty of time to do the research and brainstorm solutions, but then they must stop brainstorming and select one solution to develop. These points in the project are difficult for students to recognize, particularly if they are new to challenge-based learning. Teachers must design the experience to create a feeling of pressure such that students understand how to move on at the right points.

29 With regard to outcomes of the project, 38.4% of the teacher comments in the pre-project survey indicated an expectation that challenge-based learning would have a positive impact their teaching practice; of those, a third mentioned the beneficial effects of working with other teachers. In the post-project teacher survey, 37.5% of the comments about outcomes dealt with professional development and new connections with other teachers and students.

30 See page 22, *The Student Experience: Do you think you can make a difference?*

Schedule the project at a time when it does not conflict with other demands on student time. If the challenge-based learning project is shoehorned in among other activities like mid-term exams, students will not be able to give it the focus that is required for deep learning. Instead, plan a time when the challenge can take center stage, which also reinforces the idea of its importance. Students in the pilot found that sources outside school provided opportunities for research, including news stories, community members, and experts around the world.[31] Scheduling the project to allow time to explore resources like these gives students a chance to look for solutions and research material in unexpected places.

Allow dedicated work time during the school day. Teachers reported that once the project got going, students were very engaged in their work. Some teachers reported increased attendance during the project; one teacher even remarked that a student who was home sick arranged to be present via videoconference so as not to miss out. Students worked on their projects outside school hours, as well. Clearly, the challenges were important and engaging to the students. Emphasize their significance by scheduling daily time for project work.

> **I think that this project is going really well. I like having the option to use the Internet to gather information as well as using books. This allows me to be able to get a lot more information pertaining to my specific topic as opposed to having to scour a lot of books to get the same information. Also, I like being able to make the multimedia presentations a lot because they are so much better than making a project with the traditional materials. I can convey the same information in a more timely and interesting manner. I can't really think of anything that isn't going well with this project.**
>
> *— 9th grade student, Mooresville Graded Schools*

Give students access to technology, and provide adequate technology support. Each of the schools in the pilot is a one-to-one school (every student has his or her own laptop with Internet capability). Students and teachers alike noted that having access to the computers and to the Internet 24/7 was a critical component of the project.[32] Students preferred to be able to do research wherever and whenever they needed to, and easily accessed information on the fly as a normal part of their working strategies. Media literacy and presentation skills are important parts of the 21st Century Skills set, and fit naturally within the challenge-based learning framework. Students clearly felt that preparing the multimedia presentations of their proposed solutions was a source of great satisfaction. Naturally, problems occasionally arose, particularly with video formats, and it is critical to have someone on hand who can troubleshoot, give guidance, and make any needed repairs or updates to the technology so that students can continue working. In the planning stages, spend some time discussing the media needs of the project. Consider setting out clear recommendations for media size and format, perhaps including software settings for rendering or exporting video, so that students clearly understand how to prepare their final work.

31 In open-ended responses, research was consistently cited by students as one of the aspects of the project that was going well throughout.

32 In pre-project surveys, 12.1% of students mentioned technology skills as something they expected to acquire during the project. In weekly surveys, technology skills were reported as a key learning each week.

Give students the opportunity to act on their solutions. The kind of learning that takes place in challenge-based projects is reinforced by action, and students will learn much from the implementation of their own ideas. Part of the attraction of the projects to the students was the opportunity to persuade their peers and the adults in their life to take part in activities they designed. In order for students to see that they can make a difference, they must be allowed to carry their solutions through to action. Implementation is accompanied by major outcomes in terms of acquisition of 21st century skills such as communication, leadership, civic literacy, and social responsibility, among many others.

> **The project is going well, but it is unusual to have this many options. There are almost no limitations. Since we are just trying this out there is not enough time to really follow through with this project. But if this style of learning does start being used all over I think that it is important that we implement our ideas and not just write them down.**
>
> *—10th grade student, Manor New Technology High*

Practice, iterate, and improve the process. At the outset, teachers were very concerned with how the process would unfold. They were apprehensive about giving up control and worried that students would not pick up the reins and do the work. By the end of the project, however, those concerns had virtually evaporated.[33] Students, too, were nervous at the start; they were not sure how to act in a situation where they directed their own learning. When it was all over, the majority of students said they would recommend a similar project to other students, and overall they felt the project went fairly well or very well.[34]

> **Yes, I would [recommend this kind of project to other students]. Not only that, I think that the work that people accomplish should, some way, be published, so people would know about the changes that need to be made, and soon.**
>
> *—10th grade student, Manor New Technology High*

We began this report with the observation that the children in our schools today will inherit unprecedented problems that will need to be addressed in their lifetimes. We know that decades of reform have not given us hope that the erosion of skills in our youth will subside.

We know new ideas are needed.

Challenge-based learning is one of those ideas. Fresh, new, relevant to today's issues, it is an approach uniquely suited to our time. The findings of the Challenge-Based Learning pilot are encouraging, and clear. They solidly support further experimentation, further research, and further work in the field.

More than that, they show it works. We know we need to make learning relevant to the challenges youth will face in their lifetimes—and we can.

The time to begin is now.

33 See page 25, *The Teacher Experience: Perceived Hurdles, Pre vs Post Project.*

34 Of the students who responded to the post-project survey question, *Would you recommend a project like this to other students?,* 88.1% said they would or they might, while only 11.9% said they would not. Also see page 19, *The Student Experience: Pre and Post Impressions.*

Works Cited

Alspaugh, J. W. (1998). The Relationship of School and Community Characteristics to High School Drop-Out Rates. *Clearing House, 71(3)*. Heldref Publications.

Ancess, J., & Wichterle, S. (2001). *Making School Completion Integral to School Purpose and Design.* New York: National Center for Restructuring Education, Schools, and Teaching. Retrieved on December 20, 2008 from http://www.civilrightsproject.harvard.edu/research/dropouts/ancess.pdf

Barton, P. (2005). *One Third of a Nation: Rising Dropout Rates and Declining Opportunities.* Educational Testing Service Policy Information Report, 2005. Retrieved December 20, 2008 from http://www.ets.org/research/pic/onethird.pdf

Berns, R. and Erickson, P. (2001). Contextual Teaching and Learning: Preparing Students for the New Economy. *The Highlight Zone: Research @ Work No. 5*.

Boaler, J. (2002). *Experiencing School Mathematics: Traditional and Reform Approaches to Teaching and Their Impact on Student Learning*. Lawrence Erlbaum Associates.

Bridgeland, J.M., Dilulio, J.J., & Morison, K.B. (March 2006). *The Silent Epidemic, Perspectives of High School Dropouts.* Retrieved on December 20, 2008 from http://www.silentepidemic.org/epidemic/why.htm

Chapman, L.H. (2007). An Update on No Child Left Behind and National Trends in Education. *Arts Educational Policy Review, 109(1), 25-36.*

Cognition and Technology Group at Vanderbilt. (1992). The Jasper series as an example of anchored instruction: Theory, program description, and assessment data. *Educational Psychologist, 27, 291-315*.

David, J.L. (2008). What Research Says About Project Based Learning. *Educational Leadership, 65 (6).*

Dewey, J. (1938). *Experience and Education.* Macmillan Press.

The Greaves Group, Strategic Educational Consulting. (2006). *America's Digital Schools, A Five Year Forecast: Mobilizing the Curriculum*. The Greaves Group & The Hayes Connection. Retrieved on December 20, 2008 from http://www.ads2006.org/ads/index.php

Haney, W., Madaus, G., Abrams, L., Wheelock, A., Miao, J., & Gruia, I. (January 2004). *The Education Pipeline in the United States, 1970-2000*. Retrieved on December 20, 2008 from www.bc.edu/research/nbetpp/statements/nbr3.pdf

Hernandez Jozefowicz-Simbeni, D.M. (January 2008). An Ecological and Developmental Perspective on Dropout Risk Factors in Early Adolescence: Role of School Social Workers in Dropout Prevention Efforts. *Children & Schools, 30(1), 49-62*.

Laitsch, D. (2006). *Assessment, High Stakes, and Alternative Visions: Appropriate Use of the Right Tools to Leverage Improvement*. Policy Brief. Education Policy Studies Lab. Tempe, AZ: Arizona State University.

Maxwell, N., Bellisimo, Y., Mergendoller, J. (March/April 2001). Problem-Based Learning: Modifying the Medical School Model for Teaching High School Economics. *The Social Studies, 92(2), 73-78.*

Mergendollar, J.R., Markham, T., Ravitz, J., & Larmer, J. (2006). *Pervasive Management of Project Based Learning, Teachers as Guides and Facilitators.* Buck Institute for Education.

Miles, M.B., Huberman, A. M. (1994). *Qualitative Data Analysis*. Thousand Oaks, California: Sage Publications.

National Center for Education Statistics (NCES). (2007) *Digest of Education Statistics*. Retrieved January 22, 2007 from http://nces.ed.gov/programs/digest/d07/tables/dt07_097.asp

National Commission on Excellence in Education. (1983). *A Nation at Risk: The Imperative for Educational Reform*. Washington, D.C.: US Department of Edcuation.

Neild, R.C., Stoner-Eby, S., Furstenberg, F. (2008). Grade and High School Dropout Connecting Entrance and Departure: The Transition to Ninth. *Education and Urban Society, 40(5), 543-569.* Sage Publications. Retrieved January 7th, 2009 from http://eus.sagepub.com/cgi/content/abstract/40/5/543

Partnership for 21st Century Skills. (2009) *Framework for 21st Century Learning*. Tucson, AZ: Partnership for 21st Century Skills.

Pearlman, B. (2006). Twenty-first century learning in schools: A case study of New Technology High School in Napa, California. *New Directions for Youth Development, 110*. Wiley Periodicals, Inc. Published online in Wiley InterScience www.interscience.wiley.com

Sanchez, C. (2007). U.S. Test Results Show Growth in Math, Not Reading. *All Things Considered,* September 27, 2007. National Public Radio. http://www.npr.org/templates/story/story.php?storyId=14698611

Saye, J. and Brush, T. (Summer 2004). Scaffolding Problem-Based Teaching in a Traditional Social Studies Classroom. *Theory and Research in Social Education, 32(3), 349-378.*

Stillwell, R. and Hoffman, L. (2008). *Public School Graduates and Dropouts From the Common Core of Data: School Year 2005–06.* National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. Retrieved on December 20, 2008 from http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2008353rev

Strong American Schools. (2008). *A Stagnant Nation: Why American Students Are Still at Risk.* Retrieved from http://www.strongamericanschools.org/a-stagnant-nation-why-american-students-are-still-risk

Thomas, J.W. (2000). *A Review of Project Based Learning.* Report prepared for The Autodesk Foundation.

United States General Accounting Office. (2002). *School Dropouts: Education Could Play a Stronger Role in Identifying and Disseminating Promising Prevention Strategies.* GAO-02-240.

Ward, J. D. and Lee, C. L. (2004). Teaching Strategies for FCS: Student Achievement in Problem-Based Learning Versus Lecture-Based Instruction. *Journal of Family and Consumer Sciences, 96(1), 73-76.*

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