Energizing Quality STEM Education: JASON Learning in the Greater Houston Area

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University of Virginia

Foreword by
Daniel Domenech

JASON Learning

Chevron
Human Energy

Energizing Quality STEM Education

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About JASON Learning

JASON Learning is a 501(c)(3) nonprofit organization. Founded in 1989 by Dr. Robert D. Ballard, the mission of JASON is to inspire and educate kids everywhere through real science and exploration. JASON provides multimedia curricular experiences in science, technology, engineering, and math (STEM) for K-12 students, and corresponding professional development for educators in a wide variety of formal and informal education environments. Each comprehensive JASON program includes reading selections, hands-on activities, videos, and online games for students, and lesson plans, implementation tips, and a powerful digital platform for educators. Live, in-teractive events throughout the year connect JASON participants with inspirational STEM role models. JASON's in-school curricula cover core content areas and can be used as replacements for traditional textbooks or as enriching supplemental materials. JASON's after-school offerings, which include the popular Immersion Learning program, bring the thrill of scientific discovery to students in Boys & Girls Clubs, YMCAs, 21st Century Learning Centers, and other out-of-school settings.

Visit jason.org to learn more about JASON, or email us at info@jason.org.

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Foreword

I was the superintendent of schools in Fairfax County, Virginia, when I was approached by one of my elementary school teachers and invited to participate in what she described as a very exciting science program for her sixth grade class. I would accompany the class to the facilities of one of our high tech firms in Fairfax, a firm that was a supportive business partner for her school. We sat in a studio-like room with the children squatting on the floor and we were treated to a two way conversation between the class and scientists aboard a research ship called the Nautilus sailing somewhere in the mid-Atlantic. I marveled at the excitement on the faces of the young students as they asked their questions and heard the static hiss surrounding the voices emanating from the speakers on the wall, making it sound like they were coming from another world. Imagine, having a live conversation with people on a ship somewhere in the middle of the ocean!

The teacher explained that this was part of a program called the JASON Project and that it made science exciting and fun. The ship belonged to Bob Ballard, the famous oceanographer that had located the wreck of the Titanic in 1985. Years later I had the pleasure of meeting Mr. Ballard and listening to him as he shared his passion for the sciences and his belief that experience based learning is the key to turning students on to them. He started the JASON Project in 1989 as a way of exposing students to exciting activities that would engage them in scientific discovery.

The sixth grade teacher shared with me that she had never seen her class be so excited about science until she introduced the JASON Project to her school. I had seen enough to become an immediate convert. Over the years JASON went through various iterations as it attempted to provide students with fabulous experiences at a cost to the schools that would not be prohibitive. By 2012 it had evolved into JASON Learning, a unique science program blending experienced based learning with on-line programming, after-school programs, science camps and even teacher training.

In "*Energizing Quality STEM Education: JASON Learning in the Greater Houston Area*", Daniel Duke has taken on the challenge of chronicling the implementation of JASON Learning in school districts in the Houston, Texas, area. I am familiar with Duke's meticulous research and methodology having been a subject in one of his previous works, "Education Empire: The Evolution of an Excellent Suburban School System", a history of the Fairfax County school system.

Ballard's quest to ignite a passion for science among our youth resonated with corporate executives at Houston-based Chevron. They were already involved in providing support to students in the area and, given the nature of their business, they wanted to encourage student interest in the sciences. After listening to a presentation by Ballard they approached JASON with the intent of introducing the program in three districts that had a substantial population of low-income students. At that point Dr. Eleanor Smalley, JASON's Chief Operating Officer, became the point person for the Chevron/JASON initiative.

Eleanor is a colleague and a savvy school district administrator. In this book, Duke details the Theory of Action that Eleanor helped to craft that would begin with buy-in at the top, involving the district superintendent, and work its way to buy-in on the part of the teachers. The JASON curriculum aligns well with the new wave of college and career level standards, focusing not just on knowledge, but on analysis, evaluation and application. Proper teacher professional development and ongoing support is essential for success.

Duke has provided us a descriptive analysis of a change process taking place in major school systems in the Houston area designed to stimulate the interest of students in the sciences and improve their academic performance in that area. It is being done through a partnership between Chevron, JASON Learning and the school districts involved. It could evolve into a national effort to increase student participation in STEM and subsequent careers in those fields, an initiative supported by President Barack Obama. You will find it a fascinating read.

Daniel Domenech

Acknowledgments

This book was made possible by the generous contributions of Chevron. The collaborative public-private partnership between Chevron and JASON Learning provides a sustainable and systemic solution to the need for high-quality, effective STEM (science, technology, engineering and mathematics) education in the Houston area.

It is the focus and excitement of K-12 learners like those in Houston – where interest and achievement in science are demonstrably on the rise since the introduction of JASON Learning curricula – that will provide a steady pipeline of qualified STEM professionals to help secure our future.

On behalf of JASON Learning and Chevron, we would like to dedicate this book to our first Houston districts: Spring-Branch ISD, Alief ISD, Aldine ISD, and Cypress-Fairbanks ISD. Your tireless efforts and willingness to pursue new opportunities and challenges have been the backbone of this of this project, and the engine for its success.

JASON Learning is committed to the vision of inspiring and educating kids in STEM through exploration and discovery. The alignment of leadership and dedication to success that we have seen in this project will set the example, and make enhanced levels of success in STEM possible for students all across our country.

Introduction

What happens when a world famous explorer and the educational organization he founded join forces with a world-class corporation and a collection of concerned school systems to promote greater student interest in science, technology, engineering, and mathematics(STEM)? Does the story of this initiative offer lessons to educational leaders and policy makers concerned that America's economic future depends on scaling up such efforts? What does it really take to transform science instruction and student learning?

Robert Ballard, deep sea expert and the man who discovered the Titanic, is the explorer, and JASON Learning is the organization he created to advance the teaching of STEM. Chevron is the enormous energy corporation that made a commitment to share JASON with school systems in the Houston area. The school systems, including Aldine, Alief, Cypress Fairbanks, Southwest, and Spring Branch, serve large numbers of Hispanic/Latino and African-American students that qualify for free and reduced price lunch.

Context is essential to storytelling. The present story involves a community context, an educational context, and a corporate context, as well as the circumstances surrounding Robert Ballard's decision to create what originally was known as the JASON Project. All will be explored later in the book. For now, however, it is important to understand the national context in which STEM education has risen to prominence.

The Education/Economy Nexus

Ever since the U.S. economy began losing ground to other industrialized nations in the 1970s, policy makers, pundits, and professors have sought ways to make the U.S. more competitive in the global marketplace. More often than not, the recommendations have included improvements in education, specifically education in the STEM subjects.

When Robert Reich (1983, p. 159), a Harvard professor and later Secretary of Labor, analyzed economic decline in the U.S., he noted that interest in careers in science and engineering was waning, while programs in law, finance, and accounting were attracting ever larger numbers of college students. By the time he published The Next American Frontier in 1983, the U.S. had 590,000 lawyers, one for every 400 citizens. By contrast, Japan – one of America's most successful competitors

– had roughly one lawyer for every 10,000 citizens. One out of every 25 Japanese citizens, however, was trained in science or engineering.

The same year that Reich's book appeared, a blue ribbon commission appointed by Secretary of Education Terrell Bell published a landmark report entitled *A Nation at Risk: The Imperative for Educational Reform*. The commissioners attributed America's economic problems to the failure of public schools to educate a competitive workforce. To combat what the report considered to be a "rising tide of mediocrity," recommendations were made to require high school students to complete four years of English, three years of mathematics, three years of science, three years of social studies, and a half year of computer science.

Whenever the spotlight is focused on the need for greater academic rigor, concerns for disadvantaged students are likely to surface soon thereafter. Such was the case following the publication of *A Nation at Risk*. Fearful that increased academic requirements would widen the achievement gap between high-achievers and low-achievers, advocates for poor and minority students pressed for greater attention to the needs of struggling students. Ensuring that all students met minimum academic standards became the rallying cry of reformers.

The ultimate expression of this concern that all students meet basic academic requirements came with the passage of the No Child Left Behind Act (NCLB) of 2002. Schools receiving federal assistance were required by NCLB to ensure that various student sub-groups hit the same achievement targets.

Developing academic standards and implementing standardized tests to ensure that the standards are taught to all students is important, but such measures do not ensure that large numbers of young people will become sufficiently interested in the STEM subjects to pursue related careers. Realizing that an additional push from the federal government was needed, President George W. Bush signed the America COMPETES Act in 2007. The full name of the bill was the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act (P.L. 110-69).

Contained in the 146-page bill were provisions covering various federal agencies and calling for greater coordination of government efforts to support innovation and applied research. Three provisions dealt directly with education. One focused on graduate training to enhance the skills of teachers of STEM subjects. Another sought to increase by 700,000 the number of teachers qualified to teach Advanced Placement (AP) and International Baccalaureate (IB) courses in STEM subjects and critical foreign languages. The goal of this provision was to increase by 700,000 the number of students from high-needs schools who performed well on AP and IB tests. The third education provision established a panel of experts to compile the most promising practices for strengthening

STEM instruction.

Two years after the passage of the America COMPETES Act, President Barack Obama echoed the concerns of his predecessor and launched new initiatives to motivate and inspire students to excel in science and mathematics. The driving force behind these initiatives would be a series of partnerships involving leading companies, foundations, non-profit organizations, and science and engineering societies. Obama, like others before him, acknowledged the connection between STEM education and America's economic future:

> The key to meeting these challenges – to improving our health and well-being, to harnessing clean energy, to protecting our security, and succeeding in the global economy – will be reaffirming and strengthening America's role as the world's engine of scientific discovery and technological innovation. The hard truth is that for decades we've been losing ground. One assessment shows American 15-year-olds now rank 21st in science and 25th in math when compared to their peers around the world. (Prabhu, November 24, 2009).

By the time President Obama delivered these remarks, Americans had become accustomed to opening the newspaper and finding that U.S. students lagged behind their peers abroad in critical subjects like science and mathematics. On the 2009 Program for International Student Assessment (PISA) tests, for example, U.S. students ranked 31st in mathematics and 23rd in science (OECD, 2009).1 When the results of the 2009 National Assessment of Educational Progress (NAEP) tests were released in January of 2011, only 21 per cent of high school seniors were reported to have scored at the proficient level (Banchero, January 26, 2011). Identifying the difference between stars and planets is an example of a skill that 12th graders must demonstrate in order to score at the proficient level. NAEP test results in science for 4th and 8th graders were not much better than those for 12th graders.

While there has been widespread agreement that steps must be taken to raise student achievement in science and mathematics, the exact nature of these steps is a subject for debate. This is because policy makers and educators are uncertain why student achievement has declined. Possible reasons range from insufficient resources for science programs and the latest technology to a lack of highly qualified teachers. Some argue that the decline corresponds to the increase in the number of poor and minority students in public schools (Schultz, et.al., 2011). Others point to weaknesses in science and mathematics curricula. Rather than covering a few topics in great depth, many programs superficially address a large number of topics, thereby failing to provide students with a solid understanding of fundamental science and mathematics concepts. Still others claim that science and mathematics content fails to engage, challenge, and inspire students. Lessons miss the necessary connections between academic work and the world in which today's young people live.

As a result of growing concern over the quality of STEM education in the U.S., a coalition of 26 states and several national organizations was formed to develop a new set of standards for science education (Robelen, May 15, 2013). Dubbed the Next Generation Science Standards, this initiative aims to bring greater depth to science understanding and more focus on the application of scientific knowledge through inquiry and engineering design.

The partnership between Chevron, JASON Learning, and Houston-area school districts that was mentioned in the opening section is committed to addressing many of the concerns noted in the previous paragraphs. These stakeholders acknowledge that improving performance in the STEM subjects and inspiring young people to consider careers in science, technology, engineering, and mathematics are complex goals that only can be achieved by a multifaceted, systematic, and sustainable initiative.

Studying Educational Change

No scholar begins with a blank slate, and this is especially true of seasoned veterans like myself. In the interest of full disclosure, therefore, I must acknowledge that I have been studying educational change for almost four decades. During this time I have formed and tested various notions regarding the keys to successful educational reform. It is thus the case that when I was invited to undertake a study of the Chevron-JASON initiative in Houston I brought to the endeavor several guiding assumptions.

First, I assumed, based on my experience and the investigations of fellow researchers, that successful educational change is greatly dependent on leadership. And not just top-level leadership, but leadership down the line. Without such distributed leadership, desired reforms all too easily vanish once classroom doors are shut.

Second, I assumed that how changes are introduced and implemented goes a long way to determining whether changes "stick." In other words, the change process itself is a critical element in the success or failure of reform efforts. Having said this, it must be added that the change process that works best in one school system may not necessarily be the process that works best in another school system. Variations in the culture, structure, and politics of school systems invariably influence which change processes work and which ones don't.

These two core assumptions served to guide the design of the study presented in this book. Please do not think, however, that the study was an exercise designed to confirm my preexisting beliefs about change. I approached my work with an open mind, fully prepared to discover that leadership, or lack of it, was not particularly important and that the process of change offered little help in accounting for programmatic outcomes.

I should add one additional comment about the design of this study. My approach to studying educational change is grounded in the belief that stakeholders' perceptions play a powerful role in explaining whether or not change is achieved and sustained. If teachers, for example, perceive that a new curriculum is being forced on them, they are more likely to resent and resist it, regardless of whether district leaders actually intend to compel teachers to adopt it. In order to gather perceptual data, I relied heavily on interviews with key actors as well as surveys, regular reports from district personnel, and classroom observations. Between January and June of 2013, more than 40 extended interviews were conducted, 13 schools in three districts were visited, and observations in 12 classrooms were conducted.

Organization of the Book

Section I of the book sets the stage for efforts to implement JASON in three Houston-area school districts. Chapter 1 examines some of the challenges that must be confronted in order to improve the quality of STEM education in the United States. These challenges range from generating a sense of urgency regarding the need for change to finding ways to motivate young people to tackle rigorous curriculum content. Then there are the difficulties associated with ensuring that improvements reach the neediest students. Finally, improvements must be scaled up and sustained if they are to have a lasting impact on the U.S. economy.

Building the momentum needed to launch major reform initiatives often requires an animating vision. Chapter 2 describes the serendipitous convergence of visions – Bob Ballard's vision for the future of STEM education and Chevron's vision of the Houston area as the epicenter of STEM education – that led to the unique partnership which serves as the focus of this book.

Details regarding the design principles support the JASON program and the Theory of Action supporting its implementation are presented in Chapter 3. Key components of this Theory of Action include the centrality of leadership and the necessity of ongoing professional development and support. Principles of learning and instruction upon which the design of the JASON curriculum is based include customization and differentiation.

The stories of how the JASON curriculum was implemented in three of the original Houston-area school districts serve as the foci of Chapters 4, 5, and 6. What stands out in these accounts is how each school system customized the adoption process based on the local needs and concerns that were judged to be of greatest importance. The stories of implementation also illustrate how changes in school organization culture may be necessary prerequisites to successful reform.

Section III examines the early impact of JASON on the three focal school districts and some of the lessons learned about the process of educational change. Chapter 7 reviews the results of teacher and student surveys collected in May of 2013 in Spring Branch, Aldine, and Alief school districts. Reflections on the implementation process in the three districts and what they reveal about effective innovation in schools are presented in Chapter 8. The last chapter looks at JASON's future, both in greater Houston and as a national organization committed to high quality STEM education.

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Notes

1. PISA is a triennial survey of the knowledge and skills of 15-year-olds. More than 400,000 students from 57 countries making up close to 90% of the world economy take part.

Section I

The Development of the Chevron-JASON Initiative

Chapter I

A Convergence of Visions

Once upon a time there was an eighth grader at Northbrook Middle School in the Spring Branch School District near Houston. Joe's major claim to fame was his involvement in football. In class, Joe was quiet, rarely volunteering a comment or asking a question. Like many students, he did what was necessary to get acceptable grades, but he revealed little enthusiasm for what he was taught.

Then one day early in second semester, he and his classmates were assigned to work on a lab that focused on plate tectonics and the various layers that make up the Earth. It also happened that this day Joe's science class was being observed by six visiting principals. Much to his teacher's surprise, Joe became highly engaged in the lesson, so much so that when one of the visitors asked Joe what he was doing, the usually taciturn student provided an in-depth explanation of the lab.

Joe's interest in the make-up of his planet might not have been stimulated had his teacher, Cassie Seelbach, not taken an interest in a new curriculum entitled *Tectonic Fury*. The curriculum was packed with challenging labs and lessons about unlocking the planet's geologic mysteries. Cassie Seelbach, in turn, might not have discovered *Tectonic Fury* if Rojana Luecken, Spring Branch's District Instructional Specialist, had not encouraged Seelbach to get training in the middle school science programs developed by JASON Learning. Luecken might not have heard of JASON Learning had her Superintendent, Duncan Klussmann, not taken a keen interest in using the JASON programs to advance STEM education in his school district. Klussmann would not have known about JASON Learning if he had not met Joni Baird of the Chevron Corporation at a Houston-area function and been encouraged to partner with Chevron and JASON Learning. Joni Baird would not have seen the potential of JASON Learning to advance STEM education if she had not heard a presentation by Bob Ballard and become convinced that his approach to STEM education held great promise for the young people of the Houston area.

So, how did Bob Ballard become committed to improving STEM education and promoting scientific literacy? And what factors drove Chevron to embrace a similar aim? This chapter explores the origins of JASON Learning and the events that led to a remarkable convergence of visions between the Chevron Corporation, JASON Learning, and Houston-area school districts.

Evolution of an Explorer[1]

Robert Duane Ballard was born in 1942 in Kansas, far from the oceans that would be his habitat for much of his life. He did not remain landlocked for long, for his parents moved to San Diego. As a boy, Ballard read Jules Verne's Twenty Thousand Leagues Under the Sea, a visionary novel that Ballard credits with igniting his interest in underwater exploration. Later in life when he began to focus on advancing science education, Ballard remembered that the path to passion begins with interest. The first step in learning about science, he insists, must be engaging the interest of young people. That interest was heightened for him during high school when he received a National Science Foundation scholarship to join researchers from the Scripps Institute on an ocean expedition.

Ballard's interest in science took another giant step forward when his father, the chief engineer at North American Aviation's Minuteman missile program, helped him get a part-time job working on a failed proposal to build the submersible Alvin for the Woods Hole Oceanographic Institution. At age 20, Ballard began to understand the value of hands-on experience. Reading about scientific adventures might generate a spark, but the fuel needed to build a fire required direct involvement.

Inspired to learn more about science, Ballard earned undergraduate degrees in chemistry and geology at the University of California at Santa Barbara. While in college, he participated in the Reserve Officers Training Corps (ROTC), earning an Army commission. Called to service during the Vietnam War, Ballard requested a transfer to the Navy, where he might make better use of his training as a marine geologist. The Navy assigned him to the Woods Hole Oceanographic Research Institute where he worked on deep submergence.

After leaving the Navy and completing his Ph.D. in marine geology, Ballard returned to Woods Hole as a full-time marine scientist. Thus commenced a remarkable career of deep sea exploration and path breaking discoveries. Completing 140 scientific voyages over the course of the next four decades, Ballard would be involved in locating hydrothermal vents, developing the technology of underwater field mapping, explaining the mineral composition of sea water, and advancing the discipline of marine archaeology. Already well known in the marine science community, Ballard achieved widespread popular acclaim in 1985 when he and his crew located the wreck of the Titanic more than two miles below the North Atlantic.

Not one to rest on his laurels, Ballard continued to undertake headline-capturing expeditions. Using the maneuverable, remote-controlled photographic robot that he designed for deep sea exploration, Ballard located the German battleship Bismarck, the ill-fated passenger liner Lusitania, and John F. Kennedy's PT-109. In recent years, he has turned his attention to the Black Sea, where he has found intriguing evidence of a massive flood around 7,000 years ago. It is not inconceivable that this was the flood referenced in the Old Testament.

Now at age 71 Ballard is still as excited about exploration as ever, but he sees his role shifting from explorer to mentor and facilitator of exploration. Using the Nautilus, the ship he has outfitted with state-of-the-art equipment, serves as a wandering home to an every-changing collection of young researchers. Scientists from across the globe submit proposals for research projects that then are reviewed by Ballard's advisory board of veteran scientists. Those fortunate enough to have their proposals accepted are welcomed on board the Nautilus and provided with the support they need to conduct their investigations. The only condition is that they must share their discoveries with the world.

To facilitate the sharing of these discoveries, engaging, non-technical reports are regularly published in the journal Oceanography. The Nautilus also is equipped to transmit live broadcasts of scientific exploration to audiences around the world.

As Ballard undertook one adventure after another, he increasingly worried about the declining level of scientific literacy among the American population in general. Equally concerning was the shrinking number of U.S. students who expressed an interest in scientific careers. What would it take, he wondered, to re-invigorate the pursuit of science and related subjects? To answer that question, Ballard embarked on one of his most ambitious undertakings.

The Birth of the JASON Project[2]

If Bob Ballard believes in anything, it is the power of discovery to more the world forward. He makes no secret of the fact that many of his greatest discoveries were accidents. These fortuitous accidents never would have occurred had he not left his office and ventured forth on the oceans of the world. Ballard puts it simply, "I honestly believe in exploration." Exploration, as he sees it, is the most direct route to meaningful education.

Following the discovery of the Titanic, Ballard received thousands of letters from students wanting to know more about how the discovery had been made. Ballard started thinking about the educational possibilities of his remote-controlled photographic robot. Telecommunications was advancing rapidly. Why couldn't young people have access to scientific exploration as it was happening? What better way to engage the imaginations of young people.

Dreams don't just roll off the drawing board and become reality, however. Telecommunications are expensive. Funding was needed. So, too, was an organization capable of reaching large numbers of young people. Ballard located a variety of corporate executives who believed in the mission of promoting greater interest in scientific discovery among young people. Thus was born the JASON Project in 1989.

Ballard had serious doubts that the traditional methods used to teach science could generate interest among young people. He also worried that it was too easy for high school students to opt out of taking science. “Kids today” he observed, “are up against amazing competition for their attention.” First it was television, then computers, cell phones, and video games. Ballard understood that teachers needed to find new ways to engage their students, but he was unsure they had the capacity or the will to do so.

Ballard’s answer was to provide access to live science events in the field through the use of telecommunications. Young people would attend these events by going to museums and after-school programs. Not only would they be able to watch the eruption of a volcano or the exploration of hydrothermal vents miles beneath the ocean’s surface, but they could communicate in real time with scientists in the field.

Steve Coan, President and CEO of the JASON Project, maintains that the venture was never supposed to be permanent. “JASON,” he states emphatically, “was intended to be a process, a change agent.” One of the founding partners, technology giant EDS, was interested in testing the market for education-oriented telecommunications. Other founding partners included National Geographic and the Woods Hole Oceanographic Research Institute, both committed to finding new ways to promote science.

The first two decades of the JASON Project were characterized by considerable experimentation and frustration. A step forward often was followed by a setback. Arranging live events in the early days before the Internet posed lots of logistical problems. Busing large groups of students to museums and universities to watch live events proved costly and challenging. Sending camera crews to remote locations like Belize and the Galapagos Islands was even more challenging. Each “shoot” also was costly, running between one and three million dollars. Users began to balk at the cost of access to JASON live events.

The focus of the JASON Project gradually began to shift from live events to after-school and classroom-based activities. The advent of the Internet opened up vast new possibilities. JASON developed a relationship with the National Aeronautics and Space Administration that enabled schools to provide students with direct access to scientists in the field. Still, the JASON Project lacked a viable business model that would enable it to reach large numbers of young people. Members of the JASON Project Board included CEOs of major corporations, and they wanted a bigger impact for their investment.

At the same time that the JASON Project was searching for stable funding and new ways to reach more young people, public education in the U.S. was experiencing major changes. In an effort to provide a foundation for greater educational accountability, governors and state education officials pressed for curriculum standards to guide classroom instruction and the development of state standardized tests. Building on the momentum of the standards movement, the administration of President George W. Bush with bi-partisan support from Congress passed the No Child Left Behind Act in 2002. States receiving federal aid to education henceforth would be required to have standards-based testing and make the results public.

Ballard and others at the JASON Project realized what they needed to do. Reaching large numbers of young people would require developing JASON curriculums and aligning them with state standards. Curriculum development is a costly and time-consuming process. It would take five years and a considerable infusion of funding before the new curriculums were available for educators.

Based on the assumption that high school probably was too late to capture the interest of many young people, JASON planners decided to target middle schoolers. Some might say that it was foolhardy for JASON to enter the arena of curriculum development, an arena in which giant multinationals like Pearson and Harcourt Brace dominated. But an organization founded by a fearless deep sea researcher was unlikely to back away from such a challenge. The folks at the JASON Project understood that the big textbook publishers' products were known more for their weight and uniformity than their ability to inspire and support innovative teaching.

To fund curriculum development and keep JASON afloat, a sizable investment was required. But the post 9-11 period was marked by a shrinking economy and tight money. The federal earmarks on which JASON had become dependent largely dried up. In 2005 National Geographic came to JASON's rescue, acquiring the organization and investing 15 million dollars in its re-invention.

Still a Work in Progress

In 2007 the first JASON text, Monster Storms, was completed. Between 2008 and 2011, four additional volumes appeared – Resilient Planet, Infinite Potential, Terminal Velocity, and Tectonic Fury. Each one includes dramatic photographs, stimulating activities, and personalized vignettes of contemporary scientists. The texts are available on-line and supported by a website, an array of engaging computer-based resources, and a cadre of researchers who make visits to schools.

Much like science itself, JASON has continued to evolve. New curriculums have been planned in order to address science standards not covered by the first five curriculums. A new initiative focuses on mathematics. Students and teachers who have signed on with JASON can compete for summer opportunities to join Bob Ballard and his team of researchers on scientific expeditions, aboard the Nautilus.

In 2012, the JASON Project was re-branded JASON Learning. No longer a short-term experiment, JASON Learning now represents an institutional commitment to transform the education of American youth. JASON Learning pulls together previous endeavors – on-line teacher training, after-school programs, curriculum development, science camps, and award-winning school-based programs – and provides a solid foundation for new ventures. As of 2013, JASON Learning served over two million students in schools across the nation and more than 500 after-school programs in Boys and Girls Clubs, museums, and other organizations. The result, according to the organization's website, is a "year-round continuum of classroom and out-of-classroom learning."

JASON Learning still reflects Robert Ballard's dream of a better way to inspire a passion for science in young people, and Ballard continues to play an active role in the organization, but JASON Learning no longer is solely "the lengthened shadow" of its founder. It has become an international community of people – researchers, educators, students, alumni, foundation and corporate sponsors – who share a common interest in the excitement of scientific inquiry and the promise of discovery. The motto of JASON Learning says it best – "Education through Exploration."

Chevron's Concerns Lead to a Commitment[3]

That energy giant Chevron should be concerned about the education of young people is no surprise. Besides a sincere interest in the general welfare of American society, Chevron depends on schools and universities to provide a steady flow of well-educated young talent to keep its business growing and improving. Even before Houston Chevron executives forged a relationship with JASON Learning, they had supported a variety of initiatives aimed at helping young people and educators in the Houston area. The Offshore Energy Center provides teacher training and "Mobile Learning Units" for use in classrooms, funding for the Houston Museum of Natural Science was used for "Science on Wheels," and support was provided to the Houston Children's Museum for engineering programs. The Chevron "Fuel Your School" program was launched in Houston in 2012 and annually provides a million dollars for Houston area classrooms through DonorsChoose.org, a "citizen philanthropy" website. Houston Chevron also sponsors the Conference for the Advancement of Science Teaching (CAST), an opportunity for Texas teachers to learn about new developments in science education.

At the center of Chevron's philanthropic work for Chevron North American Exploration and Production, which includes the greater Houston area, is Ed Spaulding, General Manager for Policy, Government and Public Affairs for Chevron North America. A veteran of 35 years with Chevron, the Berkeley-trained chemical engineer from Palo Alto came to Houston in 2004 from Bakersfield, California, where he led Chevron's external relations from San Francisco to the Nevada border. He was charged, as he puts it, with "taking a good program to the next level."

Chevron's presence in the Houston area had grown enormously, from 1,000 employees in 2000 to 8,000 employees plus 2,000 contractors in 2013. Chevron now occupies two huge office buildings in downtown Houston. In his efforts to explain Chevron's commitment to Houston, Spaulding reaches in his desk and pulls out a copy of a brochure titled "The Chevron Way" and sub-titled "Getting Results the Right Way." He points to the core vision statement: "At the heart of The Chevron Way is our vision...to be the global energy company most admired for its people, partnership and performance." Spaulding then adds, "The order of these three is significant. People come first."

Chevron, according to Spaulding, believes in doing what it can to support the communities in which its employees live and work. The corporation's program of giving concentrates on three themes: education, health, and economic development. For those who believe that big corporations don't put much thought into how they distribute their gifts, they don't know Chevron and they don't know Ed Spaulding.

Believing that too much money that is spent on education in the U.S. produces too little return on the investment, Spaulding devoted considerable effort to discovering the best way to support Houston-area education. He notes, "I'm not an educator. I needed knowledge to help me decide how to invest in education." He pauses, then continues, "It's easy to invest. It's harder to invest effectively."

In order to gather more knowledge on education, Spaulding turned to Joni Baird, Chevron's Manager of Public Affairs. A Coloradan with 20 years experience in Denver with Johns Manville, Baird joined Chevron in 2008, bringing with her many strong connections not only in Houston, but across the nation as well. Education reform was a particular interest of Baird's. Spaulding assigned her the task of preparing a White Paper on how best to invest in education. Baird recalls, "He said he wanted a significant number of citations." To assist in this daunting assignment, Baird contacted a veteran educational leader and commissioned the White Paper.

Not surprisingly, the White Paper concluded that there was no "magic bullet" – no single investment strategy that would guarantee great results in all cases. Instead, there were three reasonably promising strategies that had proven productive in a number of cases.

The first strategy involved focusing resources on school districts rather than individual schools or teachers. By doing so, Houston Chevron would be more likely to maximize its impact. The second strategy called for channeling resources to districts that were poised to make a significant jump in student achievement. In other words, the research did not endorse pouring money into the lowest performing districts or the top-performing districts. The former faced too many organizational and social issues, while the latter had little room for improvement.

The third strategy recommended by the White Paper called for a long term commitment of resources. Raising student achievement – the bottom line for Spaulding and Baird – was not an overnight matter. Spaulding draws on an example from physics to illustrate this point. “You have to apply force over a relatively long period of time in order to change direction,” he observes. “Think of trying to change the course of an aircraft carrier.”

Drawing on these three findings, Spaulding and Baird began to search for a specific area of education on which to focus. They now possessed an understanding of how to use Houston Chevron’s resources intelligently and they knew that improved student achievement was the ultimate goal, but they remained unclear about where the most meaningful impact could be made.

“We looked at the universe of all possible things we could do in education,” Spaulding recalls, “and we decided to zero in on STEM education.” STEM education made sense, given the nature of Chevron’s business. But still more focus was needed. “Our research told us,” Spaulding continues, “that middle school was a critical point for students. Students unknowingly make decisions affecting their future career choices. If they don’t decide to take higher math in the 8th grade, for instance, they are unlikely to have the math needed to enter engineering after graduating from high school.”

Satisfied that a meaningful focus for Chevron’s Houston social investment had been identified, Spaulding tasked Baird with determining what needed to be done “on the ground.” Baird had seen many education programs lack long term impact, and she allowed herself to “dream big,” envisioning the Houston area as “the epicenter of STEM education in the United States.”

As it happened, Baird had heard a presentation by Bob Ballard at a meeting of the Texas Science Teachers Association, an organization which Chevron supported. Ballard had discussed the JASON Project and the impact it was making in schools and after-school programs. Baird liked JASON’s emphasis on getting young people and teachers excited about science. When she shared information on JASON with Spaulding, he believed that the program possessed “the gravitas to make a meaningful impact.” The first step toward merging Bob Ballard’s goal of raising scientific literacy and Chevron’s commitment to improving education in the Houston area had been taken.

In the months that followed, Baird and Dr. Eleanor Smalley, JASON’s Chief Operating Officer and point person for the Chevron/JASON initiative, began to forge a partnership. Baird initially thought that JASON might work best as a science enrichment experience in a summer camp. Concerned that more young girls needed to develop an interest in STEM, she saw the summer camp as a promising means to that end. Unfortunately, only a handful of girls signed up for the one-week camp.

Knowing that JASON was used in after-school programs, Baird next decided to support science enrichment programs with a local non-profit organization. The results of this effort, however, were disappointing. Personnel at the non-profit lacked the experience, training, and skills to implement JASON as the program was designed. Baird wanted larger scale impact and scalability, and she came to realize that both were unlikely to result from the partnership with the organization.

After discussing these false starts with Smalley and conferring with Spaulding, Baird concluded that the only way to achieve her "big dream" was to work with public school districts. The White Paper had recommended such a course of action. Negotiating the channels of school district bureaucracies, Baird understood, can be daunting. The graveyard of educational reforms is littered with examples of well-intentioned, well-funded initiatives that failed to secure the local buy-in and continued support to be sustainable. Would a partnership between one of America's largest corporations and a dynamic educational incubator led by one of the nation's leading scientists and explorers provide sufficient momentum to overcome the inertial forces of public education?

Notes

1. Information concerning Robert Ballard's career was obtained in an extensive interview with Ballard on March 21, 2013, and from the Academy of Achievement website www.achievement.org/autodoc/page/bal0bio-1, downloaded on February 18, 2013.
2. Details concerning the creation and development of the JASON Project was gathered from interviews with Robert Ballard, Chairman of the Board of the JASON Project; Steve Coan, President and CEO of the JASON Project; and Eleanor Smalley, Executive Vice President and COO of JASON Learning.
3. Information regarding Chevron's efforts to promote STEM education and partner with JASON Learning was gathered from interviews with Edward Spaulding, General Manager for Policy, Government and Public Affairs for Chevron North America; Joni Baird, Houston Public Affairs Manager for Chevron; and Dr. Eleanor Smalley, Executive Vice President and COO of JASON Learning.

The Challenges of Educational Change

Improving STEM education, or anything else in American schools for that matter, is more challenging than landing an astronaut on the moon or exploring the depths of the ocean. After all, the last two challenges, actually have been overcome. Just because a renowned researcher and a major corporation agree to partner with school districts in order to implement an innovative science curriculum is no guarantee that the venture will succeed.

Yale sociologist Seymour Sarason (1971) devoted considerable time to understanding what happened to the science curriculum reforms of the sixties. Millions were spent by the federal government to promote high quality high school science programs. Internationally known scientists were enlisted to design "teacher-proof" curriculums in biology, chemistry, and physics. Summer institutes were set up to train high school science teachers. Despite these efforts, however, implementation of the curriculums was uneven, and results were often disappointing.

What happened? Sarason maintained that the developers failed to grasp the complexities of educational change. Positioned in prestigious universities, they did not understand the inertial effects of school cultures. They also overestimated what could be accomplished by one-shot trainings. Sarason reasoned that veteran teachers first needed to "unlearn" how they had been taught to teach science before they could successfully master new methods. Over the years teachers develop routines for doing just about everything. Routines, like habits, are very difficult to change, especially if they are perceived to be working.

Other students of educational change support Sarason's observations (Duke, 2004; Tyack & Cuban, 1995). Successful innovation and reform appears to be more the exception than the rule. In their provocative analysis of the difficulties of changing schools, Tyack and Cuban observe that "some innovations seem to die on contact with the institutional reality of the school. It is the rare reform that performs and persists precisely according to plan" (p. 60).

Why is achieving meaningful educational change so daunting? This chapter begins by examining some of the hurdles that must be cleared in order to achieve successful educational change. The chapter goes on to describe the theory of action that guides the Chevron-JASON initiative in its efforts to promote high quality STEM education in Houston-area middle schools.

Change Is Complex

To contend that school improvement is complex is to risk understatement. Changing schools for the better, as organization theorists frequently observe, is a multi-dimensional process involving structural adjustments, human resources, political maneuvering, and cultural shifts (Bolman & Deal, 1997). It is not for the faint of heart, the cynical, or the listless.

Consider the way schools are structured. Teachers are required to align what they teach with state curriculum standards. These standards, in turn, form the basis of the state standardized tests upon which judgments of student progress and teacher effectiveness are based. Test results also determine whether or not schools are subject to sanctions.

To ensure that schools achieve their academic missions, structural mechanisms are in place in most school systems. These mechanisms include supervision of instruction and evaluation of students and teachers. Responsibility for seeing that these mechanisms function appropriately is vested in the office of the district superintendent and delegated to subordinates, including curriculum directors, instructional coordinators, and school principals. When schools fail to achieve their missions, inadequate leadership is typically the first focus of concern.

Lack of leadership, however, is not the whole story when it comes to accounting for failed reforms. Leaders cannot improve education by themselves. Successful change requires a team effort. Teachers and other staff members – the school's human resources – must regard proposed changes as potentially useful. The history of school improvement is replete with programs and innovations that failed to gain the buy-in of educators. Reforms that promised to make teaching more effective wound up taking lots of time and money without much impact. Over time teachers reverted to conventional ways of delivering instruction. These well-established routines – what Tyack and Cuban (1995) term the grammar of teaching – are not easily displaced.

Educational change also involves a political component. Support for reform can never be assumed. At any given time, there are always individuals who benefit from the status quo. They regard change as a possible threat. Regardless of the proposed reform, the question of who benefits invariably arises. Some new programs, for example, are perceived to benefit high-achievers at the expense of low-achievers. Other programs appear to be designed primarily for low-achievers, leading parents of high achievers to raise questions.

Educational change also leads to questions concerning resources. Reform is not cheap, and schools always seem to be short on funds. Conflicts predictably arise over whether or not to devote scarce resources to support untested reforms.

Just because a particular reform or new program garners support at one point in time is no guarantee that support will continue. School Boards change; Superintendents come and go. Funds dry up or are re-allocated. The political backing that was once enjoyed can erode overnight, leaving supporters of change bewildered and frustrated. The more educators ride the roller coaster of reform, the more doubtful they become regarding the possibility of genuine improvement.

Another dimension of educational change concerns organizational culture. Schools and school districts typically are characterized by distinctive cultures. These cultures consist of norms, values, and accepted ways of doing things. The culture of an organization develops over a long period of time, and it is not easily altered. Educational change often is perceived to be a threat to the current culture. Personnel may resist reforms because they have become accustomed to and comfortable with this culture, even though it may not necessarily support high levels of achievement. Whatever its shortcomings, the existing culture has the benefit of being familiar.

Educational change experts frequently observe that a key to successful innovation involves changing school culture (Bambrick-Santoyo, 2010). This may mean challenging prevailing assumptions about students, professionalism, and teaching effectiveness. Beliefs and values associated with certain aspects of the status quo must be replaced by beliefs and values more in line with proposed changes. Contemporary reformers focus a great deal on creating cultures of accountability, collaboration, high expectations, and continuous improvement.

Given the multi-dimensional and complex nature of educational change, it is likely that implementing a new program or curriculum will entail continual adjustment and fine tuning. Put differently, change is best regarded as a process, not an event (Hall & Hord, 2001). A major reason for this view of change is the fact that all change, educational change included, occurs in specific contexts – a particular location, a particular point in time, a particular collection of individuals. Contexts can vary significantly. To ignore or underestimate the impact of contextual differences is to place a reform, no matter how potentially beneficial, at risk. Successful reforms typically allow for some degree of local customization.

An Emerging Theory of Action for JASON[1]

Joni Baird could not have provided a clearer mandate for JASON Learning. Chevron in Houston wanted its efforts to promote STEM education in the Houston area to be systemic and sustainable. Achieving these directives would require more than expertise in designing new curriculums and training teachers. It would need the leadership talents of someone familiar with the challenges of educational change. Fortunately JASON Learning possessed such talent in the person of Dr. Eleanor Smalley, JASON's Executive Vice President and Chief Operating Officer. A highly successful former Virginia Superintendent and instructor for the University of Virginia's Educational Leadership Program, Smalley understood what it takes to implement reforms and make them stick. As Superintendent of Clarke County Public Schools, she transformed a mediocre school system into a top-performer. Among the reforms she introduced was the JASON program.

Smalley knew that the successful implementation of JASON ultimately depended on getting science teachers and their students excited about its curriculum materials and activities. First, however, the program needed to be sold to district leaders – Superintendents and School Board members. No amount of grass-roots enthusiasm is likely to overcome lack of commitment by top-level leadership. As Smalley put it, "If Superintendents keep the focus exclusively on reading and math and they don't continue pressing to improve science education, not much will be accomplished to promote STEM."

Smalley's strategy of beginning at the top resonated with Ed Spaulding and Joni Baird. Baird contacted Dr. Linda Pitre, Assistant Superintendent for Professional Support Services at the Harris County Department of Education, to see if she wanted to take the lead on implementing JASON. Pitre advised Baird to go directly to school district Superintendents in Harris County. Like Smalley, Pitre understood that Superintendents were more likely to support JASON if they were the first point of contact.

Baird believed that districts that enrolled a high percentage (at least 50%) of students on free and reduced price lunch (a key indicator of poverty) would benefit most from the Chevron-JASON initiative. When she asked Pitre to suggest districts that met this criterion, three districts were mentioned – Spring Branch, Aldine, and Alief. Interestingly, Baird had independently zeroed in on these districts. All three were known to be receptive to new ideas and they were not so large that red tape might be a problem.

Serendipity took over at this point. Baird happened to run into Duncan Klussman, the Superintendent of Spring Branch Independent School District (ISD), at a dinner for Teach for America. Klussman had led Spring Branch, a district of 35,000 students with an annual budget of $250,000,000, since 2004. Professionally active and respected by his peers, he sat on various committees of the Texas Association of School Administrators and the Advisory Board of the Rice University Education Entrepreneurship Program.

Baird asked Klussman if he would be interested in the JASON program. Klussman responded that he had heard Bob Ballard speak about JASON at a conference for the Texas Association of School Administrators, and he had liked what he heard. He admitted, however, that the price tag for JASON discouraged him from pursuing the program any further. Baird indicated that Chevron in Houston would be interested in helping out.

Baird had sown the first seed, but she understood that a seed sown is not a seed grown. Baird asked Eleanor Smalley to call Klussman. "Superintendents like to talk to other Superintendents," Baird asserts. The strategy worked. Smalley and Klussman hit it off, but Klussman, understanding what was needed in his district to ensure a successful launch for JASON, said that his Leadership Team first had to support the effort. Smalley was asked to present JASON to the Leadership Team. The presentation went well, and the Chevron-JASON initiative established its first beachhead in Harris County.

On December 12, 2011, Klussman and the Board of Trustees of Spring Branch ISD received a $300,000 check from Chevron, with $250,000 earmarked for the JASON middle school science program. The other $50,000 was given to send 14 Spring Branch elementary teachers to the Clearwater Aquarium to learn about marine biology.

It takes more than one school district to create an "epicenter," so Baird and Smalley consulted Klussmann in order to identify other Harris County Superintendents who were likely to embrace Chevron's vision and the JASON program. Klussmann suggested Dr. Wanda Bamberg of Aldine ISD and H.D. Chambers of Alief ISD. Baird asked him to contact his fellow Superintendents to see if they might be interested. Getting referrals from a sitting Superintendent proved to be a very effective way of enlisting new partners for the Chevron-JASON initiative. The fact that JASON promised to benefit both high achievers and struggling students, of course, also enhanced the program's attractiveness.

After conferring with their Leadership Teams and getting the green light from their School Boards, both Bamberg and Chambers signed on. With 63,000 students, Aldine ISD was the 11th largest school district in Texas. Nearly one in seven students were Hispanic/Latino, while a quarter of the enrollment was African American. Aldine operated 11 intermediate campuses (grades 5 and 6) and 10 middle school campuses (grades 7 and 8). Alief enrolled more than 45,000 students, with Hispanics/Latinos making up just over half and African Americans just under a third of the student population. Eight out of ten Alief students qualified for free or reduced price lunch. The district operated 6 intermediate and 6 middle school campuses.

The first set of Chevron-JASON districts also included a fourth district – a charter organization. Baird was interested in seeing whether JASON could help the two charter schools that made up Southwest Schools.2 Superintendent Janelle James expressed great interest, knowing that her students lacked access to the kinds of resources that JASON provided.

While it is essential to gain the support of top-level district leaders and their boards, the actual work of seeing that JASON is implemented successfully must be carried out by subordinates. A second important component of JASON's theory of action, therefore, consists of identifying key central office supervisors and school-based leaders. These would be the individuals with direct responsibility for transforming middle school science education.

In Spring Branch ISD Rojana Luecken, the District Instructional Specialist for Secondary Teaching and Learning, assumed the role of project manager for JASON implementation. Reporting to her were Cadre members from each middle school. These individuals were science teachers handpicked to take the lead in coordinating school-based JASON activities and training.

Xandra Williams-Earlie, Program Director for Secondary Science, and Tracy Mansfield, Program Director of Elementary and Intermediate Science, shared the lead role in Aldine ISD. They coordinate the school-based efforts of Science Specialists at intermediate and middle schools. Besides coaching their colleagues on the finer points of the JASON curriculums, the Science Specialists help determine which elements of JASON fit best with each grade-level's science program.

In Alief ISD, central office leadership responsibilities were delegated to Dr. Karen Jacobs, Secondary Science Coordinator, and Gelyn Cornell, Science Coordinator for grades K-6. Cornell works with Professional Learning Communities and the Campus Science Specialist at each intermediate school to plan JASON-based lessons. Jacobs supervises the efforts of JASON coaches at each middle school in order to facilitate the implementation of JASON curriculums.

By distributing leadership responsibilities, the JASON theory of action addresses the need for a structured foundation for program implementation. Distributed leadership also is a key to sustainability. Even if top-level leadership changes, the proliferation of leaders at other levels ensures that there will be sufficient expertise and experience with JASON to perpetuate the program. The fact that each of the three districts opted for a somewhat distinct way of distributing leadership illustrates the importance of having a theory of action flexible enough to accommodate differences across districts.

Flexibility is Eleanor Smalley's mantra. From experience she knows that school districts and schools vary. One-size-fits-all reforms rarely survive. Teachers want to be treated like professionals capable of deciding how best to implement new programs. Forcing teachers to do things the same way, Smalley insists, undermines sustainability. Teachers often come up with ingenious ways to adjust and improve new programs. The JASON Program underscores the importance of science standards, not standardization.

Training is the third essential element of JASON's theory of action, and it addresses another crucial dimension of change – the human resource dimension. Before students can get excited about science and other STEM fields, teachers must get excited. JASON designers understand that many middle school science teachers lack a strong science background. Some did not major in science or science education, while others completed their teacher preparation so long ago that much of their factual knowledge is outdated. JASON professional development programs are designed to ignite teachers' imaginations about instructional possibilities while simultaneously filling in gaps in their content knowledge.

JASON training is offered in extended national training programs during the summer as well as customized training sessions on-site in school districts. Middle school science teachers and their supervisors from Spring Branch, Aldine, Alief, and Southwest began by attending a training program. Science teachers receive an initial two-day training, while coaches and other lead teachers attend 5 and 6-day training sessions. All training is delivered by JASON's cadre of national trainers.

In the first year of JASON implementation in the Houston area, a total of 72 school-based coaches and lead teachers and 259 teachers received training. JASON's theory of action recognizes, however, that one-shot professional development is unlikely to "stick." Follow-up training on a local basis, frequently offered by district and school-based science specialists, coaches, and lead teachers, ensures that JASON lessons and activities are reinforced and fine tuned. Teachers who take a special interest in JASON can compete for opportunities to become national trainers and go on scientific expeditions aboard the Nautilus with Bob Ballard and his Argonauts.

Schools in Texas, as elsewhere, must teach content in the core subjects that reflect state curriculum standards. Knowing this, JASON curriculum designers make certain that their content is aligned to the science standards in all the states. JASON's theory of action calls for middle school science teachers, as part of their training, to review their district's curriculum and pacing guides in order to determine where best to place JASON lessons. Teacher receptivity to new curriculums such as those offered by JASON is contingent on such alignment. Teachers know that their students must focus on standards-based content in order to pass state standardized tests in science.

Under the leadership of Rojana Luecken, Xandra Williams-Earlie, Tracy Mansfield, Dr. Karen Jacobs, and Gelyn Cornell, teachers in Spring Branch, Aldine, and Alief have devoted considerable time and energy to identifying the best places in their courses of study to introduce JASON lessons and activities. Once curriculum content has been earmarked for particular units in the approved pacing guide, the likelihood of system-wide implementation and sustainability is greatly increased.

The final element in JASON's theory of action involves continuous feedback and formative assessment. JASON designers understand that no program, however well-designed, is likely to be implemented flawlessly. Every school and district constitutes a distinct context for change with their own challenges and contingencies. The key to success is to create a culture of collaboration and continuous improvement, one in which teachers routinely expect to examine how implementation is going and make appropriate adjustments.

In Spring Branch, Aldine, and Alief, the central office leaders responsible for overseeing JASON's implementation meet periodically with school-based specialists to discuss how particular lessons went and what can be done to improve them. Plans are made for upcoming lessons and activities. School-based specialists and lead teachers are expected to repeat these feedback and planning sessions with science teachers at their schools. While it obviously takes more than a year or two to develop a new culture around science teaching, the first steps toward this goal have been taken with encouraging results.

Two additional change strategies complement JASON's theory of action. Joni Baird deserves considerable credit for both. First, Chevron in Houston funding for the implementation of JASON is provided for three years, thereby ensuring that resources for training and texts will continue for a long enough period to enable local educators to see the program's benefits. Nothing is more frustrating for teachers or damaging to the prospects for school improvement than watching funds dry up before a new program has had a reasonable opportunity to take hold.

The second change strategy is something Baird refers to as "layering." Layering involves the acquisition of supplemental funding from external sources to support the Chevron-JASON initiative. The example of Donors Choose is illustrative. Chevron funds cover training and texts, but not the kits of science supplies that enable teachers to conduct hands-on experiments in class. Baird approached Donors Choose, a Houston charity to which individuals can apply for small grants to support worthy causes, to see if the organization would accept applications from JASON-trained teachers. The charity agreed, thereby paving the way for teachers to secure the funds needed to purchase science kits.

Figure 2.1 provides a graphic of the JASON theory of action. It should come as no surprise that this theory of action is, itself, a work in progress. JASON is, after all, an organization devoted to inquiry and exploration. As new knowledge about efforts to implement JASON is acquired, it is likely that the theory of action will evolve.

For the present, the theory of action undergirding the Chevron-JASON initiative seems to have all the right ingredients to enable it to avoid many of the problems that have plagued other education reforms. Account has been taken of the complex and multifaceted nature of educational change. Various dimensions of the change process, including the political, structural, human resource, and cultural, have been addressed. Local differences have been accommodated.

Despite these provisions, however, no implementation initiative is likely to succeed if what is being implemented is poorly designed or incapable of achieving desired outcomes. The next chapter examines the principles of learning upon which JASON curriculums are based.

Notes

1. A theory of action represents a set of beliefs about the causal relationships between certain actions and their desired outcomes. JASON's theory of action involves the steps most likely to result in the successful implementation of the JASON program.

   The information in this chapter is based on interviews with Eleanor Smalley, Joni Baird, Rojana Luecken, Xandra Earlie-Williams, Tracy Mansfield, Dr. Karen Jacobs, and Gelyn Cornell.

2. The author was unable to conduct interviews and observations in Southwest Schools, so they will not be addressed in this book.

Figure 2.1. JASON Theory of Action

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District leader commits to support JASON initiative
Responsibility for JASON implementation delegated to central office supervisors and school-based teacher leaders
Initial and on-going training
Alignment of JASON content to district standards and pacing guides
Provisions for continuous feedback and collaboration on JASON implementation

Chapter III

Charting a Course to Effective Learning

No one can accuse Ed Spaulding or Joni Baird of modest ambitions. Not only did the mission they chose for Chevron in Houston to support involve transforming an enormous metropolitan area into an epicenter of STEM education, but they wanted to do it by focusing first on middle schoolers, arguably the toughest segment of the school-age population. And what's more, they wanted to concentrate on school districts serving large numbers of young adolescents from poor neighborhoods.

Students in high-performing schools, schools typically located in well-to-do suburban communities, have richer opportunities to learn science than their counterparts in poor neighborhoods. One Massachusetts study, for example, found that students in high-performing schools were exposed to 60 minutes more science instruction each week than students in low-performing schools ("Opportunity to Learn Science," May 8, 2013). High-performing schools in the study also were more likely to offer science fairs, science clubs, and other science-based extra-curricular activities. Spaulding and Baird wanted less advantaged students to have greater access to these opportunities.

Relying on traditional teaching methods to reach middle schoolers, especially middle schoolers from economically challenged neighborhoods, is a recipe for failure, according to Baird. That is why she was drawn to JASON and the work of Bob Ballard. This chapter examines the foundations upon which the JASON program is based. It begins by reviewing some of the assumptions about science, learning, and teaching that undergird the design of JASON curriculums and activities. The chapter goes on to discuss the design principles that derive from these assumptions. These principles guide how JASON actually functions in classrooms and other learning environments.

Challenging Cherished Assumptions[1]

The curriculum developers and researchers who created the JASON program knew that their work had to be innovative. They also understood that innovation requires challenging longstanding assumptions. Some of these assumptions concerned the nature of science itself. Lee Charlton, a core member of the JASON team, indicated, for instance, that developers rejected the notion that science had to be studied within the parameters of discrete academic disciplines – biology, chemistry, physics, geology, and so on. The actual day-to-day investigations by scientists frequently draw on the findings of various branches of science.

Charlton proceeded to point out that science teachers often treat science as a highly formalized endeavor demanding prescribed procedures and rigorous execution. While such a characterization is valid to some extent, it is not completely accurate. Recall Bob Ballard's observation that many of his discoveries were accidental. He stressed the importance of creative inquiry, guesswork, and a trail-and-error mindset. When science teachers over-emphasize rigid methods and exact findings, they risk not only misrepresenting the true nature of science but also turning off large numbers of young learners. The playful nature of discovery is just as important as highly disciplined investigation.

JASON developers went on to challenge conventional wisdom about learning. They rejected the idea, for example, that learning can be decoupled from motivation. It seems that policy makers today, the ones that press for more standardized testing and greater accountability, do not appreciate the value of inspiration and excitement about learning. Any middle schooler could tell them that test-taking is not very motivating, especially for students whose parents are not stressing the importance of going to college.

The following statement from an article on science education captures a key belief supporting JASON:

...learning is inherently difficult, so that motivation plays a large role. To succeed, the learner must be convinced of the value of the goal and believe that hard work, not innate talent, is critical. (Wieman, 2012, p.4)

Chevron's Ed Spaulding, a trained engineer and no stranger to science, could not agree more. As he put the challenge facing JASON implementers, "Kids today are different. They learn differently. The way we teach them must evolve. We need to engage their hearts and minds."

One assumption that guided the development of the JASON program was that motivation is the first step to engaged learning. A second assumption extends the first. Engaged learning is a function, in part, of the learning environment. In other words, learning is situated in a particular context at a particular time. Contexts for learning are made up of various elements, including other learners, materials, technology, instructors, furniture, and physical space. Conventional beliefs about learning typically ignore the interplay of these elements. JASON developers, however, devoted considerable attention to thinking about the kinds of learning environments that promote student engagement.

Another assumption that JASON developers challenged concerned learners themselves. Learning theories sometimes minimize differences among and between learners. Cognitive learning theory, however, asserts that all learning is based on prior learning. Since prior learning is likely to vary greatly from one learner to the next, it is unwise to develop approaches to learning science that overlook these variations. JASON developers also recognized that learners varied in terms of their interests. In the design of JASON lessons and activities, developers were careful to provide for a range of interests and prior learnings.

Finally, JASON developers rejected the traditional notion of learning as simply the acquisition of knowledge. This notion has served as the foundation for much instruction and practically all standardized testing of students. Regarding learning as an acquisition process leads to over-emphasis on memorization of factual information and abstract concepts.

JASON developers believed that learning entails more than the acquisition of knowledge. Learners also must be able to apply acquired knowledge. The correct application of acquired knowledge should be regarded as the best evidence of learning. Virtually all JASON lessons, activities, and games require students to apply what they are learning, often by solving problems based in the real world.

Challenging assumptions about learning and the nature of science predictably led JASON developers to question traditional views of science teaching. The ever-changing knowledge base in the sciences, for example, meant that many middle school science teachers might not be aware of the latest developments. But why must teachers always know everything? JASON developers hoped to put to rest the old notion that teachers had to be the source of all knowledge. Couldn't teachers and students become co-investigators? By modeling how to seek answers to difficult questions, teachers might better promote inquiry and problem solving – the very heart of science.

In that same spirit, students can learn from other students. Cognitive theory affirms the social nature of learning. A key dimension of learning involves observing and listening to others as they engage in the learning process. JASON developers believed that young people would benefit from team-based activities and group inquiry. The traditional view that every student has to complete work on his or her own simply does not fit the actual nature of scientific investigation.

Another popular belief associated with science teaching holds that teachers must implement curriculums with fidelity, meaning that deviations from the prescribed path are unacceptable. JASON developers, recognizing the contextual nature of learning, felt that flexibility trumps fidelity in many instances. If teachers' understanding of their students' backgrounds, prior learning, and present circumstances leads them to modify the implementation of a science curriculum, that is not necessarily a bad thing. Nor is it automatically wrong for teachers to make adjustments based on their preferred teaching style, classroom conditions, and available resources.

Key Beliefs Supporting JASON Programs and Curriculums

Beliefs about science

1. Science is dynamic, not static.
2. Scientific discovery depends as much on guesswork and trial-and-error as formalized procedures.
3. Scientific inquiry is best regarded as an inter-disciplinary endeavor.

Beliefs about learning

4. Learning depends to a great extent on motivation.
5. Learning cannot be understood apart from the context in which it occurs.
6. Learners vary in terms of their prior learning and interests.
7. Learning entails the application as well as the acquisition of knowledge.

Beliefs about science teaching

8. It is not essential for science teachers to know all the answers to questions posed by and for students.
9. Students can learn from peers as well as adults.

JASON Design Principles

By challenging cherished assumptions about science, learning, and the teaching of science, JASON developers have been able to identify a variety of principles for designing learning environments for science and related STEM content. The two foundational design principles, alluded to at the close of the last section, are *differentiation* and *customization*.

2 KEY DESIGN PRINCIPLES

Differentiation: The adaptation of lessons and learning activities to meet the needs, ability levels, learning styles, and content knowledge of different students.

Customization: The adaptation of lessons and learning activities to reflect teaching styles, classroom conditions, and available resources.

Differentiation and customization would be difficult, if not impossible, were the JASON program to consist solely of standard science textbooks. That is why JASON developers created a multi-dimensional program encompassing on-line as well as attractively packaged texts, digital labs and games, hands-on labs, videos of researchers, and on-line as well as on-site “live events.” Arranging content in separately bound, mission-specific volumes rather than one large science text provides teachers with additional flexibility.

Recognizing the importance of motivation, developers embraced the following trio of design principles:

- Learners are motivated to solve real and significant problems from the world around them.
- Learners are motivated by competition.
- Learners are motivated by role models that they can relate to.

Problem solving is inherently satisfying as long as individuals have access to the tools they need and timely assistance when they get stuck. Catering to the natural inquisitiveness of youth, JASON developers have employed labs and games in order to pose a variety of interesting problems, from designing a roller coaster that has sufficient momentum to complete two full loops to analyzing the survival strategies of organisms in a local ecosystem. The problems are chosen for their relevance and appeal to young people, with many problems deriving from recent events in the news.

Educators often downplay the value of competition, but handled in a constructive way, competition can be a powerful motivator for many students. JASON developers encourage competition to solve problems between teams of students, thereby encouraging individuals to work together and share knowledge. National leader boards have been set up for many of the video games, so students can compete with other students and even their teachers. The ultimate JASON competition, of course, involves vying for a spot as an Argonaut on the Nautilus.

JASON developers understood the potential impact of role models. How frequently, after all, do middle schoolers, especially middle schoolers from poor neighborhoods, come into contact with actual scientists? While seasoned researchers like Bob Ballard can be inspiring, developers also knew that young adolescents would be more likely to relate to scientists closer to their own age. One of the most important responsibilities of these individuals is to help students understand and appreciate what scientists really do for a living and how they got to be scientists in the first place.

Many of JASON’s videos, live events, and school visits involve young scientists carefully chosen for their engaging personalities, enthusiasm for science, and communications skills. JASON developers also appreciated the importance of diversity, so their role models include both men and women and representatives of different ethnic and racial groups.

One such role model is Kobie Boykins, a young African-American engineer from the Jet Propulsion Laboratory in Pasadena, California. Boykins helped develop the Mars Exploration Rover. When he speaks in person or in videos about space exploration and the technology required to undertake it, young people cannot help but become excited. Boykins often begins by asking students how they would land the Rover on Mars, given various challenging conditions. After hearing what they have to say, he describes the actual steps that were undertaken.

Some of JASON's most effective role models are teenagers. Young people who are chosen to go exploring in the summer aboard the Nautilus are asked to maintain an "Argonaut Blog" so that their peers back home can keep in touch. Live broadcasts from the ship offer another way that students learn about what youngsters like them are doing on a scientific expedition. JASON developers also have integrated video clips of student "scientists" into the on-line programs that support each curriculum.

It is tempting when thinking about science to focus on the difficulty of mastering highly technical content and the challenge of exercising patience in the face of failed attempts to solve vexing problems. While JASON developers do not pretend that science is easy, they also acknowledge that science can be fun. When students engage in JASON's brain-straining labs and games, they are as likely to produce smiles and laughter as furrowed brows and perplexed frowns. Finding ways to make learning about science enjoyable is a major mission for JASON.

Toward this end, developers have created activities that focus less on getting things right the first time than experiencing what it is like to investigate a problem. There is no such thing as failure in science as long as individuals learn something when they do not get results that they sought. JASON trainers urge teachers to encourage experimentation and guesswork.

Another design principle intended to make science more enjoyable involves hands on activities. Young adolescents thrive on activity. Sitting and listening to lengthy lectures is not the best way to engage them in learning science. Each JASON curriculum is packed with labs and lessons that require students to do things. Hands on activities are supplemented by digital labs. Developers appreciated the fact that today's young people have been raised on technology and enjoy playing video games, solving problems on line, and blogging.

More media-oriented than any previous generation, today's young people know a lot about what's going on in the world around them. For this reason, JASON developers make a continuing effort to update their curriculums. Soon after a major event of scientific significance, JASON is likely to host a live event so that students can hear about it and interact with a researcher who helps them understand the phenomenon.

A brief two weeks after the massive earthquake and subsequent tsunami that devastated Japan in 2011, for example, JASON hosted a live event with Vasily Titov, Director of Tsunami Research at the National Oceanographic and Atmospheric Administration. For half an hour, students from across the U.S. were able to ask Titov questions about the earthquake and tsunami and learn about efforts to improve the prediction of such catastrophic events.

The last design principle concerns teachers more than students. Before students can benefit from the JASON program, teachers must find the program compelling and user-friendly. By the conclusion of JASON training, most teachers agree that the program offers advantages that many science texts cannot provide. Besides the features already noted, JASON developers provide sample lesson plans, worksheets that can be copied and distributed to students, data sheets for in-class analysis, and assessments of material covered in the curriculums. These assessments can be customized to match the particular content covered by different teachers, thereby providing JASON users with quick and convenient ways to check for student understanding.

KEY DESIGN PRINCIPLES

The JASON program must be adaptable to the needs, ability levels, learning styles, and content knowledge of different students.

The JASON program must accommodate differences in teaching styles, classroom conditions, and available resources.

The JASON program must expose students to real problems from the world around them.

The JASON program must provide students with opportunities to compete.

The JASON program must expose students to role models that they can relate to.

The JASON program must include lessons and activities that students enjoy.

The JASON program must encourage experimentation and guesswork.

The JASON program must provide opportunities for hands on and technology-based activities.

The JASON program must be continually updated to address recent events of scientific significance.

The JASON program must be compelling to teachers and user friendly.

Looking Ahead

We have now taken a close look at the origins of the JASON Project and the beginnings of the Chevron-JASON initiative in the Houston area. Details of the theory of action that grew out of this partnership and guided the introduction of JASON in Harris County school districts have been discussed, and the design principles upon which JASON lessons and activities are based have been reviewed. Section II of this book focuses on initial efforts to implement JASON in Spring Branch, Aldine, and Alief Independent School Districts.

Notes

1. Information for this section on instructional design was obtained from interviews with Bob Ballard and Lee Charlton of JASON Learning as well as various researchers working on board the Nautilus.

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Section II

Implementing JASON in Three School Districts

Introduction

The chapters in this section describe how the JASON program initially was implemented in Spring Branch, Aldine, and Alief school districts, three of the four founding partners in the Chevron-JASON initiative. Before doing so, a brief discussion of how data was collected is in order.

A balanced and honest account of any improvement effort requires multiple sources of information. To understand how JASON was implemented in Spring Branch, Aldine, and Alief, information was gathered from interviews with central office personnel assigned to oversee JASON's implementation and from sixth, seventh, and eighth grade science teachers in each district. Besides individual interviews using common interview questions, focus groups of science teachers were conducted in each district. The interviews were conducted between January and April of 2013. They yielded important insights regarding the implementation process, which JASON components teachers chose to implement, and how students responded to these components.

Additional information was collected during classroom observations in each district. District science coordinators selected classrooms where JASON lessons were being conducted. Observations lasted for an entire class period and included conversations with students about the lessons.

A third source of information was the quarterly reports submitted in each district by the individual or individuals assigned to oversee the implementation of JASON. These reports contained both quantitative and qualitative information, ranging from how many teachers were receiving JASON training to school-based efforts to share the JASON program with parents.

The last source of information involved surveys of teachers and students. Based on interviews, observations, and reports as well as assistance from the district science coordinators, survey items were written that related to which JASON components were being implemented and their perceived impact on student learning. Two districts administered teacher surveys using the on-line service, Survey Monkey. The other district distributed hard copies of surveys to teachers. Students in two districts completed hard copies of surveys in their science classes. The third district chose to have students complete their surveys using Survey Monkey. Details concerning the survey results will be presented in Section III.

As for student achievement data, it is important to bear in mind that this volume focuses on the first year to year-and-a-half of implementation. None of the three districts had fully implemented JASON by the time data was compiled. Some teachers still had to be trained, and many classrooms were just beginning to expose students to JASON. Remember, too, that the Chevron-JASON initiative called for a three-year implementation period. Under the circumstances, it would be premature to expect a demonstrable impact on student performance as measured by the TEKS-based science test for Texas.

Each of the following three chapters is written in the form of a case study. The chapters open with a vignette of a JASON lesson based on a classroom observation. This is followed by a chronological account of the steps taken to implement JASON during the first year of the initiative. The case study concludes with accounts of several science teachers and a status check of where things stood as of May 2013.

Spring Branch Implements JASON

A Lesson on Energy

Eighteen sixth grade students file into Amarylis William's science class at 8:50 a.m. Some appear to be still half asleep. It would be hard to nod off in this class, however. Amarylis exudes the kind of energy and enthusiasm that principals pray for in their teachers. It seems only fitting that the topics in class this morning are kinetic and potential energy.

Wasting no time getting the hour-long lesson going, William begins a warm-up activity based on the exit tickets students completed before leaving yesterday's class. Students had been asked to draw a roller coaster and indicate the point of greatest potential energy on the ride. Many of the students had mis-located the point, confusing potential and kinetic energy. By checking for understanding, William is able to correct students' mistakes quickly, before they dive into today's lesson.

Moving around the room as she speaks, William explains that the lab today involves going outside to build a roller coaster. She goes to the white board and writes the lab's objective: "Students will use vocabulary words such as potential energy and kinetic energy." William realizes that learning to use technical terms is especially important for this class's students because all are Hispanic and some need considerable help with English.

William calls a boy to the white board where she previously has drawn a roller coaster with climbs, dips and loops. She asks him to identify the points along the track where potential and kinetic energy are greatest. He successfully identifies these points and returns to his seat as students from the sixth grade class next door enter. Periodically the two classes work together on labs, teams being formed by mixing students from each class.

A low groan is heard from William's students as their neighbors arrive. She later explains that the incoming students are from a pre-Advanced Placement class taught by Andre Brooks. William's students are aware that they are not on the same level academically as their visitors.

William gives a set of three-page instruction sheets from JASON to a student to distribute to each team. The sheets are entitled "Energy Survey Lab: Infinite Potential Mission I" and they provide instructions for four learning stations. Each team will start at a station, complete the assigned task, get checked by William or Brooks, and move on to another station. When all the stations have been visited, the teams will go outside to construct a roller coaster.

Station 1 asks students to measure how high a tennis ball, a baseball, and a golf ball bounce when dropped from a height of one meter. The balls are dropped twice and an average bounce is calculated. Team members then predict the height of a third bounce. The final task is to explain which ball contains the most potential energy. At Station 1, as well as the other three Stations, every team member has a job to do. One member drops the balls, another measures the bounce, and a third records the results. Science, students learn, is a matter of team work.

At Station 2, students pour baking soda into an uninflected balloon, then fill a bottle with 50 milliliters of vinegar. After slipping the balloon over the bottle opening, they invert the balloon, allowing the baking soda to mix with the vinegar. After drawing pictures of the changes they observe in the balloon and the bottle, students write about what the experiment reveals about potential energy.

Students get a different look at energy at Station 3. After inflating and knotting a balloon, they rub the balloon's surface with different fabrics and record what happens when the balloon is passed over wood shavings and paper scraps. The directions ask students to consider how the length of time the balloon is rubbed affects the strength of its effects on the shavings and scraps of paper.

Students get approximately four minutes to conduct the experiment at each station, followed by a few minutes to complete the worksheet questions. Given the number of teams rotating through the stations and the time required to leave class and complete Station 4, William needed to shorten the directions for each station. Customizing labs to accommodate available time is encouraged during JASON training.

Station 4 is what students have been waiting for. They get to take foam pipes and tape and construct a roller coaster track on the walls outside of class. Each track has to have at least two loops. A cup is placed at the end of the track to catch the marble that is rolled down the track. Teams must identify points of maximum potential energy and maximum kinetic energy. The challenge is to build the track so that the marble accelerates fast enough to complete the two loops, but not so fast that the marble overshoots the cup at the end.

As they leave class to construct their roller coasters, the students are obviously excited. They get to form new teams consisting of their classmates. Students in William's class like to compete against students in Brooks' class. In the Station 4 experiment, the team that gets its marble safely in the cup in the shortest time wins.

Class ends far too soon for the competing teams. Some groups still are adjusting their roller coaster tracks in the hope of improving their times. As students collect their notebooks and depart, Shari Jones, the Instructional Coach who has been observing the lesson, pulls William aside and suggests videotaping the students building their roller coaster tracks. Doing so would enable William and Brooks to replay the videos and have students critique their own lab work.

JASON Comes to Spring Branch

Mention already has been made of how Joni Baird met Spring Branch Superintendent Duncan Klussman at a Teach for America dinner. His support for the Chevron-JASON initiative and the interest expressed by his Leadership Team led to the launching of JASON in December of 2011. So how did Spring Branch go from the receipt of a generous Chevron check to classes like Amarylis William's and Andre Brooks'?

The first step in implementing JASON involved the identification of one science teacher at each of the nine middle schools who would receive training in all five JASON curriculums. Together these nine individuals and Rojana Luecken, a District Instructional Specialist, formed the so-called Cadre. The Cadre was tasked with the responsibility of seeing that JASON was successfully implemented at each middle school. Overseeing the work of the Cadre was Dr. Jennifer Blaine, Associate Superintendent in charge of the Curriculum and Instruction Division of Spring Branch ISD.

In January of 2012 Cadre members traveled to Cincinnati, Ohio, for the five-day national training for lead teachers. JASON's national training sessions are conducted by individuals who have extensive experience with the JASON program and who are designated as national trainers. Fourteen months after she completed her own training, Ro Luecken joined the ranks of national trainers.

Cadre members returned to Spring Branch, having become familiar with all aspects of the JASON program. They planned to schedule local training sessions for their colleagues in the summer of 2012. In the meantime, Spring Branch engaged in a curriculum audit to determine whether what was being taught in middle school science classes linked up with the Texas Essential Knowledge and Skills (TEKS) standards. Until this important work could be completed, middle school teachers were provided with templates developed by Ro Luecken. These templates (see Figure 1) linked JASON lessons to the district's science curriculum.

Seven separate training sessions were held for middle school science teachers during the summer of 2012. An eighth training, occupying a full school day, took place after school began in September. Substitute teachers were hired to cover the classes of those in attendance. Though these trainings were "highly recommended," not required, 69 out of 76 middle school science teachers opted to receive some JASON training. The untrained teachers were located at one campus, and Ro Luecken vowed she would find the funds to get them trained in the summer of 2013. The training sessions afforded Cadre members an opportunity to participate in delivering professional development to their colleagues on various components of the JASON program.

Luecken has played and continues to play the key role in JASON's implementation in Spring Branch. Born in Venezuela where her father, a chemical engineer, was working at the time, she returned to the U.S. to attend school, eventually graduating from high school in Spring Branch. After majoring in education at Texas A&M, she went back to Spring Branch to teach. Highly regarded by her colleagues, Ro, as she is known, is the perfect team leader for the Cadre.

As Luecken looks to the future, she wants to provide JASON training for high school teachers involved in teaching Integrated Physics and Chemistry (IPC). The IPC course is designed to help students who struggle with science prepare to take full-year courses in Physics and Chemistry. Luecken believes that JASON's Terminal Velocity curriculum is especially well-suited to the IPC offering.

Funds to train IPC teachers were unavailable for the summer of 2013, but Luecken worked with Associate Superintendent Jennifer Blaine to add a line item in the following year's budget for JASON training. Such a move not only speaks to Spring Branch's commitment to JASON, but to the prospects for sustaining the initiative beyond Chevron's three years of support.

Luecken sees another role for JASON at the high school level. Spring Branch established a special program called Operation Graduation for high school seniors at risk of not graduating. These students – about 30 in 2013 – are taken off their campuses and provided focused instruction in a separate setting where they won't be distracted by their peers. They are helped to complete the courses in which they are currently enrolled and, in addition, offered on-line opportunities to recover credits from courses they previously failed.

Ro Luecken taught for Operation Graduation in 2012-2013 and found that the stimulating lessons and engaging labs of the JASON curriculums were well-suited to the needs of her students. Students were able to earn a science elective credit with JASON. Luecken plans to continue using JASON in this way as well as employing Terminal Velocity to help students who need to pass Physics. She is particularly drawn to the journaling opportunities provided by JASON. They enable her to pose on-line questions for her students and give them quick feedback on their responses.

Perhaps the second most important step in JASON's implementation in Spring Branch should be completed by the end of 2013 or early in 2014. The school district is engaged in the process of reviewing and, where necessary, revising science curriculums. Following an external curriculum audit, curriculum teams began work on 6th, 7th, and 8th grade science as well as high school Biology. Chemistry and Physics will be taken up last. The goal is to create a new Curriculum Dashboard that shows, among other things, how what is taught in Spring Branch aligns with the TEKS.

Ro Luecken explains why the curriculum rewrites are so critical for JASON. “If the teachers don’t see where JASON lessons fit into the science curriculum, they are less likely to use them,” she points out. “A lot of times teachers forget they have additional resources.”

Looking back over the year-and-a-half period of implementation, Luecken observes that teacher adoption of JASON might have gone more rapidly if some of the curriculum alignment work could have taken place during the initial training in Cincinnati. Still, she feels that many teachers have embraced at least some of the JASON curriculums and expressed an interest in learning more. Responding to this interest is the primary responsibility of each Cadre member. They also conduct demonstration lessons in their schools and notify Luecken when issues arise.

A major impetus for interest in JASON took place soon after Duncan Klussman sealed the deal with Chevron and JASON Learning. Spring Branch got the opportunity to have two middle school students and a teacher participate as Argonauts aboard the Nautilus in the summer of 2012. Individuals competing for the limited number of spots on the Nautilus have to submit applications that include written and video essays. The two Spring Branch eighth-graders, Freddy Corrales and Allison Eggert, along with sixth-grade science teacher Sheena Guevara, completed a three-day “boot camp” in Mystic, Connecticut, before embarking on their journey to the Aegean Sea.

During their expedition to study underwater relics and unusual life forms, the three Spring Branch Argonauts maintained on-line communication with people back home. When they returned from their 7-day adventure, each individual had the chance to share their experiences with Spring Branch administration and staff at the District Convocation that kicked off the 2012-2013 school year.

In November of 2012, JASON Host Researcher, Shirley Murillo, visited Spring Branch middle schools, speaking about her career pathway to becoming a research meteorologist for the National Oceanographic and Atmospheric Agency (NOAA). She also addressed an evening community event attended by families and district faculty. Her visit provided an additional boost to the implementation of JASON.

Classroom Perspectives

This section provides an opportunity to visit briefly with several Spring Branch teachers who are using elements of JASON to enhance their science instruction.

Sheena Guevara. A sixth grade science teacher at Northwood Middle School, Guevara also represented the teachers of Spring Branch as an Argonaut in the summer of 2012. Since then, she has been busy sharing her experiences with colleagues as well as implementing the Tectonic Fury curriculum. Guevara's class motto, posted at the front of her class, reflects her time as an Argonaut and her vision of science – "It takes many people from different backgrounds to make an expedition successful."

Guevara jokingly admits that she was clueless in high school regarding what scientists and engineers did for a living. JASON materials are helping to make sure her students gain this knowledge so they can give serious consideration to careers in STEM fields. Her students were especially impressed by Tim Samaris' visit to Northwood. The famous storm tracker, one of JASON's Host Researchers, shared insights regarding what it is like to investigate tornados and other violent weather phenomena. Sadly, a year after visiting Spring Branch, Samaris and two colleagues lost their lives when a severe tornado in Oklahoma unexpectedly changed direction.

Guevara is drawn to the JASON program for a number of other reasons as well. Admitting that she never uses the outdated science textbook provided by the district, Guevara speaks enthusiastically about all the materials and resources available in the JASON program. Readings are engaging, and the teacher's manual is full of great ideas. She likes all the opportunities for students to develop their measurement skills. JASON's on-line resources enable her to differentiate instruction by providing high-ability students with challenging material that they can explore on their own. At the other end of the spectrum, students who struggle with reading benefit, she feels, from all graphics and science vocabulary words that are spotlighted in JASON texts.

As is the case with many teachers, Guevara zeroes in on struggling students when asked about JASON's impact. One student on whom she was maintaining a behavior chart because of his frequent off-task behavior in class, for example, showed significant improvement as he began to explore violent weather. When she taught a remedial summer school class in 2012, Guevara found JASON lessons were especially effective with her students. She frequently shares her positive experiences with other Spring Branch teachers.

Cassie Seelbach. An eighth grade teacher in her third year, Cassie Seelbach obtained alternative certification after working as a grant writer at the University of Texas in Austin. Her science classes at Northbrook Middle School consist of large numbers of Hispanic students and students receiving free and reduced price lunches. Seelbach is especially drawn to JASON's hands on activities, digital labs, and video clips. Tectonic Fury and Monster Storms have been the JASON curriculums that she finds to be the best fit for the eighth grade TEKS. She credits JASON with helping her get up to speed quickly on the Physics elements of the eighth grade curriculum, as she had previously taught at a different grade-level.

Asked for an example of JASON's early impact on her students, Seelbach refers to a lesson on convection that she co-taught with a special education teacher. One of Spring Branch's district-wide goals is to encourage students to verbalize what they are seeing and thinking using the vocabulary of science. In this particular lesson, six visiting principals observed as her students carried on academic conversations about changes in the earth's mantle. The visitors left praising the lesson.

Seelbach feels that her students interact very productively when they are engaged in JASON lessons. She notes that her classes have "a different feel" on these occasions. Students have a chance to become "miniature scientists" seeking answers to interesting questions. In other words, they get to "do" science, not just hear about it.

Teachers at Northbrook have taken to JASON, according to Seelbach, because the lessons are easy to implement. "It doesn't take two days to set up a lab," she points out. "You can set things up in the morning." Accessing JASON on-line activities also is easy at Northbrook because science classes have their own laptop computers. Teachers do not have to sign up in advance for time in a computer lab, as they often have to do elsewhere.

Amarilys William. William, a native of Puerto Rico, is one of those enthusiastic teachers who always is in motion. At Landrum Middle School, a school that is 97 percent Hispanic, she serves as a science teacher and Cadre leader. William takes her Cadre role seriously, reaching out to her fellow science teachers to encourage them to implement JASON lessons.

One way that William provides assistance is by modeling JASON lessons. Teachers also come to her to find out if the JASON curriculums offer activities that fit the TEKS objectives that they are addressing in class. As the opening vignette illustrated, William also enjoys co-teaching JASON labs with her fellow science teachers. William has even set up a special Blog called "Science Superstars." Students and teachers can use the Blog to search for JASON topics and materials.

William is constantly searching for new ways to promote JASON at Landrum because she feels her students respond better to JASON than they do to the outdated textbooks in science. She especially likes the way that JASON lessons highlight important vocabulary in science. Many of her students are English language learners, and they are helped by the visuals that accompany highlighted vocabulary. One of William's latest ideas is to promote JASON's approach to lesson design by co-planning JASON-style lessons with non-science teachers. She already has shared JASON's "How to Read Maps" lessons with social studies teachers at Landrum.

When she teaches JASON labs in her own classes, William typically distributes instruction sheets to teams and has her students figure out how to do the lab on their own. The following day she then demonstrates how the lab should be done. Students determine what they did and did not do correctly. In this way, William lets students know that they don't have to get everything right the first time. Science, after all, is about trial-and-error learning.

Committed to encouraging students to take an interest in science and mathematics, William also runs an after-school enrichment program. She enlists high school students to instruct middle schoolers using JASON lessons and other materials. William is finding that the high school students also enjoy working with JASON.

Status Check

By the close of the 2012-2013 school year, the implementation of JASON was proceeding smoothly in eight out of nine Spring Branch middle schools. Cadre teachers in all but one case were providing the school-based leadership required to promote the use of JASON, particularly by sixth and eighth grade teachers. At the district level, Ro Luecken's leadership ensured that work continued on linking JASON lessons with the Texas Essential Skills and Knowledge in science.

Chapter V

Aldine Implements JASON

A Lesson on Rocks and Minerals

At 10:00 a.m. Jasmine Goodjoint, a second year teacher at Reed Engineering Academy, convenes her sixth grade glass. Students quickly settle down at their tables, each table accommodating four individuals. Wasting no time getting the lesson going, Goodjoint instructs students to read a section from JASON's Tectonic Fury text. Some are assigned a reading on igneous rocks, others a reading on sedimentary rocks, and the remainder a reading on metamorphic rocks.

A slip of paper containing four questions related to how the three types of rocks were created and their particular characteristics has been placed at each table. Students are given several minutes to read their section and then told to write answers to each question. Goodjoint also instructs the students at each table to select a reporter to present their responses to the class.

A pre-set signal from the teacher's computer notifies students that time is up. Goodjoint asks a girl in one group, "What's molten rock?" The girl appears to be an English language learner, and she struggles with the question. "Ishmael, help her out," Goodjoint says to a student at another table. Ishmael provides the appropriate answer.

Students are expected to record the correct answers to questions in their notebooks. These notebooks will be their primary reference for quiz and test preparation at home because there are not enough JASON texts at Reed Engineering Academy to provide each student with a book to take home.

Goodjoint directs another question to the first table, a chance for the girl who struggled to define molten rock to redeem herself. "What happens when molten rock cools?" The girl is able to provide the correct answer this time, and she is congratulated by her table mates.

The question-and-answer process goes on for a few more minutes, but class ends before all the questions can be covered adequately. After class, Goodjoint explains that science classes used to run 90 minutes, sufficient time to complete a lesson like today's. Due to budget cuts at Aldine ISD, however, classes have been cut back to 50 minutes. Goodjoint acknowledges that it is hard to have students read material, write down answers to questions, and then participate in a classroom discussion of their answers in this shortened period of time.

JASON Comes to Aldine

When asked what other Harris County Superintendents would be receptive to JASON, Duncan Klussmann immediately thought of Dr. Wanda Bamberg at Aldine ISD. As indicated in Chapter 2, Aldine is one of the largest school districts in Texas, with 11 intermediate campuses (grades 5 and 6) and 10 middle school campuses (grades 7 and 8). Although the original plan for the Chevron-JASON initiative called for a focus only on middle school campuses, Bamberg pressed for inclusion of intermediate campuses as well, and Joni Baird and Eleanor Smalley agreed. The job of implementing JASON in Aldine therefore was more complex than in the case of Spring Branch, where implementation was limited to one set of schools.

Aldine has acquired a reputation for providing quality educational services to its almost 64,000 students. Approximately seven of every ten students is Hispanic. Another 26 percent are African-American. Chosen as a finalist for the prestigious Broad Prize for exemplary urban school districts, Aldine also is known for being receptive to innovative academic programs like JASON.

The role of point person for JASON's implementation in Aldine was filled by Xandra Willliams-Earlie, Program Director for Secondary Science, and Tracy Mansfield, Program Director of Elementary and Intermediate Science. They, in turn, relied on the Science Specialist assigned to each intermediate and middle school to coordinate the introduction of JASON at each school. Williams-Earlie, Mansfield, and the 21 Science Specialists went to JASON headquarters in Virginia for training in the JASON curriculums in June of 2012.

In a modification of the training protocol used for Spring Branch, JASON officials decided to set aside an entire day so that the Aldine team could meet together in cross-campus teams. The teams worked with their district Scope and Sequence document for science and the TEKS for sixth, seventh, and eighth grade science in order to determine places in the curriculum where various JASON lessons and activities should be embedded. This step proved to be very important in expediting JASON's implementation in Aldine. It meant that each Science Specialist had a clear idea of where elements of JASON fit before the new school year began.

Upon returning to Aldine, Williams-Earlie, Mansfield, and the 21 Science Specialists turned their attention to the training of intermediate and middle school science teachers. Four two-day trainings were offered between July 30 and August 10. Rick Folwell, one of JASON's national trainers, conducted the trainings, which covered each of JASON's curriculums. Teachers became students again, participating in hands-on labs and online activities.

Following the national trainer's visit, the Science Specialists then took responsibility for additional training at their schools. Codes also were distributed to all science teachers so that they could access JASON on-line. Aldine's technology department assisted in uploading JASON materials and helping teachers when they encountered problems accessing the special gated website.

Williams-Earlie believes that the ultimate success of JASON's implementation depends, not just on teacher training, but on buy-in from campus administrators. She therefore took the unusual step of having all the middle school campus principals go through a JASON activity during an administrators meeting in July of 2012. Each principal also was provided with a packet of JASON materials to take back to their campus. Williams-Earlie explains that principals need to understand JASON if it is to become an integral part of the science curriculum, rather than an add on.

Later on, after the start of school, Williams-Earlie followed up with the principals to find out how implementation was going. Using a SWOT analysis activity, she asked the principals to identify strengths, weaknesses, opportunities, and threats associated with JASON's introduction. The exercise indicated that their only concerns involved the cost and availability of "consumables" such as JASON texts and lab materials.

In order to address the principals' concerns, Williams-Earlie considered taking advantage of Houston's DonorsChoose program. Funded by local donations, DonorsChoose provides small grants to first-time applicants who present a compelling case for support. The cost of the classroom kits that JASON sells to schools to provide the materials needed for in-class labs, however, exceeded the DonorsChoose grants. Not one to give up easily, Williams-Earlie approached Eleanor Smalley to see if JASON would reduce the cost of the kits. Smalley agreed and encouraged Aldine science teachers to apply for DonorsChoose support.

As the fall progressed, the Science Specialists began to take a leadership role in campus implementation efforts. Karen Thomas, for example conducted weekly model lessons for her colleagues at Drew Academy. Discussions of these lessons followed the demonstrations and led to adjustments and modifications in some instances. Thomas also arranged for a Science Night for parents in September. Parents and their children had an opportunity to experience firsthand a selection of JASON lessons.

Williams-Earlie and Thomas agree that teachers must rethink the teacher's role when using JASON. Rather than a lecturer and imparter of information, the teacher becomes a facilitator who creates learning challenges for students and then offers assistance when students get stuck. Williams-Earlie admits that some teachers have embraced this change better than others.

On December 15, 2012, Aldine conducted its annual Science Fair. On this occasion, however, a visiting researcher sponsored by JASON served as a judge. Tracy Drane, a young African-American systems engineer with the National Aeronautics and Space Administration, followed the judging with an address to students and parents about the solar system. Her infectious enthusiasm for science captivated the more than 300 people in attendance and generated great interest in JASON.

Looking ahead, Williams-Earlie plans to find ways that high school students can benefit from JASON. She wants to have middle school teachers who are familiar with JASON work closely with high school Biology and Physics teachers to see what components of JASON curriculums fit best in the high school program. She also wants teachers who are using JASON to provide her with video clips of lessons so that they can be used for training purposes.

Williams-Earlie and Mansfield have organized a refresher training program in the summer of 2013 for intermediate and middle school teachers who have started using JASON. They understand that implementing new curriculums is not a one-shot arrangement. Continuing reinforcement of skills and content is the key to successful and sustainable implementation.

Aware of the boost in interest about science that Spring Branch experienced when two of its students and a teacher were chosen as Argonauts, Williams-Earlie wants Aldine middle schoolers to submit applications for summer expeditions. The application process entails a video clip in which applicants explain why science is important. Williams-Earlie believes that this task can prove daunting for many Aldine students, so she plans to hold a workshop to instruct students on how to script and deliver a video presentation.

Classroom Perspectives

This section provides an opportunity to visit briefly with several Aldine teachers who are using elements of JASON to enhance their science instruction.

Karen Thomas. At Drew Academy, Karen Thomas serves as the Chair of the Science Department and the Science Specialist responsible for overseeing the implementation of JASON. In the latter role, as indicated earlier, Thomas conducts model lessons using components of various JASON curriculums. Thomas attended the initial training in Virginia and subsequent training sessions back in Aldine.

JASON, according to Thomas, is intended to address four key goals of Aldine ISD:

- Increase academic achievement.
- Increase interest and motivation in STEM.
- Increase acceleration and differentiation.
- Increase community interest and support in STEM.

The third goal is especially important at Drew Academy because, as Thomas points out, students range from the highly gifted to those requiring special education services. She feels JASON lessons provide ample opportunity to accommodate the needs of students of varying abilities. By setting up several "stations" devoted to activities of varying degrees of difficulty, science teachers can differentiate instruction for various JASON lessons.

Thomas and her colleagues at Drew focused initially on implementing components of the Resilient Planet curriculum. According to Thomas, students found the "Predator-Prey" lab activity very interesting. The reflection questions at the end of the "Predator-Prey" lab were helpful in checking on student understanding of the key concepts covered by the lab. Students also liked the fact that student Argonauts often are involved in JASON-based research projects.

A high point in the fall was Science Night on September 27, 2012. In order to get as great parent attendance as possible, Thomas utilized the automated parent call system and the school's website. Parents and students who attended Science Night were treated to a variety of JASON activities, including "Measuring with Tools" (Terminal Velocity), "Energy Transfers and Transformations" (Terminal Velocity), "Coaster Creator" (Terminal Velocity), "Clouds in a Bottle" (Monster Storms), and "Modeling Tornadoes" (Monster Storms). Laptop computers also were available so parents and students could preview each JASON activity.

Asked if she expected any impact on student achievement from the first year of JASON implementation, Thomas feels that student understanding of weather-related concepts and some Physics concepts such as potential and kinetic energy should improve. More extensive gains will depend, in her judgment, on additional teacher training and efforts to embed JASON in more TEKS-based units.

Vicki Pillow. As Science Specialist and Science Department Chair at Reed Engineering Academy, an Aldine intermediate campus, Pillow is responsible for coordinating the implementation of JASON. Like Thomas, she attended JASON training in Virginia. She used part of the time to meet with fifth and sixth grade teachers to match JASON content with each grading period's TEKS. Subsequently Pillow prepared a binder containing all the JASON components that matched the fifth and sixth grade TEKS and distributed it to Reed science teachers.

Back at Reed, Pillow regularly meets with science teachers to review JASON texts and online offerings. She fields questions regarding ways to apply JASON and handles teacher sign-ups for JASON labs. Asked how teachers have responded to JASON, Pillow acknowledges that the younger teachers have been quicker to embrace the on-line versions of JASON. More veteran teachers have requested additional training before implementing JASON.

In the first month of the fall semester, Reed students had opportunities to complete the "Energy City" game and "Transform It" activities from Infinite Potential. Pillow indicates that the JASON video showing how teachers can use these on-line activities and the accompanying worksheets were especially helpful. Science teachers also hosted parents in September for Science/Engineering Night. As with Drew Academy, parents were given opportunities to experience on-line JASON activities firsthand.

Echoing the concern expressed by Jasmine Goodjoint in the opening vignette, Pillow admits that the budget cuts that resulted in the elimination of teaching positions and the subsequent reduction of time for science from 90 to 50 minutes a day have hampered efforts to complete many JASON activities in one class period. Nonetheless, progress is being made. Reed teachers appreciate being able to choose from a variety of JASON activities and labs.

Pillow reports that initially her most effective strategy for disseminating information about JASON to teachers was to conduct demonstration lessons during meetings of the Science Department. As the 2012-2013 school year progressed, however, teachers began to pick up JASON lessons on their own. Pillow and her colleagues plan to make particular use of JASON's offerings related to space exploration for Reed's curriculum strand that deals with the international space station.

Pillow feels that it will take several years and continued teacher professional development for JASON to make a significant impact on student test scores, but she already is seeing increased interest in science as a result of JASON.

Monica Angelle. Angelle serves as Science Specialist and Science Department Chair at Hoffman Middle School. When asked how students at Hoffman are responding to JASON, she relates a brief story of a student who complained that a JASON activity was going to be uninteresting. Once the activity started, however, he took the lead in seeing that everyone in his group completed the activity correctly. At the end of class, the young man told his teacher, "I thought this was going to be boring. I had fun today."

Angelle says that students started playing games on the JASON website in September. They made a point of finishing their class assignments in a timely manner so that they would have time to log on to the website before the end of class. Teachers use the website to introduce a new topic, taking advantage of the interviews with scientists, games, and great photographs. Hoffman students like to compete with each other on JASON on-line games to see who can move up the leader board. Some of the higher achievers also use website resources to accelerate their learning in science.

Reflecting on the impact of JASON on her own students, Angelle says that the "Predator-Prey" game helps them to learn about graphs and how to analyze graph data to explain how organisms are affected by other organisms. Students are placed into groups of three and instructed to record data concerning how many prey survived the simulation. After graphing their findings, they make predictions about the survival rate of predators.

Hoffman teachers have taken advantage of JASON's various formative assessments to check on student progress. Asked to express her colleagues' feelings about JASON in general, Angelle wrote,

JASON provides us with readings, so we don't have to research the information ourselves, and we can pay more attention to how the content is implemented in class. The labs are excellent and student friendly. The lab activities held the attention of the students, they had fun completing the labs, and the content was easy to scaffold the students knowledge of the topic.

Hoffman Middle School operates an afterschool program that also takes advantage of JASON materials. Angelle reports that JASON curriculums such as Infinite Potential enable teachers in the afterschool program to accelerate instruction for gifted and talented students while also providing appropriate lessons for special education and limited English students. Students of all ability levels, she adds, are drawn to hands on activities such as "Coaster Creator" and the Rube Goldberg design project.

Angelle, like her colleagues at Drew and Reed, makes an effort to keep parents apprised of developments with the implementation of JASON. She introduced JASON at a Parent Night in the fall and provides progress reports on JASON in school newsletters and on the Hoffman and Aldine websites. Parents also can access JASON on-line at home.

Status Check

Under the direction of Science Program Directors Mansfield and Williams-Earlie and with the school-based leadership of Science Specialists, most of Aldine's 11 intermediate and 10 middle school campuses have begun to implement JASON lessons. Some science teachers have taken greater advantage of JASON materials and on-line resources than others, but most teachers have received some training, either at the national training in Virginia, district-wide workshops, or school-based professional development meetings. Provisions also have been made for JASON "refresher" training sessions in the summer.

Teachers are provided with guides that link JASON content to the TEKS. Some Science Specialists report the use of JASON for differentiated instruction, accelerated learning for high achievers, and afterschool programs.

Alief Implements JASON

A Lesson on Ecosystems

As students entered Lisa Antaki's sixth grade class at Mata Intermediate campus, they read the science objective written on the board: Diagram the different levels of an ecosystem including the various biotic and abiotic factors. Antaki greets the class and explains that they will be continuing the previous day's work on JASON's Resilient Planet curriculum. Yesterday students completed an on-line lab from Mission 2 involving keys to the survival of ecosystems. Today's lesson picks up with a video briefing on ecological succession, the process by which ecosystems change over time. The video focuses on the aftermath of the Mount St. Helen's eruption in 1980.

To provide a more recent illustration of a threatened ecosystem, Antaki stops the video and asks students to consider the recent explosion and subsequent oil leak from a British Petroleum oil rig in the Gulf of Mexico. She also points out that Bob Ballard's Argo spends considerable time on expeditions in the Gulf of Mexico. Students are told that there are opportunities for middle schoolers to join the crew as Argonauts.

Following the video, students are directed to reflect on their lab worksheet from yesterday. Top scorers on the worksheet are asked, "What did you do to make your organisms survive?" Each time students give an answer, they are encouraged to explain how they arrived at their answer.

Between student answers, Antaki reinforces key concepts from the previous day's lesson and sets up the current lesson. She reminds students to write down important content from today's video in their notebooks so that they will know what to review for the upcoming test.

Antaki resumes showing the video, stopping periodically when vocabulary words are displayed and defined. Later she explains that these interludes help her English language learners acquire the science vocabulary they need to understand in order to do well in class and on the state test. As the video continues, Antaki points out that students are seeing real life examples of the ecosystem survival and succession information that they covered in yesterday's on-line JASON lab.

Student interest in the video picks up when teenagers aboard the Argo are shown studying schools of fish and the ecosystem in the Gulf of Mexico. Antaki stops the video to stress the significance of survival techniques and mutualistic symbiosis. “As humans,” she observes, “we change our environment in order to survive.”

At this point, Sandra Weston, Mata’s Science Specialist, joins Antaki in conducting the lesson. She helps students reflect on the main ideas from the video. Students are told that they should be able to 1) explain how an ecosystem evolves over time, 2) investigate how organisms compete for resources, and 3) distinguish between different survival strategies.

With class nearing the end, Antaki gives the homework assignment. Students are to write five paragraphs on why it is important to study ecosystems. Just before the bell rings, one student is asked to review the simulations on plate tectonics that were done in a previous class. Weston wants to know what the student liked and didn’t like about the activity.

JASON Comes to Alief

Alief’s H.G. Chambers, the second Harris County Superintendent recommended to Joni Baird by Duncan Klussmann, expressed great interest in the Chevron-JASON initiative. Under Chambers’ leadership, Alief already had made a major commitment to science education, and he was convinced that implementing JASON would only enhance that commitment. Chambers also understood that the success of JASON depended on buy-in from others besides himself. He called for an in-depth review of JASON content by a core group that included Gina Thomas (Deputy Superintendent of Instruction), Dr. Karen Jacobs (Secondary Science Coordinator), Denia Puerto (Secondary Science Interventionist), and Gelyn Cornell (Elementary Science Coordinator). The group affirmed Chambers’ support for JASON.

Chambers also believed that it was important for his School Board to endorse the partnership. At the presentation of JASON to the School Board, he asked board members if they would stand behind the implementation of JASON, even if test scores did not improve immediately. Chambers understood that it can take a while before new programs produce gains in measured student achievement. The School Board agreed, and Alief joined Spring Branch and Aldine as Chevron-JASON partners.

A large district with 45,000 students, Alief operates six intermediate campuses (grades 5 and 6) and 7 middle schools (grades 7 and 8). One middle school includes grades 6-8. A little over half the student body is Hispanic, 32 percent is African American, and 13 percent is Asian/Pacific Islander.

Alief administrators decided that each intermediate and middle school campus should have two trained JASON coaches, a Science Specialist and a science teacher. In June of 2012, 22 coaches joined Jacobs, Cornell, two Science Interventionists, and two Alief principals in attending JASON national training in Virginia. The inclusion of the principals, according to Jacobs, was based on Gina Tomas' belief that JASON's ultimate success depended on "hooking" principals as well as teachers on the program's merits. Before leaving Virginia, the Alief delegation, like the one from Aldine, was given an opportunity to review pacing guides for intermediate and middle school science in order to identify JASON content that aligned with the TEKS.

Upon returning to Alief, Jacobs, Cornell, and JASON officials organized district professional development for science teachers. Training sessions led by national trainers were conducted in July and August at Albright Middle School. Professional development activities for JASON did not conclude with the opening of school, however. Jacobs and Cornell understood that effective implementation of a new science program requires on-going inservice training.

Plans were made to pull teachers out of class once a semester for focused training by Alief's coaches. Coaches also received training once a month. Alief's Professional Learning Communities (PLCs), which already had been implemented, were utilized as an additional opportunity for training related to JASON. Because so much of JASON depends on access to technology, Cornell and Jacobs also decided that Alief's Technology Specialists should be encouraged to participate in JASON training sessions.

Thanks to the curriculum alignment work in Virginia and the in-district summer training sessions, Alief science teachers were ready to roll out JASON lessons as soon as school began. Seventh grade teachers initiated some games and simulations so students would become familiar with JASON, thereby preparing them for the spring semester focus on Terminal Velocity. Teachers started to use JASON Project Scavenger Hunt to locate labs, activities, and particular content related to what they were teaching at the moment. Eighth grade teachers used their Professional Learning Communities to pilot test JASON labs and digital games. DonorsChoose funding also was sought in some schools so that additional JASON materials could be acquired.

During the fall semester, intermediate and middle school students received their usernames and passwords so that they could access JASON on-line at home as well as in school. Coaches provided training for teachers on Resilient Planet, Terminal Velocity, Infinite Potential, and Tectonic Fury. A variety of JASON lessons and labs were implemented. They included "It's a Blast" and "Coaster Creator" from Terminal Velocity.

On November 29, two Paleo Quest scientists, Jason Osborne and Aaron Alford, visited six Alief intermediate campuses and explained to sixth graders what they do as paleontologists. They also presented at the 6th Grade District Science Fair, telling parents and community members about the importance of encouraging young people to take an interest in science.

Under the leadership of Gelyn Cornell, PLC meetings for intermediate campus sixth grade teams occurred every two weeks. Science teachers together with teachers of other core subjects studied the science TEKS and related JASON content. Teams of 9 to 12 teachers reviewed resources on the JASON website and decided what mission, digital labs, and interactive games to use in order to reinforce key science concepts. JASON assessment tools were used at several campuses.

At the middle school campuses, Dr. Karen Jacobs coordinated monthly campus-based meetings devoted to planning the implementation of JASON content. Seventh and eighth grade teachers also took advantage of an entire day set aside by the district so that they could review an entire JASON mission related to the TEKS and plan for its implementation. School-based coaches were assigned to assist with mission-related labs and offer constructive feedback on JASON lessons.

By November Cornell, Jacobs, the Science Interventionists, and the coaches had devised a game plan for systematic implementation of JASON curriculums. Based on their analysis of the TEKS, they decided to implement Infinite Potential for the sixth grade's unit on Force, Motion, and Energy. Resilient Planet was chosen to anchor the seventh grade's Organisms and Environment unit. The eighth grade's Force, Motion, and Energy unit would draw on Terminal Velocity. Such careful planning reduces the likelihood of unnecessary duplication across grade-levels.

The beginning of second semester found Alief science teachers starting to use JASON on-line and implementing the plans for each grade-level. A high point of the semester was a visit by Tracy Drain of the National Aeronautics and Space Administration. Excitement also attended the selection of an Alief teacher and student to be Argonauts on an expedition. From October 16 to October 23, 2013, Laura Smith, a science teacher at Albright Middle School, and Excel Luna, an eighth grader from Holub Middle School, will join scientists aboard the Nautilus as they study ecosystems in the Caribbean.

For a district that is not particularly wealthy, Alief has made a major investment in JASON and in STEM education for its students. Two new positions – Elementary Science Interventionist and Secondary Science Interventionist – were established to help revise pacing guides to include JASON lessons. In order to provide additional JASON textbooks to intermediate and middle schools, Alief also spent 40,000 dollars out of its own budget. JASON's implementation has become an important part of Alief's Career Readiness initiative which is designed to interest more girls in STEM subjects. Parents have been introduced to JASON at Math and Science nights. JASON articles are downloaded for students to read and discuss during Reading Wednesdays, an Alief initiative to promote literacy. Youngblood Intermediate has implemented a JASON component in all of its Technology course offerings. Several schools also have adopted JASON lessons in their afterschool programs.

Classroom Perspectives

This section provides an opportunity to visit briefly with several Alief teachers who are using elements of JASON to enhance their science instruction.

Joan Henington. A science teacher at Youngblood Intermediate campus, Henington attended the national training for JASON with her principal, Pam Bruner. By working on TEKS alignment at the national training, Henington and her fellow trainees discovered lots of JASON content and activities that reinforced the material they are expected to cover in the sixth grade. Some JASON lessons also were found to fit nicely into the fifth grade curriculum. Henington mentions Resilient Planet content related to the food chain as an example.

When asked about the early impact of JASON on her students, Henington refers to graphing skills. Thanks to the variety of graphs used in JASON curriculums, her students are learning to read and interpret data presented graphically. She goes on to indicate the benefits of JASON videos that introduce students to key concepts in science and help them to understand what real scientists do.

Henington also notes how her colleagues at Youngblood have embraced JASON. Some teachers, she points out, would like to abandon their traditional textbooks altogether and use JASON exclusively. Use of JASON on-line resources is somewhat limited at present, however, because classrooms other than technology labs only have three computers. When students get a chance to work on JASON games and labs in the technology lab, they become completely absorbed in their work, according to Pam Bruner. Technology teachers have even incorporated JASON into their regular Technology classes.

Henington admits that JASON is benefitting teachers as well as students. In her own case, she notes that JASON training has helped her update her training in science. Teachers of enrichment classes at Youngblood also have made use of various JASON lessons. Roughly half the students at Youngblood participate in these elective classes, thereby providing them with a double dose of science. Henington and Principal Bruner hope that more girls will take advantage of the science elective.

William Hanly. A sixth grade teacher at Klentzman Intermediate, Hanly took a circuitous route to the classroom. After attending university, he worked as a microbiologist and then sold scientific equipment. Having been a practicing scientist, Hanly appreciates the way that JASON curriculums demonstrate how scientific theories work in the real world. He gives an example involving friction and automobile crashes.

One of the first JASON lessons that Hanly implemented addressed a unit on simple machines. He brought a variety of tools to class so that students could have hands on experience. Students get to use a pulley system to see how it reduced the effort needed to lift a heavy object.

Hanly works closely with Klentzman Science Specialist Kameetra Ellis-Davis to develop and deliver model JASON lessons. One series of lessons they planned concerned the Arctic food web from Resilient Planet. Following an examination of the relationships between organisms in the Artic food chain, they focused on ecosystems and the concept of adaptation. Their lessons call on students to problem solve various ecological challenges. This focus on problem solving will stand students in good stead when they take the eighth grade state test in science. The new STAAR test places heavy emphasis on student problem solving.

Many of Hanly's students enjoy the virtual field trips showing young people participating in JASON expeditions. After mentioning several of his students who were particularly "turned on" by such activities, he admits that boys seem to be more interested in science than girls. Hanly is searching for JASON content that will cultivate greater interest in science for girls.

The 2012-2013 school year was a time for becoming familiar with all that JASON curriculums have to offer, according to Hanly. He is already looking forward to the next school year when he plans to implement more JASON labs and develop special projects linked to JASON lessons. He also has discovered that JASON visuals are very helpful for his students with reading problems.

Asked if JASON training has helped him to become a better teacher, Hanly acknowledges that he has broadened how he thinks about teaching. Thanks to JASON, for example, he sees the value of well-designed games. The videos of expeditions help students understand what it feels like to be an explorer. He has come to appreciate the fact that young people like to discover things on their own instead of always being given the answers. Hanly sums up his regard for JASON by saying, "We don't use the textbook any more. It's too out of date. JASON offers great hooks and great activities."

Brenda Fluker. One of the Alief contingent that went to the national training in Virginia, Fluker is a coach and science teacher at Killough Middle School campus. She is quick to point out the positive impact that JASON has made on Killough students. Measurement long has been an issue at Killough, but with the advent of JASON, students have begun to understand the importance of precision and accuracy when it comes to measuring things. Other areas where improvements have been noted include graphing skills and writing up lab reports. Perhaps the greatest perceived benefit of JASON's implementation at Killough, however, concerns critical thinking. Fluker observes that students are better able to describe what they see when conducting labs and explain why they got the results they did.

Just as important as the academic benefits of JASON have been affective pay-offs. Fluker says that she and her colleagues find that students are more excited about science and more motivated to work hard to find answers to scientific questions. Alief, she explains, is promoting greater academic rigor, and JASON fits nicely into the district's plans by helping students realize that challenging work can also be enjoyable and satisfying.

JASON also encourages team work, another plus according to Fluker. Students conduct labs together and collaborate on other JASON activities. Peer teaching is common during JASON lessons.

Fluker offers examples of how JASON has helped students of varying abilities. Struggling learners respond well to activities like "Coaster Creator." Special education students and English language learners appreciate all the visuals in JASON texts and on-line resources. Pre-Advanced Placement students undertake JASON lessons as independent study assignments. They particularly like the "Meet the Scientist" videos. Fluker says that certain reading materials for JASON are too difficult for some students, however.

Killough teachers, according to Fluker, have benefitted from JASON by having more high-engagement labs to draw on in order to cover the TEKS. JASON's Terminal Velocity curriculum has been of particular value to teachers as they prepare students for the TEKS related to Physics. Teachers hope that JASON Learning will soon develop curriculums in Biology and Chemistry, two other subjects covered by the TEKS.

Status Check

Alief has done an exemplary job of creating an infrastructure to support and sustain JASON. Led by two central office Science Coordinators and two Science Interventionists, pairs of coaches at each intermediate and middle school campus have received JASON training in Virginia as well as in-district. They spent the 2012-2013 school year conducting school-based meetings of science teachers to determine the most appropriate JASON lessons to implement, demonstrating various JASON components, co-teaching, and attending inservice trainings coordinated by Science Coordinators Gelyn Cornell and Dr. Karen Jacobs. Several principals also received JASON training, as have some Technology Specialists. Alief's ability to implement JASON expeditiously can be attributed in part to the work on aligning JASON with the Alief science program that was undertaken during the national training in Virginia.

Section III

Assessing the Early Impact of the JASON-Chevron Initiative

The concluding section of this book opens with an assessment of the early impact of the Chevron-JASON initiative on middle grades science in Spring Branch, Aldine, and Alief. Impact data is reported for several categories, including extent of implementation of JASON curriculums, teacher perceptions of JASON's impact on science instruction, and teacher perceptions of JASON's impact on student learning. Additional impact data involves student perceptions of JASON's impact on their learning in science and on their motivation to continue science-related studies. Student achievement data from the State of Texas Assessment of Academic Readiness (STAAR) for Grade 8 Science also is presented.

The last chapter opens with a discussion of lessons learned as a result of the first year and a half of the Chevron-JASON initiative. These lessons address the steps needed to implement JASON curriculums successfully and to lay the groundwork for sustaining JASON beyond the three years of start-up funding provided by Chevron of Houston. The chapter concludes with a look at the future of the Chevron-JASON initiative in the Houston area.

Chapter VII

Searching for Signs of Improved Science Instruction

Efforts to implement JASON in Spring Branch are just a year-and-a-half old and only a year old in Aldine and Alief, so assessing the early impact of the innovative science program requires a focus on formative rather than summative factors. Raising student achievement, of course, is the bottom line, but before that ambitious goal can be accomplished, steps must be taken to ensure that JASON is actually being implemented. The first section of this chapter therefore looks at data concerning the components of JASON that are being adopted by intermediate and middle school teachers.

The second section examines teachers' reactions to JASON and its unique approach to science instruction. The point already has been made: if teachers do not find JASON to be an improvement over traditional science programs, they are unlikely to embrace and sustain it.

Both teachers and students also were surveyed regarding JASON's impact on skill development in science. Skills ranged from how to read scientific data to how to design science experiments. The third and fourth sections present the survey results for both teachers and students.

Teachers are much more likely to implement various components of JASON if they see that students enjoy the program. Engaging students' interest in science is half the battle, to paraphrase Bob Ballard. The fifth section looks at student survey responses concerning the impact of JASON on their interest in science.

The last section reports on student achievement data from the eighth grade STAAR science test. Because JASON has not been fully implemented in eighth grade classes in any of the three school districts, it is unwise to draw any conclusions from the test data. Still, if student scores did not drop in 2012-2013, that would be an encouraging sign.

It should be noted that there were some variations in the collection of survey data in Spring Branch, Aldine, and Alief. Spring Branch, for example, elected not to collect data on the particular components of JASON that had been implemented as of May 2013. Spring Branch asked students and teachers to fill out hard copies of the surveys. Some Aldine students and teachers responded to survey questions on Survey Monkey (on-line). Alief allowed both on-line and hard copy responses for teachers, but students only filled out hard copies. While Alief surveyed all students in selected schools and grade-levels, Spring Branch and Aldine chose to sample students in different intermediate and middle schools on a more limited basis.

Because of variations in data collection procedures across the three school districts, it is best to avoid sweeping generalizations concerning the responses of teachers and students. The data are, at best, suggestive of emerging trends and a useful baseline on which future benchmarking can be based.

Section 1: What's Being Implemented?

Tables 7.1 and 7.2 provide an indication of which JASON components were tried at least once by each responding teacher during the 2012-2013 school year. Table 7.1 combines data collected on Survey Monkey from 20 science teachers in Aldine and 15 science teachers in Alief. It is not possible to determine which responses are from Aldine teachers and which data are from Alief teachers. Table 7.2 presents hard copy survey data from 49 Alief science teachers. Spring Branch officials did not choose to conduct the section of the survey concerning implementation choices.

The survey sought information on six components of each of JASON's five curriculums. The components included the teacher edition of the text for each curriculum, the student edition of the text for each curriculum, digital labs and games for each curriculum, videos for each curriculum, pre-tests and post-tests for each curriculum, and on-line classroom assignments for each curriculum.

Overall, there is evidence that every one of the five curriculums and each curriculum component were implemented to some extent. Reviewing the two tables, it appears that teachers who opted to complete the survey using Survey Monkey made greater use of most JASON components than the teachers who completed hard copies of the survey.

TABLE 7.1: Teacher Use of JASON Components during 2012-2013, Alief and Aldine ISD[1] (N=35)

Check all of the following JASON components that you have used at least once in your classes this year:

	Monster Storms	Infinite Potential	Terminal Velocity	Tectonic Fury	Resilient Planet	N/A	Response Count (N=35)
Teacher edition of the text for	58.8%	29.4%	35.3%	29.4%	58.8%	14.7%	34
Student edition of the text for	42.9%	22.9%	28.6%	25.7%	40.0%	31.4%	35
Digital labs/games for	36.4%	42.4%	36.4%	27.3%	45.5%	18.2%	33
Videos for	42.9%	25.7%	34.3%	25.7%	45.7%	17.1%	35
Pre/post tests for	21.9%	15.6%	18.8%	12.5%	37.5%	53.1%	32
On-line classroom assignments for	15.6%	15.6%	21.9%	9.4%	28.1%	53.1%	32

[1]Alief and Aldine teachers in this table completed their survey on Survey Monkey. Survey Monkey aggregated the data across the two districts. Teachers from Alief who completed the Survey Monkey version of the survey did not complete the hard copy version.

TABLE 7.2: Teacher Use of JASON Components during 2012-2013, Alief ISD[1] (N=49)

Check all of the following JASON components that you have used at least once in your classes this year:

	Monster Storms	Infinite Potential	Terminal Velocity	Tectonic Fury	Resilient Planet	N/A	Response Count (N=35)
Teacher edition of the text for	8%	27%	29%	29%	33%	0	49
Student edition of the text for	2%	4%	16%	8%	4%	0	49
Digital labs/games for	12%	35%	43%	35%	35%	0	49
Videos for	8%	31%	35%	47%	33%	0	49
Pre/post tests for	4%	8%	8%	18%	10%	0	49
On-line classroom assignments for	2%	8%	8%	10%	8%	0	49

[1]Alief teachers in this table completed hard copies of the survey.

Digital labs and games along with videos appeared to be the most frequently implemented components. On-line classroom assignments and pre/post tests were not implemented by as many teachers. Infrequent use of on-line assignments is likely a function of limited access to computers and some initial difficulty distributing access codes to teachers. It also was the case that some schools lacked sufficient copies of student texts to allow them to be taken home.

Additional data related to teacher use of JASON components was gathered by Dr. Karen Jacobs of Alief ISD. Table 7.3 presents the results of her inquiry regarding what components of the five JASON curriculums were considered to be particularly valuable to teachers in Alief middle schools and intermediate campuses. The data indicate that teachers in most schools found the following components to be of great value:

- Digital games
- Videos of scientists
- Host researcher visits
- Increasing girls' interest in science
- JASON textbooks
- Argonaut program

One of the noteworthy features of Dr. Jacobs' table is the variation across campuses in the JASON components perceived by teachers to be of greatest value. This finding is supported by on-site observations and interviews indicating that teachers at different campuses elected to implement different JASON components in Year 1 of the Chevron-JASON initiative.

Section 2: How Do Teachers Feel about the Instructional Benefits of JASON?

The science teachers survey, conducted in the late spring of 2013, included a series of items concerning the possible instructional benefits of JASON lessons. The items addressed the following:

Table 7.3: Alief Teacher Perceptions of Valuable JASON Components[1]

What portions of the JASON Project, used as a supplemental STEM curriculum, did you find most valuable in increasing student achievement for your campus?

Emergent Themes	Albright MS	Alief MS	Holub MS	Killough MS	O'Donnell MS	Olle MS	Budewig Int.	Klentzman Int.	Mata Int.	Miller Int.	Owens Int.	Youngblood Int.	% Frequency
Digital Games	X	X	X	X		X	X	X	X	X	X	X	92%
Literacy-Articles					X								8%
Scientists' Videos	X	X	X	X	X	X	X	X	X	X	X	X	100%
Host Researcher Visits	X	X	X	X	X	X	X	X	X	X	X	X	100%
Increasing Girls' Interest in Science	X	X	X	X	X	X	X	X	X	X	X	X	100%
JASON Project Text-books	X		X	X	X	X	X		X			X	67%
Labs	X		X	X		X			X			X	58%
Simulations	X								X	X		X	33%
Blogs		X											8%
Assessments					X	X							17%
After School Usage										X		X	17%
Embedment with Technology classes												X	8%
National Argonaut Program	X	X	X	X	X	X	X	X	X	X	X	X	100%

[1]*This table was compiled by Dr. Karen Jacobs, Secondary Science Coordinator for Alief ISD, in her White Paper, "STEM Infusion: Alief Independent School District Together with the JASON Project Narness Students' Success in Science" (August 2013).*

- Alignment between JASON content and the TEKS
- Value of JASON lessons for differentiated instruction
- Value of JASON lessons in promoting interesting discussions
- Value of JASON's formative assessments
- Value of JASON resources in relation to regular science textbook
- Value of JASON lessons for demonstrating real world applications of science
- Capacity of JASON lessons to engage students

Tables 7.4, 7.5, and 7.6 present the survey results for the three school districts. Spring Branch used a slightly different format and set of items than Aldine and Alief. High levels of agreement (levels exceeding 60%) on the instructional benefits of JASON lessons were reported for most items. Only the item concerning the ease of use of JASON's on-line formative assessments failed to secure an overall high level of agreement.

A substantial majority of responding teachers believe that JASON lessons align well with the Texas Essential Knowledge and Skills in science. Teachers generally feel that JASON lessons help them to differentiate instruction in order to accommodate the needs of students of varying ability levels. JASON lessons are valued for contributing to interesting discussions of science, for exposing students to real world applications of science, and for fostering a high level of student engagement during science instruction. Well over half of the responding teachers in Aldine and Alief also believe that JASON lessons cover many science topics better than their current textbook.

TABLE 7.4: Teacher Perceptions of JASON's Instructional Benefits, Aldine and Alief ISD[1] (N=35)

The items listed below represent possible instructional benefits of JASON lessons. Please circle one response for each item.

	Agree	Disagree	No Opinion	Response Count
Many JASON lessons align with the TEKS science standards.	82.9%	8.6%	8.6%	35
JASON lessons help me to differentiate instruction to meet the needs of different students.	80.0%	5.7%	14.3%	35
JASON lessons lead to interesting discussions and promote academic conversations.	82.9%	2.9%	14.3%	35

	Agree	Disagree	No Opinion	Response Count
Formative assessments found in JASON's "online teacher tools" are easy to use.	57.1%	5.7%	37.1%	35
JASON texts and online resources cover many science topics better than my current science textbook.	57.1%	11.4%	31.4%	35
JASON lessons expose students to many ways in which science is applied in the real world.	97.1%	0.0%	2.9%	35
JASON lessons keep students engaged while they are learning about science.	85.7%	0.0%	14.3%	35

[1]Aldine and Alief teachers in this table completed their survey on Survey Monkey. Survey Monkey aggregated the data across the two districts. Teachers from Alief who completed the Survey Monkey version of the survey did not complete the hard copy version.

TABLE 7.5: Teacher Perceptions of JASON's Instructional Benefits, Alief ISD[1] (N=49)

The items listed below represent possible instructional benefits of JASON lessons. Please circle one response for each item.

	Agree	Disagree	No Opinion	Response Count
Many JASON lessons align with the TEKS science standards.	68%	28%	4%	47
JASON lessons help me to differentiate instruction to meet the needs of different students.	63%	17%	21%	48
JASON lessons lead to interesting discussions and promote academic conversations.	71%	10%	19%	48
Formative assessments found in JASON's "online teacher tools" are easy to use.	39%	12%	49%	49
JASON texts and online resources cover many science topics better than my current science textbook.	68%	6%	26%	47
JASON lessons expose students to many ways in which science is applied in the real world.	92%		8%	48
JASON lessons keep students engaged while they are learning about science.	65%	2%	33%	48

[1]Alief teachers in this table completed hard copies of the survey.

TABLE 7.6: Teacher Perceptions of JASON's Instructional Benefits, Spring Branch ISD[1] (N=42)

The items listed below represent possible instructional benefits of using JASON lessons. Please circle one response for each item.

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion	Response Count
Many JASON lessons align with the TEKS science standards.	20%	66%	5%		9%	41
JASON digital labs & videos align with the TEKS science standards.	17%	61%	5%	2%	5%	41
JASON lessons help me to differentiate instruction.	12%	69%	5%		14%	42
JASON digital labs & videos help me to differentiate instruction.	12%	69%	10%		9%	42
JASON lessons lead to interesting discussions and promote academic conversations.	26%	69%			5%	42
Formative assessments found in JASON's on-line teacher tools are easy to use.	2%	38%	5%		55%	42
JASON lessons expose students to real world applications of science	33%	57%	5%		5%	42
JASON lessons keep students engaged while they learn about science.	29%	64%	2%		5%	42
JASON digital labs & videos keep students engaged while they learn about science.	38%	53%			9%	42

[1]Spring Branch elected to use a Likert Scale for its survey and to add several additional items and delete an item from the original survey.

Section 3: Do Teachers Feel That JASON Lessons Are Helpful in Developing Particular Skills in Science?

With assistance from Lee Charlton of JASON Learning, Rojana Luecken, Xandra Williams-Earlie, Dr. Karen Jacobs, and Gelyn Cornell, various skills associated with success in science classes were identified. Intermediate and middle school teachers then were surveyed to determine which skills they felt JASON lessons had helped students to develop. Tables 7.7, 7.8, and 7.9 present the data for Aldine, Alief, and Spring Branch.

JASON lessons were reported to have helped with every skill in each of the three districts. Variations existed, however, across individual skills and school districts. The skills for which all or most students were reported to have been helped by at least 40 percent of the respondents include data analysis, use of science terms, following procedures, making predictions, and problem solving. Significant percentages of teachers did not feel that many students were helped to learn graphing skills and the design of experiments. Variations across teachers, of course, could be a function of lack of training or failure to implement relevant lessons from JASON. That Spring Branch should have recorded more skills where significant percentages of students were perceived to have been helped by JASON should come as no surprise, since Spring Branch teachers had three semesters (rather than two semesters in Aldine and Alief) in which to implement JASON.

TABLE 7.7: Teacher Perceptions of JASON's Impact on Student Skills in Science, Aldine and Alief ISD[1] (N=35)

JASON lessons are intended to help students develop a range of skills. Check the appropriate category for each skill that JASON lessons have helped your students develop.

	Most Students	Some Students	No Students	Response Count
Graphing	42.9%	34.3%	22.9%	35
Data Reading	48.6%	37.1%	14.3%	35
Data Analysis	40.0%	42.9%	17.1%	35
Using of Science Terms	65.7%	34.3%	0.0%	35
Reading Comprehension	28.6%	68.6%	2.9%	35
Following Procedures	48.6%	51.4%	0.0%	35
Making Predictions	57.1%	42.9%	0.0%	35
Designing Experiments	42.9%	48.6%	8.6%	35
Problem Solving	42.9%	48.6%	8.6%	35
Writing	42.9%	40.0%	17.1%	35

[1]*Aldine and Alief teachers in this table completed their survey on Survey Monkey. Survey Monkey aggregated the data across the two districts. Teachers from Alief who completed the Survey Monkey version of the survey did not complete the hard copy version.*

TABLE 7.8: Teacher Perceptions of JASON's Impact on Student Skills in Science, Alief ISD[1] (N=49)

JASON lessons are intended to help students develop a range of skills. Check the appropriate category for each skill that JASON lessons have helped your students develop.

	Most Students	Some Students	No Students	Response Count
Graphing	36%	36%	38%	42
Data Reading	36%	33%	31%	42
Data Analysis	27%	44%	29%	42
Using of Science Terms	65%	26%	9%	42
Reading Comprehension	46%	39%	16%	42
Following Procedures	44%	30%	26%	42
Making Predictions	43%	31%	26%	42
Designing Experiments	30%	30%	40%	42
Problem Solving	42%	26%	33%	42
Writing	25%	43%	32%	42

[1]Alief teachers in this table completed hard copies of the survey.

TABLE 7.9: Teacher Perceptions of JASON's Impact on Student Skills in Science, Spring Branch ISD[1] (N=42)

JASON lessons are intended to help students develop a range of skills. Check the appropriate category for each skill that JASON lessons have helped your students develop.

	All Students	Most Students	Some Students	Few Students	Response Count
Graphing		44%	39%	17%	23
Data Analysis	16%	64%	16%	4%	25
Using of Science Terms	33%	52%	12%	3%	33
Reading Comprehension	29%	50%	21%		34
Following Procedures	39%	42%	19%		31
Making Predictions	30%	40%	27%	3%	30
Designing Experiments	14%	43%	29%	14%	28
Problem Solving	23%	57%	17%	3%	30
Writing	26%	44%	26%	4%	27

[1]Spring Branch used a version of the survey with four rating categories instead of three.

Section 4: Do Students Feel That JASON Lessons Are Helpful in Developing Particular Skills in Science?

JASON designers believe that students should understand what they are supposed to be learning and be able to track their own progress. As a basis for comparison with teacher perceptions, it was decided to ask students whether JASON lessons helped them to develop a set of skills related to science education (the same set, with one exception, used for teacher surveys). Aldine and Alief surveyed large numbers of students, while Spring Branch opted to sample students in one class per school. The results are presented in Tables 7.10, 7.11, and 7.12. Students were given three response options: "yes" (JASON lessons helped the student become better at the skill), "no" (JASON lessons did not help), and "unsure" (whether or not JASON helped).

To make comparisons across the three districts easier, Table 7.13 is provided. This table compares only the positive student responses for each science-related skill. With a few exceptions, at least half of student respondents in each district indicated that JASON helped them to develop each of the 11 skills. The lowest percentages involved "reading difficult material," "designing experiments," and "writing."

The highest percentages of positive responses tended to be for "following procedures," "reading data," "analyzing data," "solving problems," and "playing computer games." In Alief, where it was possible to examine student responses on a school-by-school basis, the range of positive responses across individual schools was often large. Consider the percentages of eighth graders who responded "yes" (that JASON helped them become better at specific skills) at Alief Middle School (AMS) and Killough Middle School (KMS):

Skill	AMS	KMS
Reading Graphs	47%	68%
Reading Data	50%	74%
Analyzing Data	61%	70%
Using Scientific Terms	44%	59%
Reading Difficult Material	30%	43%
Following Procedures	65%	78%
Making Predictions	53%	72%
Designing Experiments	53%	67%
Solving Problems	53%	72%
Writing	32%	49%
Playing Computer Games	74%	51%

Differences of this magnitude suggest uneven implementation across schools. It will be important in Year 2 of the Chevron-JASON initiative for district-level leaders to determine why the range of responses varies so much.

TABLE 7.10: Student Perceptions of JASON's Impact on Their Skills in Science, Aldine ISD[1] (N=1600)

Has working on JASON lessons and activities helped you become better at:

	Yes	No	Unsure	Response Count
Reading Graphs	50%	23%	27%	1600
Reading Data	53%	25%	22%	1600
Analyzing Data	49%	22%	29%	1600
Using Scientific Terms	40%	27%	33%	1600
Reading Difficult Material	33%	35%	32%	1600
Following Procedures	63%	16%	21%	1600
Making Predictions	60%	16%	24%	1600
Designing Experiments	52%	21%	27%	1600
Solving Problems	55%	18%	27%	1600
Writing	41%	38%	21%	1600
Playing Computer Games	53%	31%	16%	1600

[1]*Surveys were completed by 1600 Aldine 7th and 8th grade science students, 798 using Survey Monkey and 802 using hard copies.*

TABLE 7.11: Student Perceptions of JASON's Impact on Their Skills in Science, Alief ISD[1] (N=2049)

Has working on JASON lessons and activities helped you become better at:

	Yes	No	Unsure
Reading Graphs	58%	20%	22%
Reading Data	68%	13%	19%
Analyzing Data	66%	13%	21%
Using Scientific Terms	61%	17%	22%
Reading Difficult Material	41%	27%	32%
Following Procedures	68%	14%	18%
Making Predictions	67%	14%	19%
Designing Experiments	61%	19%	20%

	Yes	No	Unsure
Solving Problems	65%	12%	23%
Writing	45%	31%	24%
Playing Computer Games	66%	20%	14%

[1]Surveys were distributed in Alief ISD to six intermediate schools and six middle schools. Students in 6th, 7th, and 8th grade science classes completed the surveys. A total of 2049 surveys were completed.

TABLE 7.12: Student Perceptions of JASON's Impact on Their Skills in Science, Spring Branch ISD[1]

Has working on JASON lessons and activities helped you become better at:

	Yes	No	Unsure	Response Count
Reading Graphs	58%	21%	21%	131
Reading Data	74%	13%	13%	131
Analyzing Data	74%	13%	13%	131
Using Scientific Terms	62%	17%	21%	131
Reading Difficult Material	48%	25%	27%	131
Following Procedures	74%	10%	16%	131
Making Predictions	71%	12%	17%	131
Designing Experiments	48%	15%	37%	131
Solving Problems	71%	12%	17%	131
Writing	47%	35%	18%	131
Playing Computer Games	71%	11%	18%	131

[1]Spring Branch sampled a science class in each of six middle schools. Four were 6th grade classes, one was 7th grade, and one was an 8th grade class. A total of 131 students completed surveys.

TABLE 7.13: Percentage of Students Who Responded "Yes" (Indicating JASON Helped Them Develop a Science Skill) for Aldine, Alief, and Spring Branch

	Aldine N=1600	Alief N=2049	Spring Branch N=131
Reading Graphs	50%	58%	58%
Reading Data	53%	68%	74%
Analyzing Data	49%	66%	74%
Using Scientific Terms	40%	61%	62%
Reading Difficult Material	33%	41%	48%
Following Procedures	63%	68%	74%
Making Predictions	60%	67%	71%

	Aldine N=1600	Alief N=2049	Spring Branch N=131
Designing Experiments	52%	61%	48%
Solving Problems	55%	65%	71%
Writing	41%	45%	47%
Playing Computer Games	53%	66%	71%

Section 5: Have JASON Lessons Increased Students' Interest in Science?

An important goal of the Chevron-JASON initiative is to stimulate greater interest among middle schoolers in science and STEM-based careers. One section of the student survey administered in the three districts included items regarding the impact of JASON lessons on student interest in taking more science courses, solving problems that affect the world, becoming a scientist, becoming a science teacher, becoming an engineer, and going to college to study science. Tables 7.14, 7.15, and 7.16 present the survey results.

Student interest in science tended to be greater in Alief and Spring Branch than in Aldine, but there also were variations across individual campuses (in Alief and Spring Branch). In Alief, for example, student interest in taking more science classes ranged from 67% at Budewig Intermediate to 14% at Albright Middle School. In Spring Branch, 67% of students at Landrum Middle School indicated that they would like to take more science courses, while only 24% of Spring Branch Middle School students expressed an interest in doing so.

It is hard to explain why so few students in general express an interest in becoming science teachers. Whether this finding reflects a general disinterest in school among middle schoolers or career thinking that does not include the possibility of teaching is impossible to know. It also is worth noting that interest in possibly becoming an engineer was greater than interest in becoming a scientist or a science teacher.

TABLE 7.14: Impact of JASON's Lessons on Student Interest in Science, Aldine ISD (N=1600)[1]

Did doing these lessons and activities make you more interested in (circle one answer for each):

	Yes	No	Unsure
Taking more science courses	20%	38%	42%
Solving problems that affect our planet	37%	29%	34%
Becoming a scientist one day	10%	64%	26%

	Yes	No	Unsure
Becoming a science teacher one day	5%	76%	19%
Becoming an engineer one day	22%	50%	28%
Going to college to study science	23%	40%	37%

[1]Surveys were completed by 1600 Aldine 7th and 8th grade science students, 798 using Survey Monkey and 802 using hard copies.

TABLE 7.15: Impact of JASON's Lessons on Student Interest in Science, Alief ISD (N=2049)[1]

Did doing these lessons and activities make you more interested in (circle one answer for each):

	Yes	No	Unsure
Taking more science courses	40%	21%	39%
Solving problems that affect our planet	46%	20%	34%
Becoming a scientist one day	17%	48%	35%
Becoming a science teacher one day	12%	60%	28%
Becoming an engineer one day	28%	39%	33%
Going to college to study science	41%	21%	38%

[1]Surveys were distributed in Alief ISD to six intermediate schools and six middle schools. Students in 6th, 7th, and 8th grade science classes completed the surveys. A total of 2049 surveys were completed.

TABLE 7.16: Impact of JASON's Lessons on Student Interest in Science, Spring Branch ISD (N=131)[1]

Did doing these lessons and activities make you more interested in (circle one answer for each):

	Yes	No	Unsure
Taking more science courses	42%	25%	33%
Solving problems that affect our planet	40%	22%	38%
Becoming a scientist one day	10%	50%	40%
Becoming a science teacher one day	6%	64%	30%
Becoming an engineer one day	24%	46%	30%
Going to college to study science	44%	15%	41%

[1]Spring Branch sampled a science class in each of six middle schools. Four were 6th grade classes, one was a 7th grade class, and one was an 8th grade class. A total of 131 students completed surveys.

The relatively high percentages of students who expressed uncertainty regarding the impact of JASON on their science-related interests suggests that many students may not have been exposed to JASON for a long enough period of time. It also serves as a reminder that teachers probably should spend time finding out why students are not more interested in science and science-related careers. The fact that some schools were characterized by much higher levels of student interest than other schools merits further investigation as well. Are the differences attributable to variations in school socioeconomic status, with students from higher income families displaying greater interest in science? Could differences be a function of how much of the JASON curriculums have been implemented and how well they are being taught?

In addition to the questions in Tables 7.14, 7.15, and 7.16, students were asked two additional questions that relate to their interest in science. When asked if they would like to go on a scientific expedition, 39% of Aldine students, 61% of Alief students, and 55% of Spring Branch students responded "yes." Asked if JASON lessons were more enjoyable than other science lessons, 38% of Aldine students, 53% of Alief students, and 50% of Spring Branch students responded "yes." Once again, the range of the responses from school to school was considerable. At Olle Middle School in Alief, for example, 71% of 8th graders found JASON lessons more enjoyable, while only 17% of 7th graders at Holub Middle School did so.

Section 6: Why Are Teachers Likely to Continue to Use JASON Lessons and Materials?

The last set of items on the survey for teachers began with the following query: "If you are likely to continue to use JASON lessons, are any of your reasons for doing so listed below? If so, please check all that apply." Some reasons focused on instruction, including acceleration for high achievers, help for English language learners, and differentiation of instruction. Other reasons addressed student motivation, career awareness, self-monitoring of progress, collaborative learning, enjoyment of content, and academic rigor. Tables 7.17, 7.18, and 7.19 present the results.

Each of the reasons received some degree of support, with variations occurring across the three school districts. The most popular reason in Alief, for example, concerned JASON's benefits for English language learners, whereas Spring Branch science teachers cited instructional differentiation and student teamwork most frequently as reasons for continuing to use JASON. The least frequently cited reason across the board, however, involved student progress self-monitoring. Perhaps this aspect of JASON should receive more attention during future training sessions.

TABLE 7.17: Reasons Why Teachers Plan to Use JASON lessons in the Future, Aldine and Alief ISD[1] (N=35)

If you are likely to continue to use JASON lessons, are any of your reasons for doing so listed below? If so, please check all that apply:

	Response Percent	Response Count
JASON lessons allow me to accelerate and enrich science learning for high achieving students	68.6%	24
JASON lessons allow me to provide helpful instruction for students who are English Language Learners, using the reader and many visuals	51.4%	18
JASON lessons allow me to differentiate instruction	68.6%	24
Students are highly motivated to use JASON activities	74.3%	26
Students learn a lot about possible careers in science from JASON	71.4%	25
JASON lessons enable students to monitor their own progress	34.3%	12
JASON lessons enable students to work together	60.0%	21
JASON lessons are fun	77.1%	27
JASON lessons are challenging	60.0%	21

[1]Aldine and Alief teachers in this table completed their survey on Survey Monkey. Survey Monkey aggregated the data across the two districts. Teachers from Alief who completed the Survey Monkey version of the survey did not complete the hard copy version.

TABLE 7.18: Reasons Why Teachers Plan to Use JASON lessons in the Future, Alief ISD[1] (N=49)

If you are likely to continue to use JASON lessons, are any of your reasons for doing so listed below? If so, please check all that apply:

	Response Percent	Response Count
JASON lessons allow me to accelerate and enrich science learning for high achieving students	47%	23
JASON lessons allow me to provide helpful instruction for students who are English Language Learners, using the reader and many visuals	74%	36
JASON lessons allow me to differentiate instruction	49%	24
Students are highly motivated to use JASON activities	43%	21
Students learn a lot about possible careers in science from JASON	41%	20
JASON lessons enable students to monitor their own progress	25%	12
JASON lessons enable students to work together	47%	23
JASON lessons are fun	59%	29
JASON lessons are challenging	39%	19

[1]Alief teachers in this table completed hard copies of the survey.

TABLE 7.19: Reasons Why Teachers Plan to Use JASON Lessons in the Future, Spring Branch ISD (N=42)

If you are likely to continue to use JASON lessons, are any of your reasons for doing so listed below? If so, please check all that apply:

	Response Percent	Response Count
JASON lessons allow me to accelerate and enrich science learning for high achieving students	50%	21
JASON lessons allow me to provide helpful instruction for students who are English Language Learners, using the reader and many visuals	45%	19
JASON lessons allow me to differentiate instruction	57%	24
Students are highly motivated to use JASON activities	52%	22
Students learn a lot about possible careers in science from JASON	55%	23
JASON lessons enable students to monitor their own progress	14%	6
JASON lessons enable students to work together	57%	24
JASON lessons are challenging	50%	21

Section 7: Are There Any Indications That Student Achievement Improved in Year 1 of JASON Implementation?

Caution should be exercised when examining student performance on the State of Texas Assessments of Academic Readiness (STAAR) in science because the implementation process for JASON varied from district to district, school to school, and classroom to classroom. Furthermore, the STAAR testing program was only in its second year in 2013. Teachers in Texas school districts were still adjusting to the new tests and their TEKS-based content.

Texas students take a STAAR test in science in the 5th and 8th grades. The 8th grade test takes a cumulative look at what students have learned in 6th, 7th, and 8th grade science. Questions cover four areas of science: Matter and Energy; Force, Motion, and Energy; Earth and Space; and Organisms and Environment. On the Grade 8 test results were examined because relatively few 5th graders were exposed to the JASON curriculums.

The Summary Report on the STAAR Grade 8 Science test for Aldine ISD indicates that the percentage of students who achieved a “satisfactory” passing score in May 2013 was 68%, surpassing the 65% on the May 2012 test. The percentage of students who did not pass the test dropped 3 percentage points (from 35% to 32%) from 2012 to 2013.

Data compiled by Dr. Karen Jacobs of Alief ISD showed even greater gains from 2012 to 2013. In 2012, Alief 8th graders had a 68% pass rate on Level 2, Phase 1, of the test – 2 percentage points below the state average of 70%. In 2013, Alief 8th graders boasted a 77% pass rate, a jump of 9 percentage points from the previous year and 2 percentage points higher than the state average for 2013. When Jacobs looked at student performance at each of the six middle schools in which 8th graders were exposed to JASON lessons, she found that every school had a higher pass rate in 2013 than in 2012. The percentage increase ranged from 4% at Alief Middle School to an impressive 13% at Olle Middle School.

Rojana Luecken of Spring Branch provided an item-by-item comparison of student performance on the 2012 and 2013 STAAR Grade 8 Science test. Of 45 test items that were comparable across the 2 years, Spring Branch 8th graders posted a higher passing percentage on 26 items in 2013 than in 2012. On 19 items, the passing percentage in 2013 was lower than in 2012. Overall, 79% of Spring Branch 8th graders passed Level 2, Phase 1, of the STAAR Grade 8 Science test in 2013, compared to 72% in 2012. On Level 2, Phase 2, of the test, the pass rate rose from 41% in 2012 to 60% in 2013.

Achievement gains on the STAAR Grade 8 Science test were achieved in all three school districts that implemented JASON. While these gains may have been due to a variety of factors, there is no evidence that early efforts to implement JASON had a negative impact on student achievement. Quite the contrary, in fact. All three districts' middle school science programs clearly seem to be headed in a positive direction.

Summing Up

Implementation of JASON curriculums is well under way in all three school districts, but some curriculums and some curriculum components are in greater use than others. It is likely that implementation across all five curriculums will even out with more training and continued efforts to align JASON content with the TEKS and district pacing guides.

Large percentages of teachers in all three districts believe that JASON lessons enhance middle school science instruction and that many students are being helped to develop science skills as a result of exposure to JASON content. Substantial percentages of students also credit JASON with helping them achieve competence in science. There is evidence that some students are considering further study of science and science-related careers as a result of exposure to JASON lessons, but these percentages clearly are not as great as Chevron of Houston, JASON Learning, or the three school districts would like. Teachers offer a variety of reasons why they plan to continue using JASON lessons. Their reasons range from the need to accelerate learning for high achievers to JASON's emphasis on student collaboration.

Though early in the process of implementing JASON in Spring Branch, Aldine, and Alief, all three districts posted gains on the STAAR Grade 8 Science test in 2013. The time and effort required by teachers to learn about JASON and put JASON lessons into practice do not appear to have had any negative consequences in terms of student achievement. Most indications are that the three districts are poised to continue making gains as more teachers receive training and more JASON components are implemented.

Chapter VIII

Looking Back and Looking Forward

Section II described the early efforts of Spring Branch, Aldine, and Alief Independent School Districts to implement JASON Learning's science program for middle schoolers and thereby move in the direction of making the Houston area the "epicenter of STEM education" – the ambitious goal of Joni Baird and Chevron of Houston. It now is necessary to look across the experiences of each district to consider what lessons in educational change are being learned that might benefit future Chevron-JASON partners.

Chapter 8 opens with a look at similarities and differences in the implementation process across the three districts. A discussion follows concerning the efficacy of the Chevron-JASON Theory of Action and the public-private partnership behind it. A set of recommendations then is offered in the hopes that new partners will benefit from the pioneering efforts of Spring Branch, Aldine, and Alief.

The focus of the chapter's second half shifts from past to present and future. Actions taken in 2013 by Chevron of Houston and JASON Learning to expand the initiative are briefly described along with plans for supporting and sustaining the growing partnership.

Cross-case Analysis

An examination of early efforts to implement JASON in Spring Branch, Aldine, and Alief reveals both similarities and differences. That there are similarities is not surprising, given JASON's Theory of Action and the common training that was received from JASON's national trainers. Differences across districts are not surprising either, since JASON Learning values local customization of the implementation process.

Customization is an understandable strategy when teacher buy-in is deemed essential. Teachers appreciate being able to select the components of a new program that they wish to try. Too many educational change initiatives have failed because teachers felt that their professional judgment about what was best for their students was not valued.

Customization does not come without trade-offs, however. The price to be paid for encouraging teachers to make choices is uneven implementation. Schools in all three districts varied to some degree in the JASON components teachers chose to try. Even within particular schools, variations were noted from teacher to teacher.

Whether or not teachers eventually embrace the JASON program in its entirety is likely to be a function of how each district aligns JASON content with the Texas Essential Skills and Knowledge in science. Teachers, after all, are evaluated in part on how well their students perform on the TEKS-based State of Texas Assessment of Academic Readiness for science. All three districts have undertaken extensive efforts to identify JASON lessons that address particular TEKS in science. Aldine and Alief got a jump start on the alignment process by taking time during initial summer training to examine district pacing guides and science content. Spring Branch began this process after summer training had been completed, which probably slowed down the implementation of JASON.

All three districts created an infrastructure for supporting the implementation of JASON. Spring Branch assigned overall responsibility to one central office Instructional Specialist, while Aldine and Alief divided responsibilities between two individuals, one in charge of elementary/intermediate science and one in charge of secondary science. It should be noted that Spring Branch focused on implementing JASON only in its middle schools. Aldine and Alief decided to implement JASON at both their intermediate campuses and middle schools.

Each district provided for implementation leadership at the school as well as the district level, but here again some differences were noted. One science teacher at each Spring Branch middle school was chosen to be a member of the JASON Cadre and take the lead in coordinating implementation. Aldine decided to rely on the Science Specialist assigned to each intermediate and middle school. Alief opted to distribute school-based leadership to one science teacher and the Science Specialist at each intermediate campus and middle school. In addition, Alief charged its Elementary Science Interventionist and Secondary Science Interventionist with facilitating the implementation process.

All three districts recognized the importance of ongoing training to ensure that implementation of JASON was sustained over time. A significant portion of training in Spring Branch and Aldine was scheduled for the summer. While Alief also conducted summer training, it developed several formats for training during the school year. Teachers were released each semester for one full day of JASON training. Alief additionally relied on its Professional Learning Communities to focus on JASON training and planning on a regular basis. The central office coordinators for JASON implementation from the three districts met on one occasion to explore common concerns, including training needs. They plan to continue these meetings as a way of sharing their experiences and supporting each other.

Alief took a significant step toward balancing teacher discretion (customization) and systematic implementation. The plan generated by Gelyn Cornell, Dr. Karen Jacobs, and their colleagues called for a particular JASON curriculum to be the focus in 6th, 7th, and 8th grades. Zeroing in on one curriculum at each grade level allows training to be less random and more concentrated.

Each district took steps to expand the impact of JASON. Spring Branch incorporated JASON content in its Operation Graduation, a stand-alone program for high school students at risk of not graduating. Xandra Williams-Earlie explored ways that Aldine middle school teachers might share JASON content with high school science teachers. Several intermediate campuses in Alief included JASON content in their afterschool programs for students. All three districts welcomed JASON Host Researchers in 2012-2013. Opportunities were provided in each district for parents to meet the Host Researchers, learn more about the JASON program, and access JASON on-line resources at home.

Reflections and Recommendations

The groundwork for continued implementation of JASON clearly has been laid in Spring Branch, Aldine, and Alief. Classroom observations and interviews with teachers as well as teacher surveys provide evidence of considerable enthusiasm regarding particular components of the JASON program. Teachers and students believe that JASON is helping with the development of important skills related to science. Teachers express a variety of reasons for intending to continue using JASON. Student performance on the STAAR Grade 8 Science test in 2013 surpassed performance for 2012 in all three districts. While it is impossible to attribute these gains to any single influence, including JASON, the initial implementation of JASON clearly did not occasion lower performance.

As the implementation of JASON moves forward in the three districts as well as new partner districts, it will be important to track student performance by cohort across grade levels. Eighth graders who took the STAAR Grade 8 Science test in 2013 were only exposed to JASON content for two semesters at most. A better test of JASON's potential will be to see how this year's sixth graders in Spring Branch, Aldine, and Alief perform on the STAAR Grade 8 Science test in the spring of 2015, after having been exposed to JASON for two to three years.

The Theory of Action (see Chapter 2) supporting the Chevron-JASON initiative appears to work well as an approach to systemic educational reform. Initiating reform at the top by enlisting the support of Superintendents and then distributing leadership responsibilities to central office administrators and school-based specialists succeeded in getting JASON off the ground quickly in all three districts. Provisions for on-going professional development, alignment of JASON content with the TEKS, and continuous feedback and collaboration have enabled JASON's implementation to be an organic process. Effective implementation invariably requires periodic fine tuning and adjustment. Evidence from the initial stages of implementation in Spring Branch, Aldine, and Alief indicate that these accommodations are occurring.

While the Theory of Action has made it possible to achieve systemic implementation of JASON, it remains to be seen whether sustained reform of science instruction will follow. It is likely that a separate Theory of Action for sustainability will be required. Such a Theory of Action probably will depend on the willingness of Spring Branch, Aldine, and Alief to build line items in their budgets for continued JASON training and acquisition of materials after the three-year grants from Chevron of Houston expire.

Other factors that could affect sustainability include personnel turnover and shifts in district focus. At present each district has capable central office and school-based individuals willing to take the lead in implementing JASON. If and when these individuals leave, it is essential that they be replaced with persons who understand and are committed to the JASON program. Important also is a continuing district commitment to STEM education. Toward this end, it will be vital for those involved in implementing JASON to keep School Board members and parents informed regarding the program's impact and value.

As the three school districts begin the 2013-2014 school year, it is recommended that central office and school-based leaders reflect on the variations that exist between and within schools. Why are some teachers and schools implementing more JASON components than other teachers and schools? Why are students in some schools and science classes more excited about JASON lessons than students in other schools and science classes? Are schools where achievement gains on the STAAR Grade 8 Science test were greatest also schools where 8th grade teachers implemented more JASON lessons?

The point has already been made: customization increases the likelihood of teacher buy-in, but possibly at the expense of uniform implementation. It would be useful if at least one science teacher at each grade level in every school agreed to pilot an entire JASON curriculum. Only in this way can the true impact of JASON be determined. These "designated demonstration" classes also could be the focus of training videos and visits from teachers wanting to see what full implementation of JASON looks like.

Seeing that school principals understand the JASON program and what it is designed to achieve also will be critical to the initiative's success. Steps have been taken in each district to inform principals about JASON. This process must continue as new principals replace incumbents. Further, all principals should receive training on what to look for to determine whether or not high quality science instruction is being provided to students. Principals are in the best position to take action when instruction is found to be inadequate.

The last recommendation concerns the training provided by JASON Learning. Given the importance of sustaining reforms like JASON over time and education's dismal record of doing so, it is recommended that a component of each JASON training program be devoted to helping educators understand the process of educational change, the challenges it presents, predictable sources of resistance to change, and the keys to sustaining momentum. These are not topics, it should be added, to which educators are typically exposed.

Growing the Chevron-JASON Initiative

Following the Theory of Action that proved effective with the initial trio of Houston-area school districts, Joni Baird sought recommendations for other Harris County Superintendents who were likely to support and sustain the JASON program. Dr. Mark Henry's name quickly surfaced. Henry is Superintendent of Cypress-Fairbanks ISD, one of the largest school districts in Texas with an enrollment exceeding 110,000 students. With a commitment by the district to implement JASON in all of its 17 middle schools and all of its afterschool programs, the addition of Cypress-Fairbanks to the Chevron-JASON portfolio promises to make a significant impact.

Following receipt of a check from Chevron of Houston in January of 2013, Cypress-Fairbanks made plans to train its coaches. The coaches, in turn, will go through the district pacing guides in science and determine where to embed JASON lessons. Once this task has been accomplished, the way will be cleared to commence training middle school science teachers.

Soon after the selection of Cypress-Fairbanks, the Superintendents of three other Harris County school districts – Humble ISD, Pasadena ISD, and Klein ISD – were invited to join the Chevron-JASON initiative. As in the case of Dr. Henry in Cyrpess-Fairbanks, all three were known for their receptivity to new ideas and interest in STEM education.

Dr. Guy Sconzo of Humble readily acknowledged that improvement was needed in the performance of Humble middle schoolers on the STAAR Grade 8 Science test. So committed to the JASON program was Sconzo that he insisted that coaches be trained even before receiving a check from Chevron of Houston. Desiring a program tailored specifically to the needs of Humble students and teachers, Sconzo requested that training for coaches and later teachers take place in Humble rather than JASON's Virginia headquarters. JASON Learning consented and arranged for national trainers to go to Texas. Following the training of coaches and teachers, plans were made to take advantage of Humble's Professional Learning Communities in order to extend and fine tune teachers' skills with JASON.

Sconzo expressed a strong desire to begin implementing JASON lessons in the sixth grade. "Waiting until 7th or 8th grade," he believes, "would be a mistake." Humble middle schools include

6th, 7th, and 8th grades, thereby making it relatively easy to accommodate Sconzo's wishes. Having all three grades on one campus also promises to simplify JASON training and implementation.

Life Sconzo, Dr. Kirk Lewis, Superintendent of Pasadena ISD, was nominated by his peers as a forward-thinking educational leader who would be receptive to the JASON program. Lewis, in fact, already had heard about JASON from fellow Harris County Superintendents before he was approached regarding the Chevron-JASON initiative. Leadership for Pasadena's implementation of JASON was delegated to Dr. Karen Hickman, Associate Superintendent for Curriculum and Instruction, and Becky Benner, Secondary Director. They, in turn, plan to rely heavily on Pasadena's middle school (grades 5-6) and intermediate campus (grades 7-8) Science Specialists as well as two high school Science Specialists.

Lewis and Hickman agree that JASON content first should be implemented in grades 7 and 8. They hope that eventually elements of the program will filter down to lower grades and up to high school. Pasadena educators believe strongly in the value of coaching. Becky Benner states emphatically, "Staff development without coaching is a waste of money." Hickman and Benner have laid the groundwork for continuous coaching to support teacher training in the JASON curriculums. One novel dimension of Pasadena's implementation efforts that underscores the district's commitment to coaching is "just in time" coaching. Prior to teachers trying out especially challenging JASON lessons, coaches will meet with science teachers to go over the difficult elements of the lessons.

Several other steps are being taken to facilitate JASON's implementation in Pasadena. Benner will be monitoring progress from the central office and helping principals to know when JASON is being implemented properly. Eduphoria, the electronic data base used to house the district's TEKS-based curriculum standards, will include links to JASON content, thereby making it easier for teachers and coaches to identify appropriate JASON lessons. Plans also have been made to bring together science teachers from different campuses to share what is working well with JASON.

Joining Sconzo and Lewis as newly involved Harris County Superintendents is Dr. James Cain of Klein ISD. Cain chose Sherri Lathrop, Instructional Officer, to lead the implementation effort in Klein, and it would be hard to find a better selection. Lathrop was exposed to the JASON program in graduate school and was quickly sold on its merits. She wasted no time in gearing up for JASON's implementation. Before Chevron of Houston presented a check to the district, Lathrop had worked out a two-year schedule of planning, training, and implementation meetings.

Careful not to get out too far in front of her colleagues, Lathrop wisely chose to go to the principals of intermediate campuses in order to get their support. The principals, in turn, indicated that their science teachers needed to endorse JASON's implementation. The teachers expressed excitement about what they heard. They already were working on placing greater emphasis on STEM education and engaging students in hands on science lessons and labs. JASON fit perfectly with Klein's emerging agenda for science.

Following training for district and campus Teacher Mentors at JASON headquarters in June of 2013, Lathrop arranged for all Klein intermediate campus science teachers to receive four days of training in July. Plans for Klein include implementing JASON in both regular 7th and 8th grade science classes and in pre-Advanced Placement science classes. Lathrop also expects to work with principals on conducting regular classroom walkthroughs to ensure that implementation of JASON lessons is proceeding smoothly.

Klein's commitment to science education is clearly reflected in the statement below, which appears on the district's website page devoted to the JASON program:

Science is the use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process.

The study of Science includes planning and safely implementing classroom and outdoor investigations using scientific processes. The major concepts in grades K-12 include:

- Physical Sciences (Matter, Energy, Force, and Motion)
- Earth and Space Science
- Life Sciences (Organisms and Environments)

JASON Project

The JASON Project (www.jason.org) is made possible by a grant from the Chevron Corporation. The JASON/Chevron partnership in Klein provides access to every staff member and student both in school and at home. JASON is a hands-on supplement to the Klein science curricula and can be used to place students in challenging, real-world situations where they are connected with top scientists and engineers. JASON Learning curriculum consists of Science, Technology, Engineering and Math (STEM) resources that:

- Inspire students through deep connections to STEM role models
- Fits within the Klein core curricula
- Aligns to state standards
- Adapts to higher and lower levels (emphasis in Klein ISD will be at the intermediate level)
- Includes articles, hands-on lab activities, videos, games/digital labs, and other multimedia resources

While implementation efforts proceed in Spring Branch, Aldine, Alief, Cypress-Fairbanks, Humble, Pasadena, and Klein, Joni Baird and Dr. Eleanor Smalley continue to explore new pathways to promoting STEM education and the JASON program. Now that JASON has gained traction in Harris County, Baird and Smalley have begun to consider the possibility of a state-wide initiative in Texas. Knowing that such an ambitious undertaking would require the involvement of other partners besides Chevron of Houston, they have approached Johnny Veselka, Executive Director of the Texas Association of School Administrators. As leader of the organization representing Texas Superintendents, Veselka is in a key position to enlist the support of school districts across the Lone Star State.

Smalley believes that the future of JASON depends on the formation of consortia of participating school districts. Steps in this direction already have been taken in Connecticut, Rhode Island, and West Virginia. An important benefit of the consortium model of educational reform concerns economies of scale. JASON Learning can lower the per pupil cost of training and materials if larger numbers of school districts are involved. In addition, bringing together groups of districts encourages the sharing of ideas and contributes to the generation of momentum for innovation.

Thinking big has not caused Joni Baird to forget about the work that remains to be done in the Houston area. Recently she forged a partnership with Linda Petrie of the Harris County Department of Education (HCDOE). Plans call for HCDOE representatives to attend national training sessions for JASON and determine ways that they can support local implementation efforts. Petrie also wants to identify and develop training videos of Houston-area teachers who are making outstanding use of JASON content.

There can be no doubt that STEM education in the Houston area has been energized by the partnership between Chevron of Houston, JASON Learning, and the participating school districts. The support of forward-thinking Superintendents has been gained, implementation leaders have been designated at district and school levels, teachers have been trained, and JASON content has been aligned with Texas standards. With "lift-off" achieved, the next challenge will be to demonstrate that JASON lessons can raise student achievement in science and simultaneously generate student interest in the further study of STEM subjects and in STEM-related careers.

Considering the Impact

The following section details the results of two means of evaluating the impact of the JASON Learning implementation on student outcomes. The first (Section 7.1) is based on analyses provided by individual districts and reflects their individual approaches and concerns. The second (Section 7.2) is a systematic comparison of implementation schools with all schools in the state completed by Battelle Memorial Institute. This approach allows us to simultaneously measure and highlight both the changes within school districts as well as how they compare to the state average.

Local outcome evaluations

In 2012, Texas students began taking a STAAR test in science in the 5th and 8th grades. The 8th grade test takes a cumulative look at what students have learned in 6th, 7th, and 8th grade science. Questions cover four areas of science: Matter and Energy; Force, Motion, and Energy; Earth and Space; and Organisms and Environment. Only the Grade 8 test results were examined because relatively few 5th graders were exposed to the JASON curriculums.

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State comparative evaluation

To assess the impact of JASON Learning on student science achievement in the Houston area, we obtained the official state summary reports of two annual state performance exams, the State of Texas Assessments of Academic Readiness (STAAR; 2012 and 2013) and the Texas Assessment of Knowledge and Skills (TAKS; 2009-2012)[1]. Results for the percent of 8th grade students passing the science portion of the exams and the percent of students passing at the commended or advanced skill level were abstracted to an analytic database and graphed by the four Independent School Districts (IADs) in which JL has been adopted. To assess whether and for whom JASON Learning is improving student science achievement, this section compares student performance for all students in the State of Texas with all students of each JASON Learning IAD on these exams between 2009 and 2012.

In total, the findings presented in this chapter represent the efforts of 1,643,144 8th grade Texas students of whom 72,456 (4.41%) were in one of the four Houston IADs adopting JASON Learning. The JASON Learning IADs are Aldine, Alief, Cypress Fairbanks, and Spring Branch. The numbers of students who took the exam each year in each district and contributed to this analysis is presented in the Appendix as are the annual results for each IAD and sample described in this chapter. In general, the number of students contributing to each percentage displayed is large, and, in general, each estimate can be considered robust. Data are suppressed when the estimate is based on 50 or fewer students and the results for Asian students in Aldine, the results for White students in Aldine and Alief, and for all breakouts of Spring Branch students in 2009 should be viewed with caution as these results are based on the performance of between 50 and 100 students. It is important to recall

[1] *Available from http://www.tea.state.tx.us/. Data used include: 2013 & 2012 - Spring STAAR grades 3-8; 2011 - April TAKS 3-11 & Exit Level; 2010, 2009, 2008 - April TAKS 3-10 & Exit Level.*

that when the denominator of a percentage is small, the measured percent can change radically based on the performance of a few students.

Several statistics can be used to evaluate student performance and change in their performance over time. The simplest is the absolute difference in the percent of students meeting the standard or passing at a satisfactory level. For example, in 2013, 75.0% of all Texas students taking the STAAR science exam passed at the satisfactory level. This can be compared with the 77.0% of students in a JASON Learning IAD who likewise passed the science exam, an absolute difference of JASON-Texas of 2.0% (positive values favoring JASON Learning, negative values favoring Texas; See Table 1).

This metric, however, does not provide information on whether students have improved over time, and if students have improved more in JASON Learning IADs relative to the improvement by all students in the State of Texas. For this, we want to compare the change in performance for all Texas students (3.0% improvement) between 2009 and 2013 with the improvement by JASON Learning students over the same period (10.3% improvement). Differencing the change (DIC) in percent of students passing the exam provides a measure of how JASON Learning students improved relative to all Texas students taking the exam. By this measure, the relative improvement of students exposed to JASON Learning improved 7.3% relative to all Texas students.

One additional consideration should be noted in interpreting these statistics. As percentages approach their numeric boundaries, demonstrating change is restricted. As percentages approach 0%, declining performance is increasingly difficult to demonstrate. As they approach 100% improvement is more difficult to demonstrate. Moreover, users of findings tend to be more sensitive to minor changes in percent values as percentages are nearer to these natural boundaries. That is, a 1% change from 50% to 51% does not tend to be given the same attention as a 1% change from 99% to 98%.

The Percent of Student Passing at the Satisfactory or Met Standard Level

The findings presented in Table 1 provide several stories. For both Texas and JASON Learning IADs, in 2013 Asian, White, and Gifted and Talented students are among the highest performing students. However, Hispanic/Latino, Black or African American, Title 1 Part A, Special Education, and At-risk students in JASON Learning IADs notably outperformed their Texas counterparts in 2013. In fact, a greater percentage of JASON Learning students in each demographic breakout, but Asian, displayed satisfactory performance in 2013 when compared to all Texas students.

Table 1: Percent of Students: Satisfactory or Met Standard for State Assessment Exams						
	State of Texas, 2013	Average JASON 2013	Difference JASON-Texas 2013	Texas Change 2009-2013	JASON Change 2009-2013	Difference in Change JASON-Texas
All Students	75.0	77.0	2.0	3.0	10.3	7.3
Male	77.0	79.3	2.3	2.0	8.0	6.0
Female	73.0	75.3	2.3	3.0	7.3	4.3
Hispanic/Latino	68.0	74.5	6.5	4.0	11.8	7.8
Asian	93.0	92.0	-1.0	3.0	2.0	-1.0
Black or African American	63.0	68.3	5.3	4.0	6.6	2.6
White	86.0	88.5	2.5	0.0	1.8	1.8
Title 1, Part A	69.0	74.3	5.3	3.0	12.6	9.6
Current LEP	43.0	45.3	2.3	13.0	8.0	-5.0
ESL	42.0	44.8	2.8	13.0	8.8	-4.3
Special Education	36.0	41.5	5.5	-2.0	1.5	3.5
Gifted and Talented	98.0	99.8	1.8	1.8	0.0	1.1
At Risk	52.0	59.8	7.8	3.0	8.3	5.3

Change in performance over time tells a slightly different story, however. Between 2009 and 2013, the percentage of Texas students displaying satisfactory performance improved in each demographic category with the exception of White students (no change) and students in Special Education (-2%). By contrast, over the same period, every demographic group in JASON Learning IADs, with the exception of Gifted and Talented students (no change), showed improvement. Between 2009 and 2013 there was impressive improvement in the overall percentage of students passing at the satisfactory or met standards level in JASON Learning IADs and those JASON Learning groups showing the greatest improvement over the period are Hispanic/Latino (7.8%) and low income family (Title 1, Part A; 12.6% improvement) students.

Comparing the improvement in JASON Learning IADs with the overall improvement in Texas on the percent of students passing at the satisfactory or met standard level, the improvement was greater for every category of student for those students in JASON Learning with four exceptions. Between 2009 and 2013, JASON Learning students with current limited English proficiency (LEP), English as a second language (ESL), Asian, and Gifted and Talented students did not improve as much as Texas state students overall. Between 2009 and 2013, the percentage of Texas LEP students passing at a satisfactory or met standard level improved 13.0% to JASON Learning's 8.0% (DIC = -5.0%). A similar DIC is observed over the same period for ESL students (-4.3%), while Asian students showed a trivial -1.0% DIC between 2009 and 2013. It can be noted that the high percentage of Asian students passing in 2009 makes demonstrating improvement difficult.

In addition to the impressive overall DIC for students in JASON Learning IADs (7.3%) several categories of JASON Learning students showed impressive improvement in the percentage of students passing the STAAR or TAKS at the satisfactory or proficient level. In particular, relative to all Texas students, the percentage of passing Hispanic/Latino students in JASON Learning IDAs improved 7.8%, the percentage of passing Title 1, Part A students improved 9.6%, and the percentage of At-risk students improved 5.3% in JASON Learning IDAs relative to all Texas students.

The Percent of Student Passing at the Commended or Advanced Level

Given the difficulty of passing at the commended or advanced level, the percentage of students passing at this advanced level shows a somewhat different story (see Table 2). The greatest percentage of students passing at this higher level for both Texas and JASON Learning IDAs are Gifted and Talented students (50.0% and 64.0%, respectively), Asian students (42.0% and 38.5%, respectively), and White students (23.0% and 27.5%, respectively). Perhaps not surprisingly, passing at the advanced level is very difficult for several groups. Students with a current LEP, who are ESL or At-risk students, and those in Special Education in particular have few members passing at the advanced level. For Black or African American students in both Texas and JASON Learning, passing at the commended or advanced level is difficult (5.0% and 6.3%, respectively).

Table 2: Percent of Students: Commended or Advanced

	State of Texas, 2013	Average JASON 2013	Difference JASON-Texas 2013	Texas Change 2009-2013	JASON Change 2009-2013	Difference in Change JASON-Texas
All Students	14.0	14.8	0.8	-10.0	-2.0	8.0
Male	16.0	17.8	1.8	-12.0	-2.0	10.0
Female	12.0	11.5	-0.5	-9.0	-6.8	2.2
Hispanic/Latino	8.0	8.8	0.8	-7.0	-3.3	3.8
Asian	42.0	38.5	-3.5	-6.0	-8.8	-2.8
Black or African American	5.0	6.3	1.3	-6.0	-4.8	1.3
White	23.0	27.5	4.5	-16.0	-2.5	13.5
Title 1, Part A	9.0	11.0	2.0	-8.0	0.3	8.3
Current LEP	1.0	1.8	0.8	-1.0	-0.3	0.8
ESL	1.0	1.5	0.5	-1.0	-0.5	0.5
Special Education	3.0	3.3	0.3	-3.0	-3.5	-0.5
Gifted and Talented	50.0	64.0	14.0	-17.0	-10.7	6.3
At Risk	2.0	3.5	1.5	-4.0	-1.3	2.8

Nonetheless, in 2013 students in JASON Learning IDAs outperformed their Texas student counterparts by 0.8%. The greatest difference (14.0%) was for the percent of Gifted and Talented students passing at the advanced level. In 2013, only Asian JASON Learning IAD students did not show a greater percentage of students passing at the advanced level (-3.5%).

In 2012, Texas replaced the TAKS exam with the STAAR exam, resulting in a reduced percentage of students passing the Grade 8 science assessment at the commended or advanced level. The percentage of all students in Texas passing at this advanced level declined 10.0%, while the percentage of JASON Learning students declined 2.0%. The greatest decline for Texas students was for Gifted and Talented students (17%), White students (-16%) and Male students (-12%). JASON Learning Gifted and Talented students also showed the greatest decrease in the percent passing at the advanced level (-10.7%) followed by Asian students (-8.8%) and Females (-6.8%). This suggests that it is more difficult to demonstrate advanced performance on the STAAR exam, than it was to show commended performance on the TAKS exam.

Nonetheless, relative to all Texas students, students in JASON Learning IDAs showed greater advanced science learning in 2013 in every category but Female (-0.5% difference) and Asian (3.5% difference). The difference in exceptional achievement in science performance between JASON Learning IADs and Texas students overall becomes particularly apparent when comparing the difference in change over time. For every category but Asian (2.8%) and special education (-0.5%), students in JASON Learning IADs showed less of a reduction in students passing at the advanced level relative to all Texas students. Overall, the DIC for students in JASON Learning IDAs is 8.0% between 2009 and 2013. Male students, White students, and Title 1, Part A students in JASON Learning IDAs show notably less decline in the number of students passing at the advanced level relative to all Texas students (DIC = 10.0%, 13.5%, and 8.3% respectively).

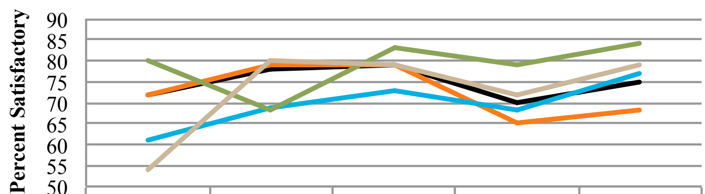
Discussion

Clearly, the 72,456 students in JASON Learning IADs are demonstrating superior performance in 8th grade science relative to all 1,643,144 students in Texas who took state standardized tests between 2009 and 2013. In total and in nearly every subgroup examined, a greater percentage of students in JASON Learning IADs are passing these standardized tests at both the satisfactory or met standard level and at the commended or advanced level. Likewise, over the five years of data included in this assessment, with few exceptions, students in JASON Learning IADs show greater improvement in passing at the satisfactory or met standard level and a reduced decline in the number of students passing at the commended or advanced level. However, as with all data, these results should be interpreted with caution.

In particular, these results are presented in the context of IADs which have adopted JASON Learning and contrasted with the results from the total number of students tested in Texas. To the extent that JASON Learning IAD students contribute to the total Texas result (4.4%), the difference observed is conservative. That is, the difference between the two results would be somewhat greater if the contribution of JASON Learning students to the total score was algebraically subtracted from the total student score prior to comparing the results.

Moreover, the average results for JASON Learning IADs are presented at the district-and not individual-level. That is, the average performance of the JASON Learning IADs calculated by equally weighting the contribution of each IAD and not by the number of students in each IAD who took and passed the exam. Further reducing the precision of the estimates is the precision at which standardized test results are reported. Prior to Texas adopting the STAAR exam in spring 2012, the number of students passing at the met standard or commended performance level was not reported in public documents. Percentage results for the TAKS exam are reported in whole numbers (e.g., 70%), limiting the sensitivity of the analysis to detect small and even modest changes in student performance over time.

All Students: Percent Passing



	2009	2010	2011	2012	2013
State of Texas	72	78	79	70	75
Aldine	72	79	79	65	68
Alief	61	69	73	68	77
Cypress Fairbanks	80	68	83	79	84
Spring Branch	54	80	79	72	79

Of perhaps greater concern is that state performance exams based on large numbers of students taking the exam might be expected to show stability over time. That is, student test performance would not be expected to vary greatly from year to year. Improving schools would be expected to show steady increases in student performance, while the performance of students in unchanging or declining schools would be expected to show level or declining performance, respectively, over time. For the State of Texas and the JASON Learning IADs there is considerably more variability from year to year in the percent of students passing at the met standard or satisfactory level (Figure 1). The dip apparent for all results in 2012 may be attributable to the introduction of the STAAR exam, while the poor performance of Cypress Fairbanks in 2010 may be attributable to the non-representative sample of students taking the TAKS exam that year. Only 164 Cypress Fairbanks students took the TAKS exam in 2010, compared to 7,047 in 2009, 7,456 in 2011, 7,731 in 2012, and 7,773 in 2013.

Summary

Data from the STAAR and TAKS exams support the conclusion that students in JASON Learning IADs are outperforming Texas students in science. In 2013, JASON Learning IDAs returned higher percentages of students passing science at the satisfactory and advanced levels in almost every student category. Moreover, the improvement over time in the percent of students passing science at the satisfactory and advanced levels almost every student category is greater in for JASON Learning IDAs than for Texas students. Strongly attributing that gain in performance to the introduction and use of JASON Learning, however, requires data beyond than those summarized here. While causality is best inferred from randomized control trials, pooled analyses of evidence from multiple implementations of controlled before and after trials would provide strong evidence of the contribution of JASON Learning to improving student science achievement. For the moment, the evidence is consistent that Texas IADs which adopt JASON Learning are improving student science achievement and are improving it faster than would be expected relative to Texas state averages. JASON Learning is clearly one component of a progressive strategy to improve student science achievement.

Implementation of JASON curriculums is well under way in all three school districts, but some curriculums and some curriculum components are in greater use than others. It is likely that implementation across all five curriculums will even out with more training and continued efforts to align JASON content with the TEKS and district pacing guides.

Large percentages of teachers in all three districts believe that JASON lessons enhance middle school science instruction and that many students are being helped to develop science skills as a result of exposure to JASON content. Substantial percentages of students also credit JASON with helping them achieve competence in science. There is evidence that some students are considering further study of science and science-related careers as a result of exposure to JASON lessons, but these percentages clearly are not as great as Chevron of Houston, JASON Learning, or the three school districts would like. Teachers offer a variety of reasons why they plan to continue using JASON lessons. Their reasons range from the need to accelerate learning for high achievers to JASON's emphasis on student collaboration.

Though early in the process of implementing JASON in Spring Branch, Aldine, and Alief, all three districts posted gains on the STAAR Grade 8 Science test in 2013. The time and effort required by teachers to learn about JASON and put JASON lessons into practice do not appear to have had any negative consequences in terms of student achievement. Most indications are that the three districts are poised to continue making gains as more teachers receive training and more JASON components are implemented.

Future directions in evaluating JASON Learning impacts

JASON Learning is partnering with Chevron and Battelle to consider new and exciting ways to evaluate the impact of JASON Learning in the Houston implementation areas. The past 20 years have seen significant changes in education with respect to classroom accountability and commitment to identifying and implementing evidence-based practices. The same period has seen the widespread dissemination and adoption of quantitative data management and analysis tools, an explosion in the ability to share and transmit data, and the ability to rapidly compile those data into electronic data "dashboards," for immediate feedback to teachers and other education stakeholders.

We propose that these changes provide the data, desire, tools, and platform necessary to build a scientifically robust system to harness evidence from the vast natural experiment which is the American Education System.

In every classroom teachers are experimenting with different curricula, different techniques, and different approaches to improving student achievement. We propose creating a surveillance system which collects evidence of the effectiveness of these efforts and assesses the strength, consistency, specificity, temporality, and coherence of each approach over many implementations.

Although classrooms differ, many are adopting the same intervention to improve student achievement. The proposed platform collects the results of each of these implementations to a central platform where modern statistical methods will be used to estimate whether, when, and for whom each intervention improves academic achievement. Moreover, since teachers are adopting different interventions, the effectiveness of different interventions can be compared to establish which practices work better and under what conditions.

A 21st century methodology routinizes the management and analysis of data, and provides instant feedback through an electronic (dashboard) allowing teachers to evaluate how their classroom's performance compared to other classrooms using a similar intervention, and to assess how the results of that intervention compares with the results of those using other intervention practices.

By making teachers central to the production of evidence this approach supports the American Association of School Administrators 2002 call for the use of data for innovation. Making the results immediately available to teachers and other education professionals through the dashboard creates an immediate evidence dissemination cycle supporting the adoption of effective practices.

The proposed method combines the epidemiology and effectiveness research traditions to create a surveillance system to discover what works, for whom, and in what contexts. The tools, infrastructure, and technologies of 21st century research provide the opportunity to accelerate the accretion of evidence and identify innovative practices and interventions for improving learning at all levels. To do this, the proposed method inverts the phase model of research and substitutes estimates of the consistency of independent replications in real world settings (high external validity) for the causal claims of the experimental design (high internal validity). Advances in statistical theory provide the means for a rigorously testing the strength and consistency of impact for each intervention, and for testing the difference in effectiveness between interventions. Instead of relying on education theorists and the few experimentalists available to test those theories, teachers become the source for hypothesizing and documenting what works, for whom, and under what conditions.

The Enlightened Partnership

There cannot be an adequate conclusion to this story of STEM education success without fully understanding the impact of the public-private partnership that brought JASON Learning into a growing number of school districts in the Houston area, and is being replicated in districts across the United States. It is important to look briefly at the principles of economics and management science as they relate to education – and as Adam Smith taught us, to know that a beneficial relationship such as that enjoyed by Chevron Corp. and the ISDs does not require that a company and its customers are seeking the same goals.

Chevron is a pioneer in this type of public-private partnership, and a successful one. The model is slightly different elsewhere and with other organizations. In Louisiana, the Baton Rouge Area Foundation, dedicated to improving the lives of people in its region, has funded JASON's implementation of STEM curricula in districts throughout the state. The Institute of Scrap Recycling Industries (ISRI) is supporting JASON programs in collaboration with its 1,600 members across the country.

The roots of America's urgency to train specialists in science, technology, engineering and mathematics, as we noted early in this book, go back many decades to the recognition that we were not educating enough students in the disciplines we need to succeed as a nation. Those decades saw many attempts to remedy the situation, but for many reasons that we discussed, those attempts were usually less than adequate. The product we were delivering — an educated student, was often not given the education that could be utilized fully in the real world, but that instead was aimed at scoring well on tests, whose results would prove little more than that we had taught them the rote answers that the existing system said they needed to know. We had made STEM unexciting and uninspiring, detached it from our economic needs, and given our children little reason to build those subjects into their future. Our failure was not just to those students never taught to inquire and explore, but also to our society and economy, which was ready to employ people with the right skills and training, but couldn't find them among the millions graduated with the wrong sheepskin in hand. Both the students and their eventual employers were the customers of our education system, but like Soviet-era central planning, we were giving them lots of products they could not use, and few that they could.

The companies that drive America's economy are not in the business of basic education. They expect to see among the newly graduated a surfeit of talent and subject-matter literacy from which they can choose the employees that will ensure their future success. If a corporation cannot find that budding electrical engineer or biochemist it needs to supply innovative and in-demand products and services to its customers, the business will not perform up to its potential. More importantly, in our version of market capitalism, that corporation will not satisfy the expectations of its owners — the shareholders — and the resulting economic punishment could be failure, mediocrity, lost jobs and lost opportunities. On a national scale, segments of our economy, as we have seen time and again in sectors such as cars and consumer electronics, could lose sales and market share to countries where educational direction and achievement were aligned more closely with the needs of business and industry. An economic kingdom could be lost, "all for the want of a horseshoe nail" — e.g., that student educated in the disciplines our society needs.

Mr. Adams took a cold view of business and its motives, even as he developed the early economic theories that help us understand trade and commerce, which are among the most human of undertakings. "It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own interest," Adams wrote in The Wealth of Nations. "We address ourselves, not to their humanity but to their self love, and never talk to them of our necessities but of their advantages." In other words, if a customer receives any benefit from a transaction, it was only because the businessperson takes his benefit first. On a larger scale, a corporation might, accidentally, do something positive for society, but its sole intent is to do something positive for itself.

Today, that unforgiving version of economic thought has been turned on its ear, by companies such as Chevron, in the development of public-private partnerships like that which has brought JASON Learning to the Houston area. Rather than the view of "what's good for us might be good for society, but we don't really care," the enlightened corporate perspective sees that doing something good for society might have a benefit for the company down the road, but it is society that is the sure winner in the transaction. In the case of Chevron, a global energy company, it needs scientists, technicians and engineers to produce and process the fuels that the world on relies today and far into the future. The company has invested millions of dollars to bring STEM education through JASON Learning to hundreds of thousands of students in the Alief, Aldine, Cypress-Fairbanks, Humble, Katy, Klein, Pasadena, Spring, Spring Branch and South West Schools ISDs. Among those hundreds of thousands of kids newly interested and excited by STEM subjects, there might – just might – be a few who will drive Chevron's future as a vital American energy company, one that keeps our society on the move, and with its success rewards its shareholders.

Of course, there is no guarantee that this investment will come to benefit Chevron, but the company sees it as worth the risk. And here is where the genius of public-private partnerships truly becomes clear, because a private company must take risks to protect and prepare its business for the future, while a public entity such as a school district, spending the taxpayers' money rather than its own, cannot. Chevron, in identifying its own problem of hiring skilled personnel in the coming years and decades, chose to tackle a societal problem as part of its solution. The company liked what it saw so much in the initial phases reported on in the previous chapters that it broadened and extended its commitment to give schools, students and teachers long-term access to JASON Learning. As we noted early in this book, a short-term investment in training teachers or buying new textbooks does not produce lasting improvement. What is required is an enduring change in the culture of education – which is the model that JASON had developed and proven over 25 years – that could be implemented in schools and districts, was up-to-date, met all state standards, and was flexible enough to fit into coursework in any classroom. With the participation of a committed corporation, and a local education establishment that sees the solution for its known problems in JASON Learning, the public-private partnership enables the systemic and sustainable reform that both parties can agree will yield the benefits both of them seek.

JASON Learning plays many roles as the facilitator of this innovative model of STEM education, and those roles complement what the school districts and corporations bring to the table. With its founding and ongoing mission to broadly improve and expand STEM learning nationwide and led by people who have committed their lives and careers to education, JASON has crafted its central position in this public-private partnership to be one that adds tangible value for each of the other actors. JASON partners with the schools to offer timely and innovative curricula that meet their local needs and standards; it trains and coaches teachers and supervisors, delivers student interactions with real scientists in the classroom and via remote learning opportunities, and sponsors one-of-a-kind experiences that put students and teachers aboard a sea-going research vessel every year to take part in actual scientific exploration.

For the companies and funding organizations, JASON Learning customizes its standards-based curricula to show students the applications of what they are studying to the real world. In partnership with ISRI, for example, JASON has developed specific modules that teach students about the science of scrap, and like Chevron, ISRI hopes the partnership with schools will someday result in more trained scientists and engineers available to its own increasingly technological industry.

Finally, as a non-profit, JASON takes its own proactive steps to enhance the value of its partnerships to an extent that a for-profit education enterprise would likely be unable to provide. JASON in the Houston area has given three years of free access to its classroom and online programs, worth about $1 million per year to each district, to help seed this new culture of STEM learning that Chevron and the ISDs are working to make real.

In the districts where JASON Learning has been implemented, educators and students have been gripped by the new-found focus on scientific literacy brought about by the partnership. Superintendents and teachers have found curricula that not only fit their need to education students in the STEM subjects, but fit into local cultures and methodologies through their flexibility and adaptability to the local system. This empowerment brings a resurgence of excitement, commitment and achievement at the school and district level, even as it fills the immediate needs that are unique and best understood within each local system.

At the same time, a consistent set of metrics embodied in the JASON program allows individual districts to gauge and report on student progress in a way that can be tracked and compared with implementation elsewhere. Like the science JASON teaches, it is replicable and verifiable, and works with the uniqueness of each school district, without attempting to impose an antipodal element into a functioning system that needs a specific innovation, not an educational coup d'état, to achieve the cultural change it requires.

Going forward, Chevron and JASON Learning are ramping up their partnership with the Houston-area districts as they head into the second year of evaluations. The first indications of success have been strong enough to more than double the extend of partnership form four districts to 10, and bring the new opportunities it offers to hundreds of thousands of additional students.

In the end, it is quite clear that supporters of this ground-breaking public-private model for STEM education, among whom Chevron is to be especially lauded, have evolved beyond the economics of Adam Smith and Milton Friedman, the Nobel Prize-winning economist who wrote in Capitalism and Freedom (Chicago: University of Chicago Press, 1962) that, "There is one and only one social responsibility of business – to use its resources and engage in activities designed to increase its profits..." Coming forward to educate thousands of children in STEM is unlikely to yield to a company a benefit that can be directly correlated with its investment. But it will yield a great benefit to our society that will be measured in the health and vitality of our nation and economy for decades to come. In a public-private partnership, the private company is planting a seed, and one day will get a bite of the apple. The public at large will reap a veritable orchard.

Appendix

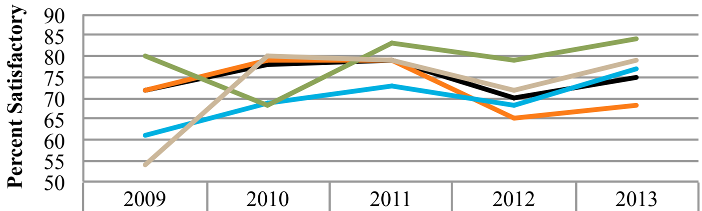
JASON Learning's Performance

Appendix 1, Table 1: Number of Students Tested

		All Students	Male	Female	Hispanic / Latino	Asian	Black or African American	White	Title 1, Part A	Current LEP	ESL	Special Ed.	Gifted and Talented	At Risk
2009	State of Texas	313,896	158,043	155,703	142,562	11,216	44,127	114,637	172,543	18,461	16,777	17,757	35,493	130,304
	Aldine	3,887	1,911	1,976	2,455	74	1,235	123	3,887	273	239	128	288	2,084
	Alief	2,806	1,374	1,431	1,363	331	1,006	104	2,805	313	307	90	132	1,632
	Cypress Fairbanks	7,047	3,648	3,397	2,498	622	1,197	2,710	44	288	231	302	561	2,457
	Spring Branch	117	72	45	82	-	21	14	97	65	65	-	-	91
2010	State of Texas	319,712	161,182	158,371	147,554	12,153	43,980	114,534	188,192	20,140	18,460	16,636	37,161	128,304
	Aldine	3,729	1,817	1,912	2,461	64	1,088	113	3,729	392	354	91	283	1,907
	Alief	2,825	1,396	1,429	1,372	358	964	104	2,796	404	375	95	191	1,608
	Cypress Fairbanks	164	117	47	71	6	46	41	107	45	42	-	-	135
	Spring Branch	2,070	1,034	1,036	1,089	159	122	698	1,103	314	307	109	211	789
2011	State of Texas	329,614	166,448	163,003	158,974	11,568	42,084	109,481	202,925	20,365	18,915	16,672	37,971	126,722
	Aldine	3,930	1,975	1,955	2,678	63	1,062	77	3,928	316	293	165	245	2,040
	Alief	2,783	1,392	1,390	1,370	354	956	86	2,725	342	320	108	204	1,463
	Cypress Fairbanks	7,456	3,711	3,742	2,988	585	1,226	2,456	3,963	290	244	264	468	2,210
	Spring Branch	2,091	1,092	999	1,107	126	115	674	1,112	255	253	120	231	863
2012	State of Texas	336,661	170,689	165,811	164,987	11,338	43,373	109,273	205,976	21,893	20,253	18,524	35,096	132,381
	Aldine	4,140	2,088	2,052	2,814	65	1,126	88	4,136	371	342	219	256	2,189
	Alief	2,699	1,389	1,310	1,344	304	952	85	2,654	280	268	95	183	1,372
	Cypress Fairbanks	7,731	3,895	3,836	3,173	568	1,282	2,470	4,404	292	250	311	481	2,722
	Spring Branch	2,179	1,109	1,070	1,162	139	144	692	1,158	280	271	110	238	890
2013	State of Texas	343,251	172,931	170,321	169,928	11,864	43,395	110,090	205,946	23,624	21,594	17,020	36,820	126,852
	Aldine	4,112	2,052	2,060	2,819	65	1,103	84	4,111	442	409	167	267	2,069
	Alief	2,650	1,305	1,345	1,386	299	867	82	2,617	333	331	78	186	1,336
	Cypress Fairbanks	7,773	4,001	3,772	3,207	617	1,321	2,440	4,454	253	212	292	424	2,348
	Spring Branch	2,267	1,173	1,094	1,235	143	143	688	1,226	305	301	73	209	958

Key: Cells containing fewer than 50 students tested highlighted in Red. Cells containing between 51 and 200 students tested highlighted in Yellow.

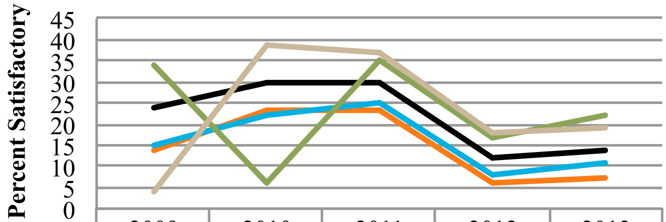
All Students: Percent Passing



	2009	2010	2011	2012	2013
State of Texas	72	78	79	70	75
Aldine	72	79	79	65	68
Alief	61	69	73	68	77
Cypress Fairbanks	80	68	83	79	84
Spring Branch	54	80	79	72	79

All Students: Percent Satisfactory or Met Standard						
Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	72.0	78.0	79.0	70.0	75.0	3.0
JASON Average	66.8	74.0	78.5	71.0	77.0	10.3
Difference	-5.3	-4.0	-0.5	1.0	2.0	7.3
Annual State Change		6.0	1.0	-9.0	5.0	
Annual JASON Change		7.3	4.5	-7.5	6.0	

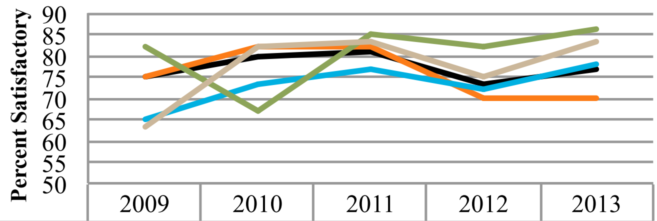
All Students: Percent Commended or Advanced



	2009	2010	2011	2012	2013
State of Texas	24	30	30	12	14
Aldine	14	23	23	6	7
Alief	15	22	25	8	11
Cypress Fairbanks	34	6	35	17	22
Spring Branch	4	39	37	18	19

All Students: Percent Commended or Advanced						
Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	24.0	30.0	30.0	12.0	14.0	-10.0
JASON Average	16.8	22.5	30.0	12.3	14.8	-2.0
Difference	-7.3	-7.5	0.0	0.3	0.8	8.0
Annual State Change		6.0	0.0	-18.0	2.0	
Annual JASON Change		5.8	7.5	-17.8	2.5	

Males: Percent Passing

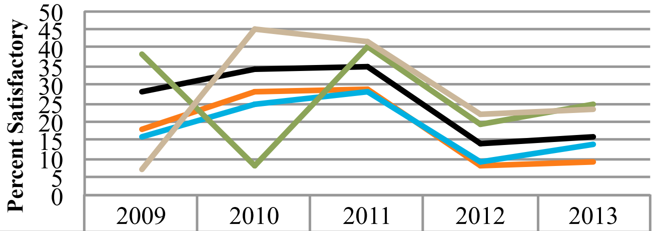


	2009	2010	2011	2012	2013
State of Texas	75	80	81	73	77
Aldine	75	82	82	70	70
Alief	65	73	77	72	78
Cypress Fairbanks	82	67	85	82	86
Spring Branch	63	82	83	75	83

Male: Percent Satisfactory or Met Standard

Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	75.0	80.0	81.0	73.0	77.0	2.0
JASON Average	71.3	76.0	81.8	74.8	79.3	8.0
Difference	-3.8	-4.0	0.8	1.8	2.3	6.0
Annual State Change		5.0	1.0	-8.0	4.0	
Annual JASON Change		4.8	5.8	-7.0	4.5	

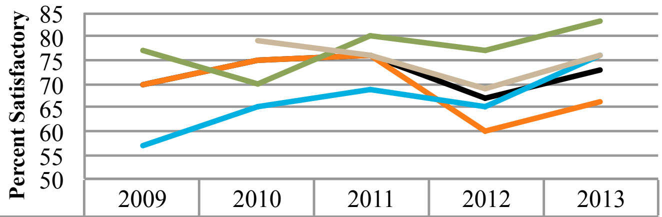
Males: Percent Commended or Advanced



	2009	2010	2011	2012	2013
State of Texas	28	34	35	14	16
Aldine	18	28	29	8	9
Alief	16	25	28	9	14
Cypress Fairbanks	38	8	40	19	25
Spring Branch	7	45	42	22	23

Male: Percent Commended or Advanced						
Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	28.0	34.0	35.0	14.0	16.0	-12.0
JASON Average	19.8	26.5	34.8	14.5	17.8	-2.0
Difference	-8.3	-7.5	-0.3	0.5	1.8	10.0
Annual State Change		6.0	1.0	-21.0	2.0	
Annual JASON Change		6.8	8.3	-20.3	3.3	

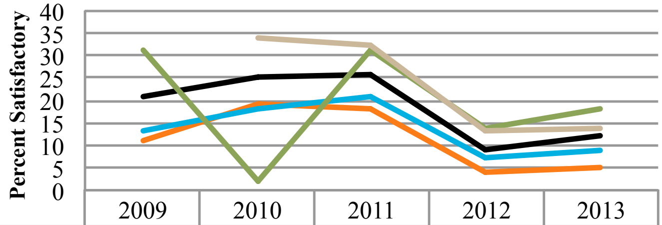
Females: Percent Passing



	2009	2010	2011	2012	2013
State of Texas	70	75	76	67	73
Aldine	70	75	76	60	66
Alief	57	65	69	65	76
Cypress Fairbanks	77	70	80	77	83
Spring Branch		79	76	69	76

Female: Percent Satisfactory or Met Standard						
Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	70.0	75.0	76.0	67.0	73.0	3.0
JASON Average	68.0	72.3	75.3	67.8	75.3	7.3
Difference	-2.0	-2.8	-0.8	0.8	2.3	4.3
Annual State Change		5.0	1.0	-9.0	6.0	
Annual JASON Change		4.3	3.0	-7.5	7.5	

Females: Percent Commended or Advanced

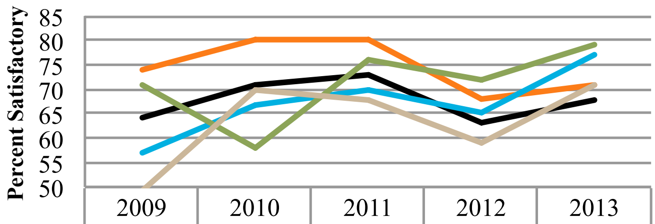


	2009	2010	2011	2012	2013
State of Texas	21	25	26	9	12
Aldine	11	19	18	4	5
Alief	13	18	21	7	9
Cypress Fairbanks	31	2	31	14	18
Spring Branch		34	32	13	14

Female: Percent Commended or Advanced

Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	21.0	25.0	26.0	9.0	12.0	-9.0
JASON Average	18.3	18.3	25.5	9.5	11.5	-6.8
Difference	-2.7	-6.8	-0.5	0.5	-0.5	2.2
Annual State Change		4.0	1.0	-17.0	3.0	
Annual JASON Change		-0.1	7.3	-16.0	2.0	

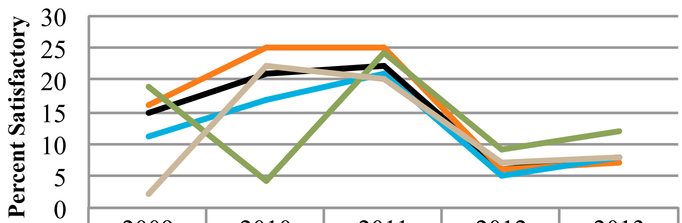
Hispanics: Percent Passing



	2009	2010	2011	2012	2013
State of Texas	64	71	73	63	68
Aldine	74	80	80	68	71
Alief	57	67	70	65	77
Cypress Fairbanks	71	58	76	72	79
Spring Branch	49	70	68	59	71

Hispanic/Latino: Percent Satisfactory or Met Standard						
Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	64.0	71.0	73.0	63.0	68.0	4.0
JASON Average	62.8	68.8	73.5	66.0	74.5	11.8
Difference	-1.3	-2.3	0.5	3.0	6.5	7.8
Annual State Change		7.0	2.0	-10.0	5.0	
Annual JASON Change		6.0	4.8	-7.5	8.5	

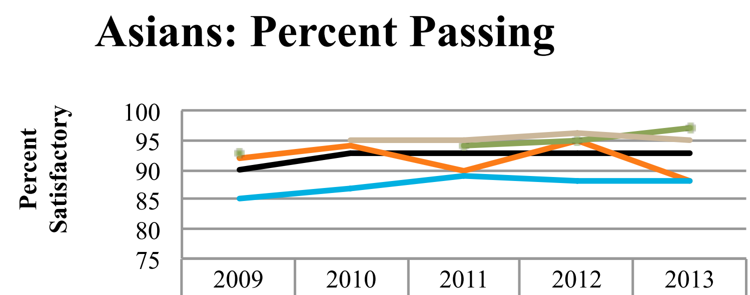
Hispanics: Percent Commended or Advanced



	2009	2010	2011	2012	2013
State of Texas	15	21	22	6	8
Aldine	16	25	25	6	7
Alief	11	17	21	5	8
Cypress Fairbanks	19	4	24	9	12
Spring Branch	2	22	20	7	8

Hispanic/Latino: Percent Commended or Advanced

Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	15.0	21.0	22.0	6.0	8.0	-7.0
JASON Average	12.0	17.0	22.5	6.8	8.8	-3.3
Difference	-3.0	-4.0	0.5	0.8	0.8	3.8
Annual State Change		6.0	1.0	-16.0	2.0	
Annual JASON Change		5.0	5.5	-15.8	2.0	

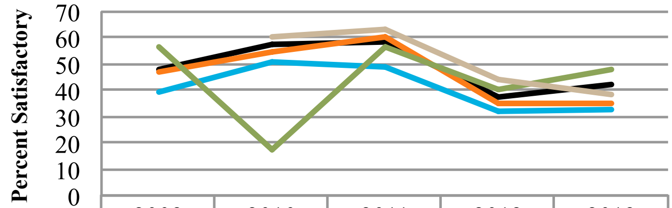


	2009	2010	2011	2012	2013
State of Texas	90	93	93	93	93
Aldine	92	94	90	95	88
Alief	85	87	89	88	88
Cypress Fairbanks	93		94	95	97
Spring Branch		95	95	96	95

Asian: Percent Satisfactory or Met Standard

Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	90.0	93.0	93.0	93.0	93.0	3.0
JASON Average	90.0	92.0	92.0	93.5	92.0	2.0
Difference	0.0	-1.0	-1.0	0.5	-1.0	-1.0
Annual State Change		3.0	0.0	0.0	0.0	
Annual JASON Change		2.0	0.0	1.5	-1.5	

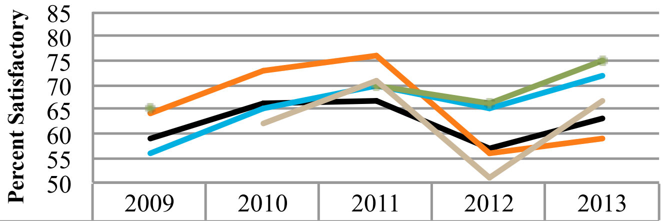
Asians: Percent Commended or Advanced



	2009	2010	2011	2012	2013
State of Texas	48	57	58	37	42
Aldine	47	55	60	35	35
Alief	39	51	49	32	33
Cypress Fairbanks	56	17	56	40	48
Spring Branch		60	63	44	38

Asian: Percent Commended or Advanced						
Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	48.0	57.0	58.0	37.0	42.0	-6.0
JASON Average	47.3	45.8	57.0	37.8	38.5	-8.8
Difference	-0.7	-11.3	-1.0	0.8	-3.5	-2.8
Annual State Change		9.0	1.0	-21.0	5.0	
Annual JASON Change		-1.6	11.3	-19.3	0.8	

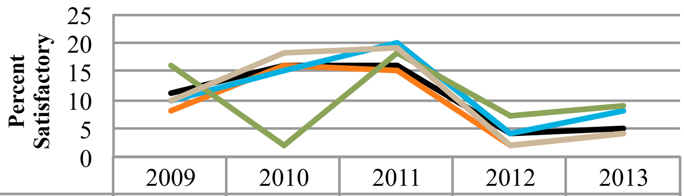
African American: Percent Passing



	2009	2010	2011	2012	2013
State of Texas	59	66	67	57	63
Aldine	64	73	76	56	59
Alief	56	65	70	65	72
Cypress Fairbanks	65		70	66	75
Spring Branch		62	71	51	67

Black or African American: Percent Satisfactory or Met Standard						
Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	59.0	66.0	67.0	57.0	63.0	4.0
JASON Average	61.7	66.7	71.8	59.5	68.3	6.6
Difference	2.7	0.7	4.8	2.5	5.3	2.6
Annual State Change		7.0	1.0	-10.0	6.0	
Annual JASON Change		5.0	5.1	-12.3	8.8	

African American: Percent Commended or Advanced

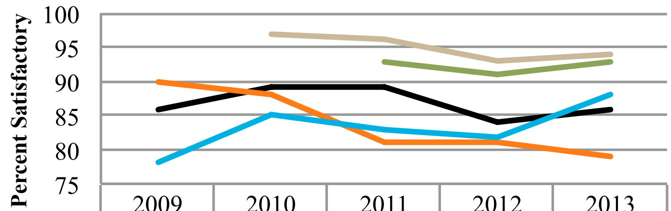


	2009	2010	2011	2012	2013
State of Texas	11	16	16	4	5
Aldine	8	16	15	2	4
Alief	10	15	20	4	8
Cypress Fairbanks	16	2	18	7	9
Spring Branch	10	18	19	2	4

Black or African American: Percent Commended or Advanced

Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	11.0	16.0	16.0	4.0	5.0	-6.0
JASON Average	11.0	12.8	18.0	3.8	6.3	-4.8
Difference	0.0	-3.3	2.0	-0.3	1.3	1.3
Annual State Change		5.0	0.0	-12.0	1.0	
Annual JASON Change		1.8	5.3	-14.3	2.5	

White: Percent Passing

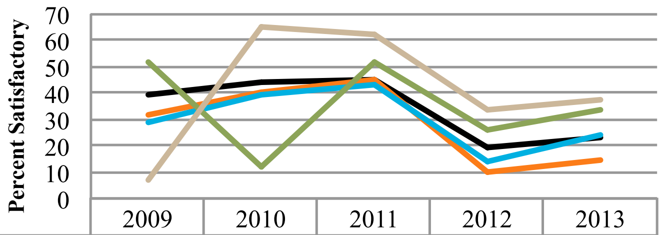


	2009	2010	2011	2012	2013
State of Texas	86	89	89	84	86
Aldine	90	88	81	81	79
Alief	78	85	83	82	88
Cypress Fairbanks	92		93	91	93
Spring Branch		97	96	93	94

White: Percent Satisfactory or Met Standard

Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	86.0	89.0	89.0	84.0	86.0	0.0
JASON Average	86.7	90.0	88.3	86.8	88.5	1.8
Difference	0.7	1.0	-0.8	2.8	2.5	1.8
Annual State Change		3.0	0.0	-5.0	2.0	
Annual JASON Change		3.3	-1.8	-1.5	1.8	

White: Percent Commended or Advanced

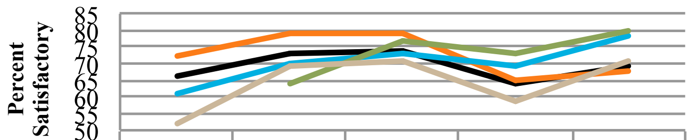


	2009	2010	2011	2012	2013
State of Texas	39	44	45	19	23
Aldine	32	40	45	10	15
Alief	29	39	43	14	24
Cypress Fairbanks	52	12	52	26	34
Spring Branch	7	65	62	34	37

White: Percent Commended or Advanced

Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	39.0	44.0	45.0	19.0	23.0	-16.0
JASON Average	30.0	39.0	50.5	21.0	27.5	-2.5
Difference	-9.0	-5.0	5.5	2.0	4.5	13.5
Annual State Change		5.0	1.0	-26.0	4.0	
Annual JASON Change		9.0	11.5	-29.5	6.5	

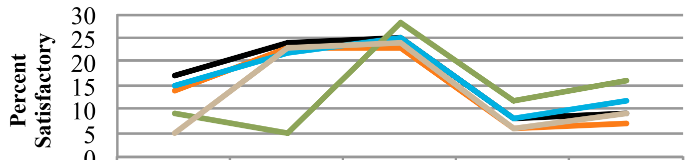
% Passing: Title I, Part A Participants



	2009	2010	2011	2012	2013
State of Texas	66	73	74	64	69
Aldine	72	79	79	65	68
Alief	61	70	73	69	78
Cypress Fairbanks		64	77	73	80
Spring Branch	52	69	71	59	71

Title 1, Part A: Percent Satisfactory or Met Standard						
Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	66.0	73.0	74.0	64.0	69.0	3.0
JASON Average	61.7	70.5	75.0	66.5	74.3	12.6
Difference	-4.3	-2.5	1.0	2.5	5.3	9.6
Annual State Change		7.0	1.0	-10.0	5.0	
Annual JASON Change		8.8	4.5	-8.5	7.8	

Title I, Part A: Percent Commended or Advanced

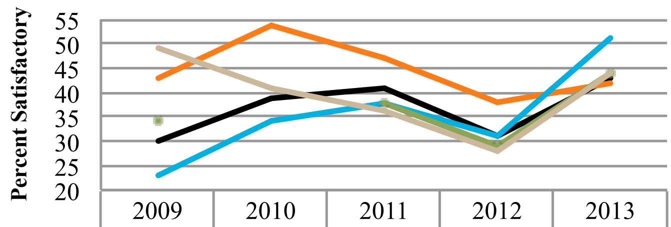


	2009	2010	2011	2012	2013
State of Texas	17	24	25	8	9
Aldine	14	23	23	6	7
Alief	15	22	25	8	12
Cypress Fairbanks	9	5	28	12	16
Spring Branch	5	23	24	6	9

Title 1, Part A: Percent Commended or Advanced

Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	17.0	24.0	25.0	8.0	9.0	-8.0
JASON Average	10.8	18.3	25.0	8.0	11.0	0.3
Difference	-6.3	-5.8	0.0	0.0	2.0	8.3
Annual State Change		7.0	1.0	-17.0	1.0	
Annual JASON Change		7.5	6.8	-17.0	3.0	

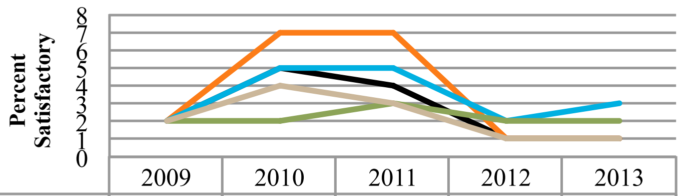
Current LEP: Percent Passing



	2009	2010	2011	2012	2013
State of Texas	30	39	41	31	43
Aldine	43	54	47	38	42
Alief	23	34	38	31	51
Cypress Fairbanks	34		38	29	44
Spring Branch	49	41	36	28	44

Current LEP: Percent Satisfactory or Met Standard						
Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	30.0	39.0	41.0	31.0	43.0	13.0
JASON Average	37.3	43.0	39.8	31.5	45.3	8.0
Difference	7.3	4.0	-1.3	0.5	2.3	-5.0
Annual State Change		9.0	2.0	-10.0	12.0	
Annual JASON Change		5.8	-3.3	-8.3	13.8	

Current LEP: Percent Commended or Advanced

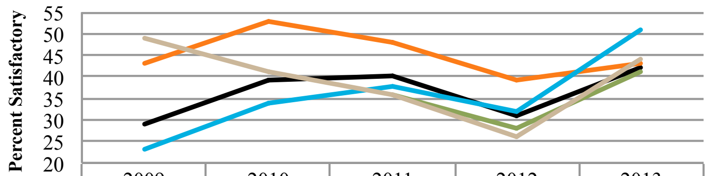


	2009	2010	2011	2012	2013
State of Texas	2	5	4	1	1
Aldine	2	7	7	1	1
Alief	2	5	5	2	3
Cypress Fairbanks	2	2	3	2	2
Spring Branch	2	4	3	1	1

Current LEP: Percent Commended or Advanced

Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	2.0	5.0	4.0	1.0	1.0	-1.0
JASON Average	2.0	4.5	4.5	1.5	1.8	-0.3
Difference	0.0	-0.5	0.5	0.5	0.8	0.8
Annual State Change		3.0	-1.0	-3.0	0.0	
Annual JASON Change		2.5	0.0	-3.0	0.3	

ESL: Percent Passing

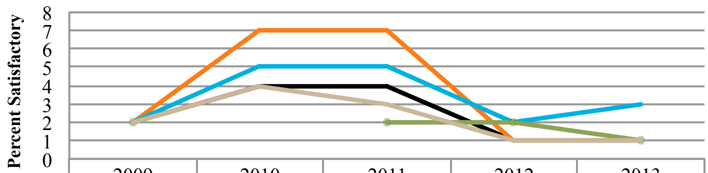


	2009	2010	2011	2012	2013
State of Texas	29	39	40	31	42
Aldine	43	53	48	39	43
Alief	23	34	38	32	51
Cypress Fairbanks	29		36	28	41
Spring Branch	49	41	36	26	44

ESL: Percent Satisfactory or Met Standard

Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	29.0	39.0	40.0	31.0	42.0	13.0
JASON Average	36.0	42.7	39.5	31.3	44.8	8.8
Difference	7.0	3.7	-0.5	0.3	2.8	-4.3
Annual State Change		10.0	1.0	-9.0	11.0	
Annual JASON Change		6.7	-3.2	-8.3	13.5	

ESL: Percent Commended or Advanced

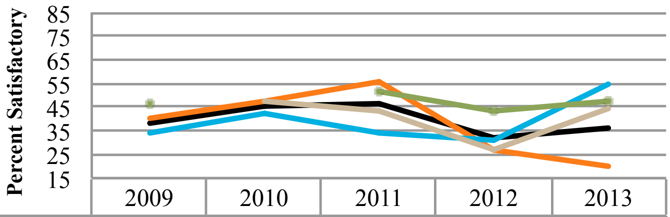


	2009	2010	2011	2012	2013
State of Texas	2	4	4	1	1
Aldine	2	7	7	1	1
Alief	2	5	5	2	3
Cypress Fairbanks	2		2	2	1
Spring Branch	2	4	3	1	1

ESL: Percent Commended or Advanced

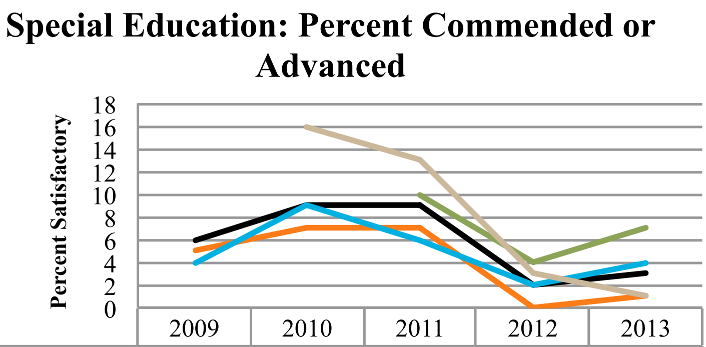
Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	2.0	4.0	4.0	1.0	1.0	-1.0
JASON Average	2.0	4.0	4.3	1.5	1.5	-0.5
Difference	0.0	0.0	0.3	0.5	0.5	0.5
Annual State Change		2.0	0.0	-3.0	0.0	
Annual JASON Change		2.0	0.3	-2.8	0.0	

Special Education: Percent Passing



	2009	2010	2011	2012	2013
State of Texas	38	45	46	32	36
Aldine	40	47	56	27	20
Alief	34	42	34	31	55
Cypress Fairbanks	46		52	43	47
Spring Branch		48	43	27	44

Special Ed Yes : Percent Satisfactory or Met Standard						
Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	38.0	45.0	46.0	32.0	36.0	-2.0
JASON Average	40.0	45.7	46.3	32.0	41.5	1.5
Difference	2.0	0.7	0.3	0.0	5.5	3.5
Annual State Change		7.0	1.0	-14.0	4.0	
Annual JASON Change		5.7	0.6	-14.3	9.5	

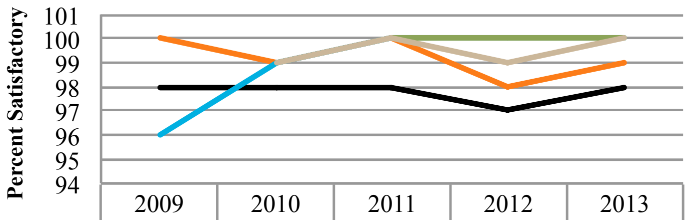


	2009	2010	2011	2012	2013
State of Texas	6	9	9	2	3
Aldine	5	7	7	0	1
Alief	4	9	6	2	4
Cypress Fairbanks	11		10	4	7
Spring Branch		16	13	3	1

Special Ed Yes: Percent Commended or Advanced

Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	6.0	9.0	9.0	2.0	3.0	-3.0
JASON Average	6.7	10.7	9.0	2.3	3.3	-3.4
Difference	0.7	1.7	0.0	0.3	0.3	-0.4
Annual State Change		3.0	0.0	-7.0	1.0	
Annual JASON Change		4.0	-1.7	-6.8	1.0	

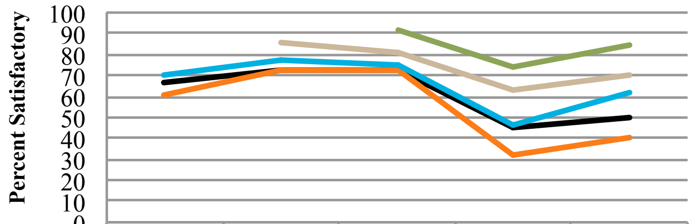
Gifted and Talented: Percent Passing



	2009	2010	2011	2012	2013
State of Texas	98	98	98	97	98
Aldine	100	99	100	98	99
Alief	96	99	100	100	100
Cypress Fairbanks	100		100	100	100
Spring Branch		99	100	99	100

Gifted and Talented Participants: Percent Satisfactory or Met Standard						
Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	98.0	98.0	98.0	97.0	98.0	0.0
JASON Average	98.7	99.0	100.0	99.3	99.8	1.1
Difference	0.7	1.0	2.0	2.3	1.8	1.1
Annual State Change		0.0	0.0	-1.0	1.0	
Annual JASON Change		0.3	1.0	-0.8	0.5	

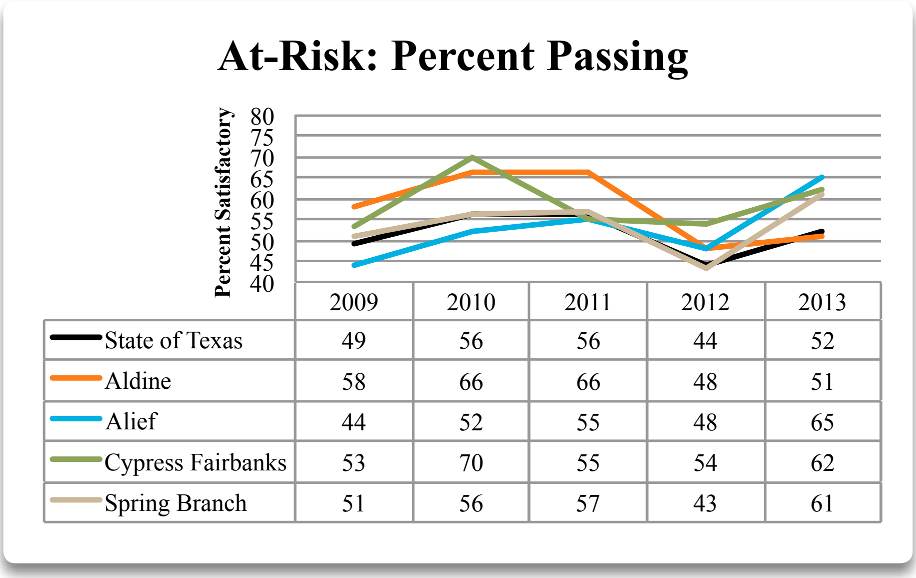
Gifted and Talented: Percent Commended or Advanced



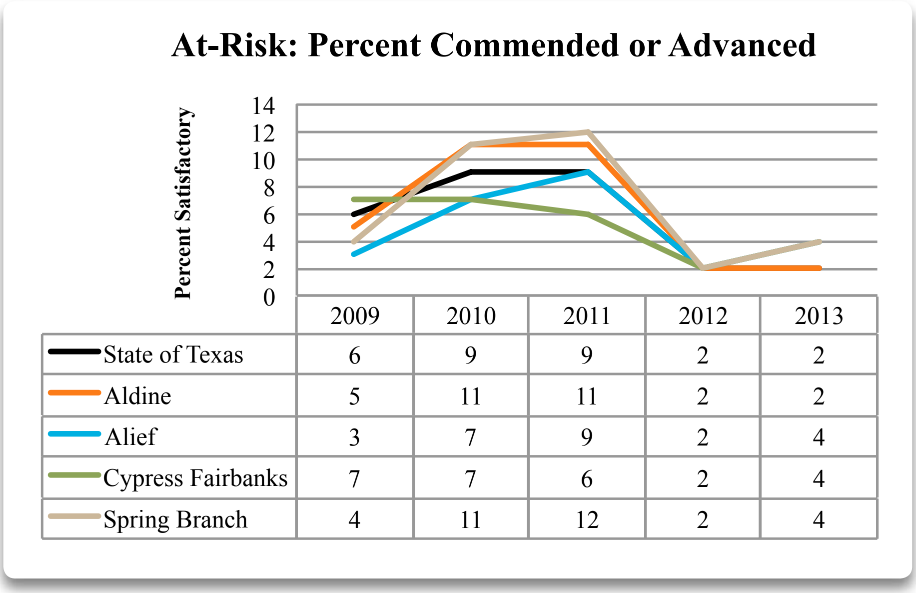
	2009	2010	2011	2012	2013
State of Texas	67	72	73	45	50
Aldine	61	73	73	32	40
Alief	70	77	75	46	62
Cypress Fairbanks	93		92	74	84
Spring Branch		86	81	63	70

Gifted and Talented Participants: Percent Commended or Advanced

Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	67.0	72.0	73.0	45.0	50.0	-17.0
JASON Average	74.7	78.7	80.3	53.8	64.0	-10.7
Difference	7.7	6.7	7.3	8.8	14.0	6.3
Annual State Change		5.0	1.0	-28.0	5.0	
Annual JASON Change		4.0	1.6	-26.5	10.3	



At Risk Yes: Percent Satisfactory or Met Standard						
Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	49.0	56.0	56.0	44.0	52.0	3.0
JASON Average	51.5	66.5	58.3	48.3	59.8	8.3
Difference	2.5	10.5	2.3	4.3	7.8	5.3
Annual State Change		7.0	0.0	-12.0	8.0	
Annual JASON Change		15.0	-8.3	-10.0	11.5	



At Risk Yes: Percent Commended or Advanced						
Year	2009	2010	2011	2012	2013	Change 2009-2013
State of Texas	6.0	9.0	9.0	2.0	2.0	-4.0
JASON Average	4.8	9.0	9.5	2.0	3.5	-1.3
Difference	-1.3	0.0	0.5	0.0	1.5	2.8
Annual State Change		3.0	0.0	-7.0	0.0	
Annual JASON Change		4.3	0.5	-7.5	1.5	

About the Author

Entering his 40th year in academia, Duke focuses his work on turning around low-performing schools. After helping to develop the University of Virginia's School Turnaround Specialist Program (a joint operation of the Curry School of Education and the Darden Graduate School of Business Administration), he worked on the Texas Turnaround Leadership Academy and the Florida Turnaround Leaders Program. Prior to these activities, Duke created the Thomas Jefferson Center for Educational Design, a multi-disciplinary think tank of scholars and practitioners in education, architecture, engineering, and sociology. Prior to coming to the University of Virginia, Duke served on the faculty of Stanford University's School of Education and helped to launch the graduate school at Lewis and Clark University.

Contributors

James Derzon is a psychologist with over 19 years of meta-analysis and cross-site research experience and is a nationally recognized expert in prevention science and the impact of research methods and procedures on study findings.

Jim Zebora is a principal and senior writer with The Dilenschneider Group. His career includes 20 years as a business editor with newspapers in the Times-Mirror, Tribune and Hearst groups.