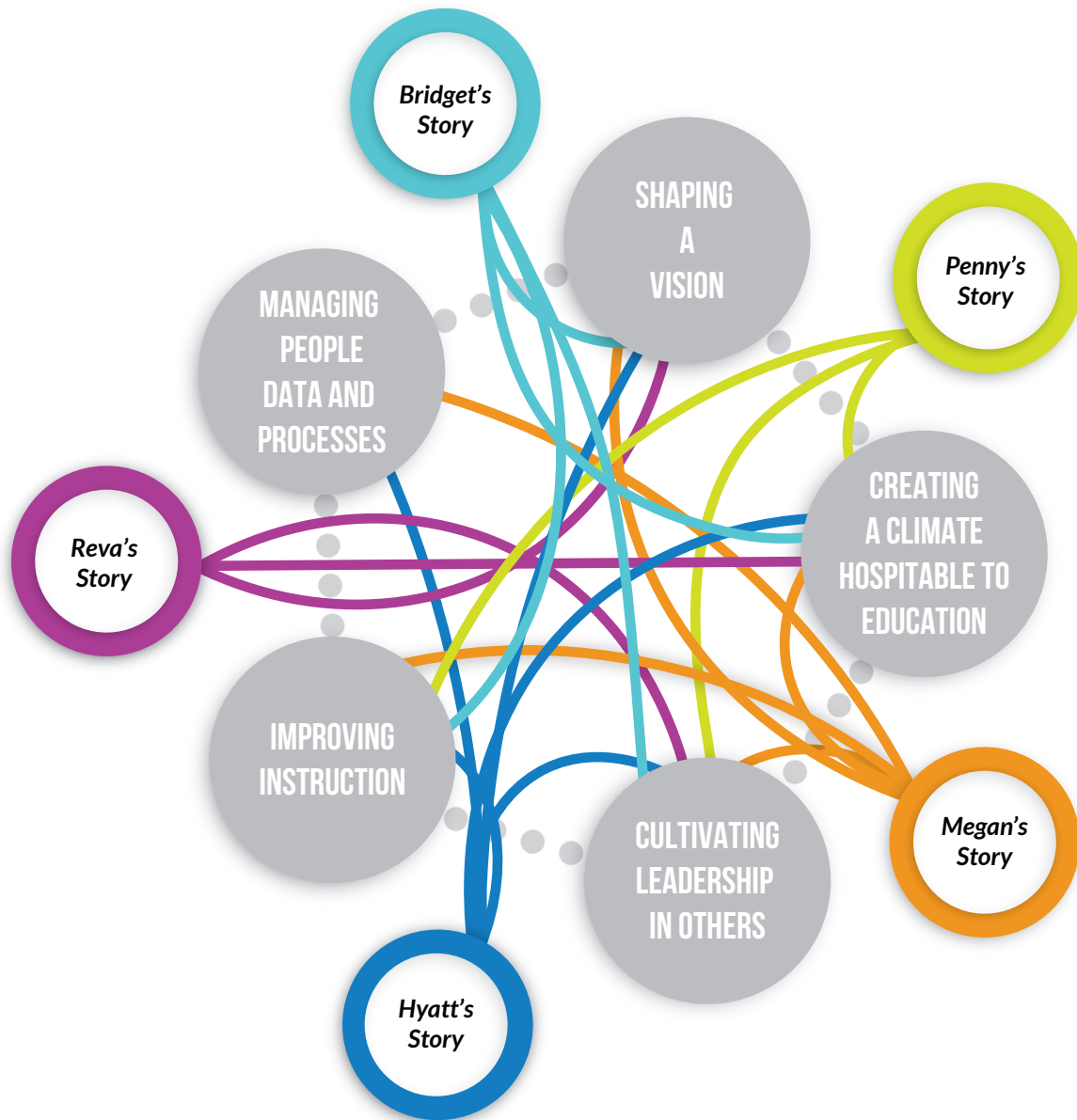


Principles of Science for Principals

Stories of Science

Instructional Leadership



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Introduction to the Principals' Stories of Science Instructional Leadership



Our goal in writing these stories for the Principles of Science for Principals project was to illustrate how the leadership practices of skilled principals can help individual teachers and whole schools improve science teaching and learning in Washington State. To do so we solicited suggestions from educational leaders across the state who identified a group of 17 principals having strong knowledge and skills in science instructional leadership and strong values of equity and access to science, technology, engineering and mathematics (STEM) for every student. From this candidate pool, we have written stories built from in-depth interviews with 5 of these principals.

We analyzed the science instructional leadership work of our interviewees and organized their stories using the 5 Pivotal Practices noted in the research on principal leadership in the 2012 Wallace Perspective Report "The School Principal as Leader: Guiding Schools to Better Teaching and Learning." These include:

1. **Shaping a vision** of academic success for all students based on high standards;
2. **Creating a climate hospitable to education** in order that safety, a cooperative spirit and other foundations of fruitful interaction prevail;
3. **Cultivating leadership in others**, so that teachers and other adults assume their part in realizing the school vision;
4. **Improving instruction** to enable teachers to teach at their best and students to learn at their utmost; and
5. **Managing people, data and processes** to foster school improvement.

The stories we developed provide vivid illustrations of how the **principals integrated these Practices to build a learning culture for science** that empowered their teachers and students. As we studied the interviews and emerging stories of these talented principals, we noted several key themes:

- The Pivotal Practices were interdependent and iterative versus linear.
- The principals' use of the Practices focused on improving both teacher and student learning.
- Context mattered. Each school situation was unique. The principals' ability to figure out the entry point, timing and intensity of effort was key to his or her success in improving science and/or STEM instruction for all students.
- It takes time and support to bring about meaningful change in schools and sustain it. And each story has continued to unfold as the change becomes integrated into the culture and matures.
- As challenging as the shift in science instructional practice was for many staff, all 5 principals and their staff teams were increasingly motivated by the powerful impact it made on classrooms and students' engagement in deep and meaningful learning.

A second key body of research that guided our stories is that of Mary Kay Stein and Barbara Nelson on "Leadership Content Knowledge." They found that leadership content knowledge was often a missing paradigm in the analysis of school and district leadership. Because we focused in this project on the specific nature of science instructional leadership by the principal versus general instructional leadership, their analysis of the issues faced by principals when they provide instructional help to teachers in an area outside of their competencies was most instructive.

Stein and Nelson describe a strategy called "postholing" that administrators use to develop additional expertise where they feel their content knowledge is insufficient to provide instructional leadership. "Postholing" has two parts. First, the leaders conduct in-depth explorations of important areas of a subject and how it is learned and taught. Then they translate that new understanding to guide adult learning of their staff. All of our 5 principals did "postholing" of some kind to strengthen their ability to lead school-wide change in science. They all had strong instructional leadership skills, but some needed better understanding of science or STEM content (science, technology, engineering and math) and/or instructional strategies. Others needed "postholing" around learning and instructional issues related to elementary versus secondary students. We will note these strategies as they pertain to each story.

The principals in our stories represent districts across a wide geographic spread in Washington State – east and west, urban and rural.* They lead at all levels of the K-12 system, but each of their schools serve diverse student bodies. Their district and community contexts varied and so did levels of support for the principal’s leadership in implementing school-wide science or STEM programs. STEM is an interdisciplinary and applied instructional approach coupled with hands-on, problem-based learning that engages students and expands their learning and career options. Three of our stories discuss the building of or transition to STEM schools. Many current societal issues – economic, cultural, and sustainability problems – will be reliant on strong STEM skills of our K-12 students as they transition to post-secondary education, the workforce, and citizenry. STEM includes a robust science education at its core. As such quality science, guided by state and national standards is crucial for every student across the spectrum of traditional, comprehensive schools to STEM aligned programs.

All the principals shared a deep personal belief in providing meaningful science instruction for all kids and a deep empathy for teachers as learners and the support they need to grow and change their practice. They knew that science and STEM knowledge, thinking skills and ability to apply learning to real world problems were all key to new opportunities for success in college and careers and productive lives in the 21st century.

There is no “silver bullet” in this important work of education. These stories are still unfolding and the principals and staff are still learning and growing. The changes they are making in their schools and communities are complex and require hard work, substantial time and systematic support to be sustainable. Just as essential is continued monitoring of impact on student learning and a commitment to adjust direction and strategy as needed based on that analysis. These principals are risk-takers and learners as well as leaders. We found the examples in each story powerful and compelling. Together, their stories build a collective vision of science instructional leadership that can can inform and inspire the education profession.

* Pseudonym names for principals and schools have been used for story-telling purposes.

Reflection Questions

The **Question Sets** below accompany the five Stories of Science Instructional Leadership from Bridget, Penny, Megan, Hyatt and Reva. Read the **Introduction** and each story, then use the self-reflection questions below to guide your thinking for professional learning in science leadership.

Question Set 1: Principal Science Content and Pedagogical Content Knowledge

Access to expertise is foundational to learning. Each principal sought to increase their own science content knowledge and knowledge of science teaching and learning. As well, they developed an understanding of what teachers might need to learn. Hyatt and Bridget already had strong science backgrounds and they figured out ways for teachers to access this expertise and that of STEM professionals in their communities. Hyatt knew that teachers' science learning depended on how they "wrestle with novel problems." He recognized that this was a way for teachers to truly understand what "rigorous, relevant and authentic" means for the teaching and learning of science.

- How might you cultivate your knowledge in science and expertise in how teachers teach and students learn science?
- "Postholing" recognizes that developing expertise in one content area can facilitate quicker learning in a new area. What content expertise do you currently have? How did you learn that content? What "ways of knowing" might be transferable to learning science content?
- What are the instructional strategies for science used in each story you could develop in your own practice?
- Penny and Reva sought out more knowledgeable colleagues to observe and discuss high quality science education. What learning opportunities could you seize for your understanding of what teachers' need to improve science instruction?
- Megan had a steep learning curve to understand science and STEM instruction. What science partners and expertise can you leverage in your community? Where might you find mentors or networks to support your own professional growth?

Question Set 2: Leveraging Strengths as a Starting Point

The principals in these stories leveraged the current strengths of their teachers as a starting point. Penny built upon the content knowledge of her science teachers and unified the entire staff around instructional best practice before working on STEM specific strategies. Megan and Bridget utilized the elementary instructional expertise of their

teachers and specialists to build a strong STEM vision. In the stories, the principals even utilized their staff to “posthole” for their own learning in a given area.

- What are the current knowledge, beliefs, and skills around science instruction in your building?
- What general instructional strengths does your staff already have that can be built upon to improve science instruction?
- How might you work and learn with your teachers to achieve your science/STEM vision?
- How might you and your teachers learn from one another and from your students?
- What data and processes can facilitate teacher learning in new instructional practice in science?
- What are the short-term goals for instruction that can build long-range capacity for science learning?

Question Set 3: Principal as Lead Learner

These stories illustrate the principals’ respect and collaboration with their teaching staff and their consistent modeling of taking a learner stance and keeping science/STEM education at the forefront of the school’s vision. For example, in the process of learning science content and pedagogy, Reva, Megan and Penny developed a strong conviction for the importance of science learning in today’s world. Their experiences honed their building’s mission to include equitable access and opportunity for all students in science. As well, these experiences were leveraged to model “learning along-side others” as each planned professional learning for their staff and the community.

- How can you demonstrate your own learning and make your science instructional leadership visible to your staff?
- What staff development strategies can support teachers as learners and risk-takers for improved science instruction?
- Based on your own experiences to develop your science content and pedagogical knowledge, what activities or scaffolds for adult learning do you see as critical to promote teacher leadership for science?
- What experiences do teachers need to understand the value and importance of science for all students as they prepare for advanced learning, careers, and citizenship in today’s world?

Question Set 4: Entry Points for Science Transformation

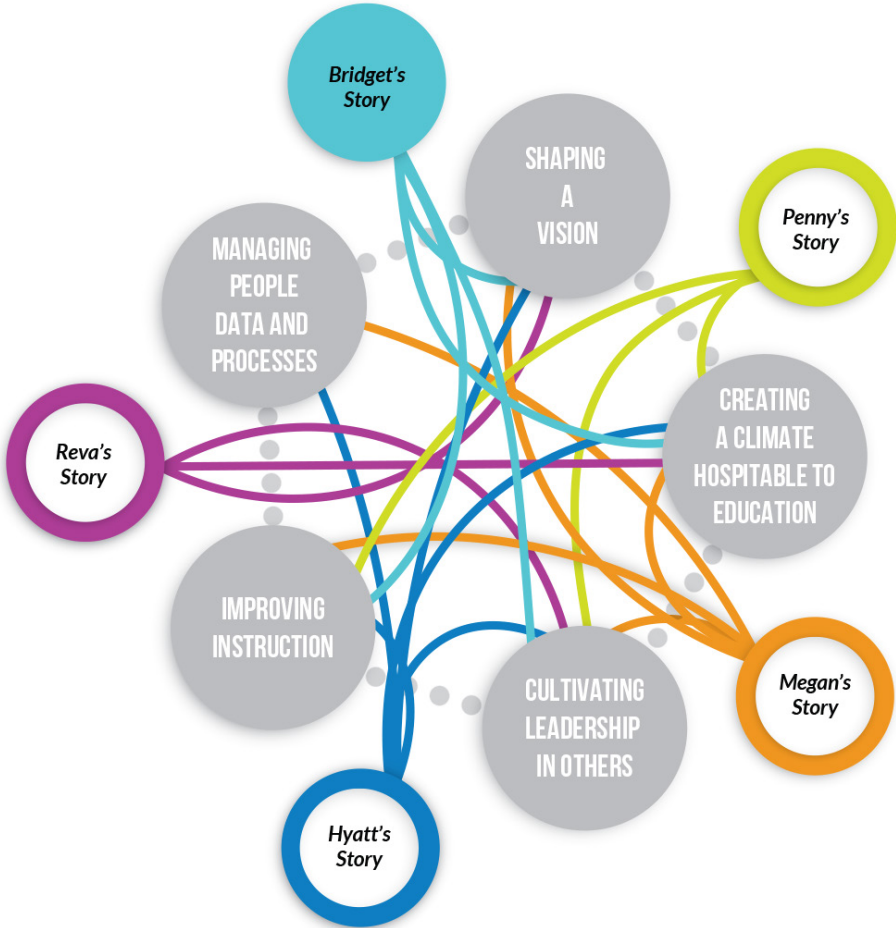
As a collective, the stories underscore the reality of multiple pathways to changing the learning culture of a school to support robust science/STEM teaching and learning. As noted in the Introduction, the 5 Pivotal Practices for instructional leadership are iterative and strongly context dependent. In real life, each principal exemplified all of the practices.

The Stories, however, highlight specific practices we interpreted as acutely leveraged by each Principal to develop strong leadership for science.

- What story context most closely aligns with your experience?
- Can you articulate one or two takeaways from the Stories for your own science instructional leadership practice?
- A vibrant science learning culture for your teachers, students and the community is the result of implementing all 5 Pivotal Practices. Which practice or set of practices might gain the most leverage toward building a strong science vision and learning culture at your school?
- How can you get the “lay of the land” in your own school in terms of what teachers know and are able to do toward access and opportunity for students in science?

Bridget's Story

Shaping a vision, creating a climate hospitable to education, cultivating leadership in others, and improving instruction



Bridget has designed and led a STEM (Science, Technology, Engineering, and Math) high school and an elementary school in the same district. This story highlights the impact of her ability to shape a STEM vision, and her science instructional leadership to implement that vision in collaboration with her staff and community leaders. It also illustrates the power of community and district context as these new STEM models have emerged. Cultivating shared instructional leadership was key to the growing STEM culture in her schools and the district.

Bridget has a rigorous science background and understands that meaningful science and STEM learning will open new and exciting possibilities in the lives, learning and careers of her students and their communities. Her commitment to deliver on that promise of opportunity drove her to develop her own instructional and leadership skills in science and integrated STEM learning, and to further extend them from secondary to elementary education.

Bridget's passion for science was sparked by a creative high school science teacher who motivated her to join the education profession. After a college program grounded in biology, chemistry and secondary education, she spent twelve years teaching secondary science nationally and internationally. Often one of the few women in her department, she learned from established science mentors in the field. This on-the-job training provided her with a solid background in the classic student laboratory experiments. From this foundation her interest in connecting science instruction to its application in the world around her increased, sharpening her desire to extend the theoretical to authentic problem-based learning for students.

Bridget came to Washington State with a Master's degree in the Natural Sciences, earned her administrative credentials and became a high school Science Department Chair. When her district set out to build a new regional STEM high school, Bridget was inspired by the challenge and real-world connections this school would afford students. She became their founding principal and had a deep influence on the development of the education program as well as the architectural design of the building itself, its labs and classroom space and equipment.

The school started with 9th grade only and built to 9th through 12th grade. The teachers recruited were talented and ready for a dynamic challenge. They and the whole community were intrigued by this STEM phenomenon and the chance to put it in action through a new kind of secondary program model. Supported by the district leaders and STEM industry experts, Bridget helped secure over \$700,000 in start-up grants from businesses and philanthropic foundations. Community leaders and organizations got behind the project and donated massive amounts of time, money, and expertise to the STEM high school project. This funding helped support a year to work and learn together, imagine student community internships and job shadows, and design the integrated, problem-based curriculum and instructional program of a STEM high school.

The community and the district leaders' commitment to expand the opportunities of the STEM learning vision to all their students required that they build a pipeline starting with the early grades. And once the high school was sufficiently established, Bridget was asked to take on that new challenge at the first of four new STEM elementary schools. She was excited to be able to lead development of the education program of the Buena Vista STEM Elementary as well as to influence the design of the facility to maximize STEM learning. She knew the importance of flexibility in the physical spaces of a building that was intended to do the interdisciplinary and interactive learning she was hoping to achieve. This school offered the promise of fully integrated STEM learning in Kindergarten through fifth grade classrooms, but now Bridget had some in-depth "postholing" to do to deliver on that promise. She knew the science content and secondary science instructional strategies to promote STEM integration, but elementary education was a new paradigm. She was a novice about student learning in the early years, the culture of an elementary school and the curriculum and instructional strategies elementary teachers would need to bring STEM to their young students.

Bridget's first goal was to help shape a vision of rigorous and engaging STEM learning successfully across the culture of the new school. And, while the district's strong support

of the STEM approach provided Bridget rare opportunities and resources there was also pressure to deliver a workable STEM model that other schools could replicate in a timely manner. So Bridget had to quickly learn a lot herself as a leader and simultaneously cultivate collaborative leadership in others.

To begin, Bridget listened to her school community and gathered their initial ideas about STEM. Staff, parents and volunteers were most comfortable and familiar with traditional, theme-based science projects. The emerging idea of deeper STEM instruction and learning that connected subject matter content through problem-based situations would take time to understand and develop together.

During the fall and winter of the design year before the school opened, Bridget worked extensively with elementary teachers who had been chosen for a voluntary district STEM planning team to develop the foundational documents for the new school- a K-6 scope and sequence, English/Language Arts integration strategies and general themes- to guide the actual units and lessons of year one at Buena Vista. Later that spring, Bridget recruited a pool of talented teachers from across the district who were “early adopters” of the STEM idea, including a core of the teachers from the district-sponsored STEM team. The district provided 10 days in August for the new staff to come together and build their first STEM instructional units based on the foundational documents developed in the previous year.

After all of her experience with secondary level content teachers, Bridget was truly impressed by the elementary teachers’ rich instructional understanding, skills and creativity in designing strategies that tapped into young children’s learning. In spite of this expertise, they were still unsure about the deeper meaning of the science content and the integrated applied learning strategies of the STEM approach. Building staff’s confidence and skills in these areas would need to be a priority for Bridget. To learn for herself and develop examples for the entire staff, Bridget worked with Elizabeth, a teacher leader on the third grade team at the school. Elizabeth, like many of her colleagues, was excited to understand and utilize Bridget’s knowledge and instructional approaches for science and STEM to make her students’ learning come alive in the real world. She wanted to tie important science concepts and facts to tangible actions that the students could take to own that information and apply what they were learning across the curriculum.

Together, Bridget and Elizabeth worked to create a STEM unit that modeled this approach. For example, students would first investigate the cotton gin from a science perspective. Students would learn how the machine worked and then consider how that invention affected the course of American history, the economy, and the rights of human beings. In another example, Bridget and the third grade team created a migration unit which related the migration of animals and people and then expanded to include the evolution of bacteria and viruses and the ways in which these pathogens are transmitted- another type of migration. In a timely, but fateful situation, they tied this foundational learning to an international Ebola crisis and the study of epidemiology and human rights. When Bridget, Elizabeth and the other teachers began the process of developing their curriculum and instructional approach, STEM began to take on new meaning across the grades. Bridget knew the power of science and integrated instruction and her talented and

pragmatic teacher team knew their students and the science standards those students were expected to attain. They wanted Bridget's knowledge to improve their practice, but they also knew better than Bridget the realities of elementary teaching in today's world of accountability. The process of developing a new curriculum framework helped them create a new and meaningful balance.

Together, they negotiated and developed a tiered approach to STEM instruction and learning that started with the state science standards for which they were accountable and then expanded to incorporate the deeper, more rigorous context related to the global issues that Bridget's STEM understanding and science knowledge brought to the table. Then they connected the important global learning to local issues facing their community and families, and finally to the students' lives and futures. This intense, complex and contextualized curriculum and instructional work was then tested and validated in the classroom with their students. Bridget's and the teachers' engagement and the insights they gained from this mutual development process ultimately led to meaningful engagement and deeper learning of their students.

As this science work progressed, Bridget recognized clearly that STEM instruction must be grounded in strong literacy and learning beginning in the primary grades and building across the school years. Once again, she knew that wasn't her forte, so she relied on the strong bilingual and K-2 background of her Assistant Principal and the deep understanding of reading, writing and second language development of the literacy leaders in her school to lead the work, with her learning along side the staff.

She also knew that Buena Vista needed strong family and community ownership and support to achieve their mission of STEM transformation. Early on, Bridget assembled a team that included over 80 STEM community and business leaders, parents, and students in defining and shaping their community's vision for STEM education. Now the heart of that vision- building all students' passion for learning and their desire to change the world- is everyone's vision and they are proud to support the work.

At Buena Vista, professional development, teacher evaluation and support are all aimed at improving integrated STEM instruction. The whole staff shares common planning time on Wednesdays from 1:30- 4:00 so they can discuss and refine units to insure that they are standards-based and designed to be accessible to the broad range of their diverse students. The teachers initially worked with Bridget's guidance and then, as trust and confidence in each other have developed, they worked interdependently with their teams and built their own instruction and leadership skills. This collaboration and mutual respect fosters a safe place for teachers to work and grow and for students to learn. Continuing forward, Bridget not only helps the Buena Vista staff but also staff from three emerging STEM elementary schools in the district and the STEM high school to explore the meaning of their STEM vision and guiding principles and how they impact the climate and instruction at the school level.

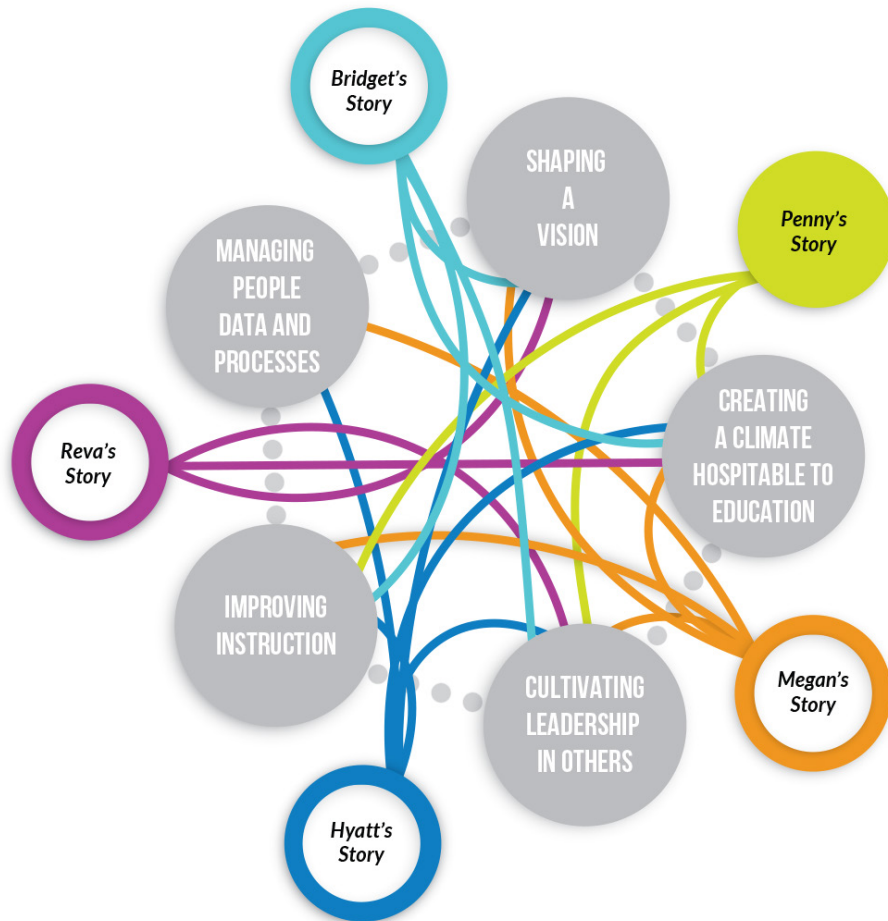
The Buena Vista staff are working very hard together and that work is paying off. The school is thriving and growing as they end their second year as a STEM elementary, but their story is still unfolding, and will be tested over time for its sustainability and impact

on learning and students' lives. Like all system change, it takes courageous, dedicated and skillful staff and leaders, the time to integrate new learning with existing strategies and structures, collaboration and ongoing meaningful support, analysis of impact and a willingness to use data to revise the plan. There is strong research that suggests at least 3 years of sustained effort is needed to see a real shift in student achievement and 5 years to institutionalize that change.

The three additional new STEM elementary schools each have their own unique visions and missions but continue to be supported in a deep way by Buena Vista's staff sharing of their foundational documents and STEM instructional units. Vital work for everyone lies ahead to sustain and grow the district's STEM programs. The accomplishments of the high school and Buena Vista need to be dissected to understand and support the challenging work and unique learning issues facing the new elementary leaders and their teams. The next chapters of this story will not only involve the STEM schools, but just as essentially, the district and the community. With any complex system change, "postholing" by the STEM school principals and their staff's, as well as district leadership and other stakeholders will continue to be essential to shape, support and sustain their community's STEM vision.

Penny's Story

Creating a climate hospitable to education, cultivating leadership in others, and improving instruction



The email from the Office Manager read, "No science subs available next Thursday." Penny pondered the message and wondered how to reschedule the learning day to provide time for her 9th grade team to meet. This was but one of the myriad of operational details she knew she must address to be attentive to her school's mission – "All students career and college-ready" – and make progress toward developing authentic science, technology, engineering, and mathematics (STEM) program opportunities for students on this journey. Penny's story focuses on creating a culture and climate for relevant learner-engaged classrooms and cultivating leadership in others toward collectively improving instruction.

Long before her woes with substitute shortages, Penny followed a unique path to becoming principal at her current high school. First and foremost, she served 7 years as a 2nd through 5th grade teacher and then library specialist. When Penny moved into her first administrative roles, she chose distinctive small school environments within her district –

an online high school, a K-12 school supporting homeschoolers, and an alternative high school. The first two positions required development of the school and curriculum from scratch. Eventually, Penny would serve as Principal in all three settings simultaneously.

Penny's strength leading for science began in these small school environments where she had to explore how to offer high quality science experiences in non-traditional classroom settings. In particular, the district Science Teaching and Learning Department questioned the ability to offer online science coursework that met the rigor of the hands-on, inquiry approach supported across regular classrooms throughout the district. Addressing this issue would exemplify one of Penny's strengths as an instructional leader. Penny's training and teaching experience was grounded in general elementary education; she was not a science content expert. Also, she was expanding her science leadership role to the secondary level, which involved different complexities than a self-contained classroom. Therefore, each new position required her to first be a learner before she could be a leader in designing effective science programming for her students or confidently coach her teachers. These areas exemplify the "post-holing" Penny needed to accomplish in science content, how students learn science, science instructional techniques and general operational strategies at different levels to build her expertise to lead her science teaching staff.

To begin her own learning, Penny searched out a colleague who could demonstrate quality science instruction and had expertise in using technology for instruction. She observed the energy, excitement, and engagement this teacher was able to inspire in his students using relevant context for the science learning. Through these and other classroom visits combined with numerous discussions, Penny developed a picture of "what science looks like" at the different grade levels and what key instructional strategies were needed to make that happen. Even though the delivery methods would vary in each of her small schools, Penny now had a strong vision for science instruction that could be adapted to the different settings. She knew that for students to access science content, they must first be engaged with relevant, context-driven curriculum and instruction. Coupled with hands-on experiences, some through computer simulations, the learning could be powerful.

Her science learning was reinforced by a very personal experience during this same time – Penny's father was diagnosed with a rare cancer. Penny took a deep dive into science content to better understand both his illness and the science behind the treatment he received. In a very visceral way, she learned the critical and direct link between understanding science and coping with real life situations. This experience demonstrated the skills and abilities students would need to have to access science learning throughout their own lives.

Penny was both humbled and emboldened with her new knowledge of science teaching and learning, and her newfound conviction that understanding, interpreting, and utilizing science on a personal level in today's technology and information-based society was crucial. In the alternative school setting, science was often seen as a barrier to graduation. Penny now saw science as offering authentic, purposeful opportunities that could ignite a student's passion to learn and acquire skills that mattered in the real world after

graduation- be it post-secondary schooling, participation in the workforce, or everyday life decisions. While often celebrated, increasing graduation rates alone were no longer enough for Penny. Truly preparing her students for their futures was her goal.

To put these ideals into the curriculum at each of the small schools was a challenge, given that face-to-face learning opportunities were limited based on the format and delivery method of each school. So Penny required hands-on inquiry science experiences with teachers as part of each learning environment even if they had to be limited in number. She worked with staff to bring relevant context to lessons that would excite each student to engage in the learning process and content.

With a steadfast vision for science upmost in Penny's mind, she decided to move on after nine years in the alternative school environment. She accepted the principal position at a comprehensive high school in the same district along with new challenges that would face her as an administrator. Penny wondered if the benefits of small school personalized learning would transfer and scale up in a larger generalized high school. She also knew that traditional roots ran deep in her new school, from the content specific credentials of the staff to the formidable Master Schedule. How could she break down the barriers created by time-honored content silos and pedagogy and connect staff to each other, to their students and to current real-world context? Forging a new school culture became her first broad mission at Summit High School.

Once again, Penny would need to be a quick study and learn for herself. Penny immersed herself in the classrooms looking for common instructional strategies that could unite the staff around relevant learning goals for students across the disciplines. For the most part however, Penny instead found disparate methods and terminology used in instruction when the learning task was similar. She realized that instruction needed to be more synchronized between classrooms for students to access and be engaged with the content being taught. Many students were spending too much time and energy simply understanding the specific vocabulary and methods each teacher required to accomplish classwork. This was particularly true for the large population of English language learners and academically struggling students at Summit High. As a self-contained elementary teacher, she knew the power of explicitly linking learning strategies through common vocabulary and procedures regardless of the subject being taught. However, she had quickly seen that high school teachers come from a love of their content and its unique terminology. This meant that her staff, while content-rich experts, would need time to examine their instructional methods and collectively build common scaffolds for student learning. This would require an open-door policy between classrooms and disciplines – a culture shift toward more shared instructional practice, teamwork, and collective growth.

A distinct moment galvanized this idea for Penny. One of her science instructors was frustrated by her students' performance on the mandatory State science end-of-course assessment. Looking at the assessment prompts, the teacher realized that the science concepts being tested were not the issue, but rather, her students were struggling to decode the meaning of the vocabulary in the question prompts (i.e., to figure out the question being asked). These students needed problem-solving techniques and general

reading strategies in order to be successful in demonstrating their science abilities. Penny leveraged this moment to provide common training for her entire staff on using metacognitive markers (a specific reading strategy) and identifying vocabulary alignment across disciplines useful for teacher instruction and student learning.

Penny continued this approach to develop a culture of research-based shared instructional practice applied across the subject areas. She used Weekly Staff Bulletins to keep a strong focus on instruction and administrative walk-throughs to identify instructional priorities. She has also begun to incorporate shared leadership opportunities to strengthen the emerging collaborative culture. As staff members received training they were purposed with sharing back with the other teachers in the building. For example, the English Language Arts teachers learned a specific scaffolding strategy for students to write evidenced-based short answer responses. The Language Arts teachers in turn worked with other teachers to apply this strategy across the curriculum. For example, the science teachers used this approach for students to write claims-evidence-reasoning analyses for science labs. As the teachers have increased their leadership of shared instructional practice, the discrete content silos have diminished and collaboration has become more evident. The emerging culture of collaboration also involves individual risk-taking by teachers. To support open, honest efforts to explore new instructional approaches, Penny provided teachers redeemable coupons that provided them with a second chance when implementing a novel approach that didn't quite work as planned. This safe method for practicing inventive strategies was an incubator for creativity that gave teachers greater license to try something new and to exchange innovative ideas.

Penny's next priority was to use her science instructional leadership as a pivotal tool for curriculum reform. She has commented that instructional leadership may mean you need to "drive the vision and wait." Although science specific instructional leadership had not been her initial focus, changes in science instruction were a part of the overall transformation at her school. From her own learning and experiences, Penny understood that science was a good vehicle for infusing the curriculum with contemporary real-world problems that would engage students and spark their individual passion for learning. When students are passionate about learning they see more connections to their individual context and this pushes students to reach their potential. Penny made plans to leverage science classrooms as a model for this approach in all curricular areas.

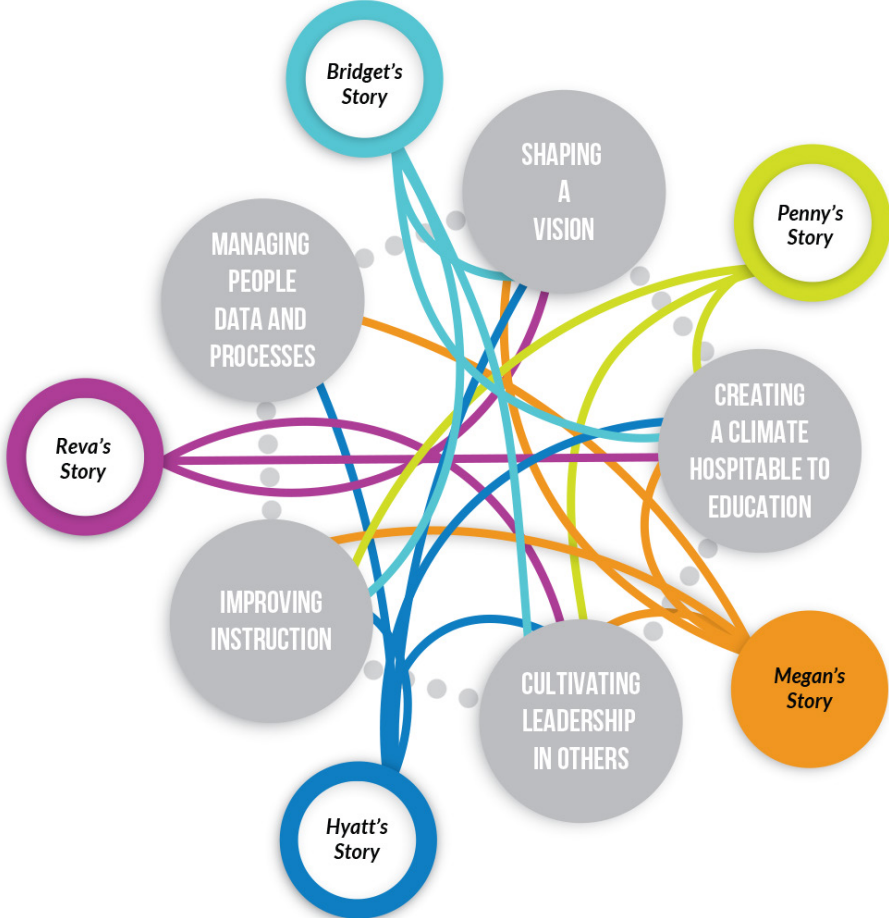
Although not a silver bullet, a potential mechanism for advancing this science vision across the curriculum came with a new district initiative to create STEM (Science, Technology, Engineering, and Math) course pathways for students within the high school curriculum. Penny's work to create a school climate conducive to shared learning, common instructional practice and distributed leadership positioned her staff to take advantage of this district support. Penny and her staff began exploring enhancements in the school curriculum, including the creation of entry-level STEM classes that build in areas of focus, giving students more targeted means to follow their own interests over their high school career. The new course opportunities would complement internships or job shadows with local STEM organizations in the community better preparing students for post-secondary training, certification, or advanced degree programs in STEM fields. As teachers have

thought differently about their courses and connections to out-of-school experiences, it has helped broaden the school science vision of collaborative, student-centered classrooms driven by real-world context across disciplines and into the community.

Penny's science instructional leadership has provided steady guidance and support needed by her staff to make connections between classroom instruction, subject-matter content, and the relevance for students' lives beyond school. The vision is strong; the work is ongoing. Penny models life-long learning in her own practice and supports her teachers and students on their own journeys. She is proud of a staff that is engaged in meaningful discourse and increasingly receptive of new ideas to make learning outcomes better for their students. "Nothing is ever easy, but we don't remember the easy decisions," might well be her mantra.

Megan's Story

Shaping a vision, creating climate hospitable to education, cultivating leadership in others, improving instruction and managing people, data and processes



Our story about Megan focuses on how she and her mission-driven staff took on a major learning challenge and transformed a struggling, low-income elementary school into a Preschool-8th STEM Academy. Their work is now transforming the learning and thinking skills and lifelong opportunities of all their students. Megan has courage, drive and a deep passion for high quality instruction for all students. When the journey started, she had strong instructional skills but negligible science content or instructional experience in her background. After teaching for 11 years in K-8 settings and successfully providing instruction within several regular and special education inclusion models, she moved into school leadership. She became the principal at a K-5 elementary school that housed the gifted and talented program in her district. Six years later she requested a move that she felt passionate about and that she knew would challenge and strengthen her leadership skills. Despite the cautionary advice of several supervisors concerning the unique challenges of moving to a low performing school, she believed she could make a difference

and empower change. She sought and was honored to gain the role as principal of Agate Elementary. Her vision and mission initially was to improve Agate's student achievement, and she was able to bring a small team with her to the new site who shared that same vision.

Spring Break of her first year at Agate, the challenge expanded dramatically. Megan's new superintendent decided that Agate would become the district's first Preschool-8th STEM School within three years. The district prepared to apply for a 3-year multi-million dollar federal grant to fund this project. Staff were given the choice to stay or go to another school. Her staff decided to stay together with Megan and committed to a shared mission of transforming the school, its instructional delivery and the learning opportunities of their students.

At that point Megan had little to no knowledge of STEM and its potential for her students' future. All she really knew about STEM was the acronym. She recognized she had to figure out how to ignite a vision and excitement within the staff, students and community in order to flip the school and make a meaningful change. And she had to do it in 3 years. What she knew for certain was that the change had to start with her and her understanding of science, engineering and STEM instruction.

That summer, she did some powerful "postholing." She went to a Midwest institute for a deep learning experience with the dual goals of being able to understand and articulate STEM learning, and becoming aware of the best models that could be developed school wide. Through that experience she was struck by the importance of STEM's deeper and more powerful instruction and learning for her students' futures.

In the fall she faced a new challenge. The district was not selected to receive the grant, but the superintendent directed her to move forward anyway with all the support they could give her and her staff. That first year, the school added sixth graders and implemented a core STEM program in fifth and sixth grade. Megan hired 2 new sixth grade teachers in August and got 5 release days from the district to support the 5th-6th grade team for that school year. She and a team traveled to visit a successful STEM school in Norfolk, Virginia with the same demographics as Agate and had the opportunity to learn from skilled practitioner colleagues. They gained a considerable amount of knowledge and were able to observe STEM teaching and learning in action.

Here in Washington, on the advice of a district leader, Megan was connected with an Assistant Superintendent in a neighboring school district who was implementing a very effective thinking skills model focused on integrating the social sciences. Megan and her staff were invited to participate in learning from and with this district. Then she and her team went back home and added science and engineering to the mix as they began creating the Agate STEM instructional plan.

As that first year progressed, Megan realized that the STEM paradigm and its benefits were becoming clearer and that they were ready to expand their work to new grade levels. With district support, she was able to hire two talented 7th grade teachers and that summer

she and her expanded team of teacher leaders immersed themselves in a rigorous STEM Leadership Institute in Washington State. During this week of learning, teaming and growing the Agate STEM leadership team designed a comprehensive, multifaceted action plan that would provide direction and guidance as they implemented their Preschool-8th grade STEM School.

Parallel with the expanded staff work, Megan had been involving community stakeholders to gain their perspectives and build their support for the work of the teachers, staff and students. While the teachers did their work to prepare during that first year and the summer months, Megan convened leaders from the mayor, to parents in the school neighborhood, to community leaders, to key philanthropic organizations. Their ongoing dialogue helped shape the new STEM vision and built a shared understanding and ownership of the school.

After those months of deep and rigorous work, Megan felt confident in her team and empowered to “jump start” their shared vision. It was like a NASA launch. That fall, they “officially” closed down the old Agate school and orchestrated a Grand Reopening Ceremony. The logo was changed, there were new colors and a new name. Rocket STEM Academy was born. It was a proud and exciting day for everyone who had been part of the work to make it happen – parents, students, staff and community.

In that second school year they expanded their STEM program by using the “inside out” approach Megan had learned during her “postholing” experiences in the Midwest and in the Virginia school they had studied. The work was highly complex and needed a significant amount of funding and support to effectively implement school-wide. So they had begun with grades 5 and 6 and then picked up another grade at either end – grades 4 and 7. Finally in year three they added grades 3 and 8. They had not only transformed the instructional approach but had also grown from a K-5 to a Preschool-8th grade school.

The plan developed by the STEM Leadership Team is still alive and evolving as they grow from knowing the acronym to understanding what it means in a classroom. The vision for STEM at Rocket STEM Academy, “high-quality, integrated, hands-on, problem-based learning focused around real world questions,” has driven their planning, implementation and professional development for two years. While some of the staff have moved on, this vision stands strong and can be seen throughout the ongoing and intense work of innovating and strengthening the instructional STEM program.

Learning together and shared leadership at Rocket STEM Academy PreK-8 is a constant. From the very beginning, mixed grade teams papered the school media center with standards and timelines. The staff focused on the standards and key research-based instructional practices in STEM. Next they analyzed student achievement data within grade levels and across the system and reflected upon their learning outcomes and the progress they were making. The staff insured that their curricular progressions made sense developmentally and that they were logically related to the STEM content. They looked for themes and real world problems that were multifaceted and engaging to students. That form of on-going reflection and staff dialogue continues today.

Data for feedback is a critical element of the Rocket STEM Academy's ongoing planning and instructional program. They engage in ongoing deep data dives evaluating ELA and math achievement along with other learning indicators in highly organized full-day release study sessions. Megan has supported the development of well-trained and highly skilled instructional coaches and teacher leaders to take over the management of this key process to build a sense of shared leadership. This frees her up to be an advocate and networker, engaging with the community at the local, state and federal level. Megan actively leads the next phases of work and reaches out to locate and secure the resources to achieve it. The result is a highly, effective and efficient teaching and learning organization that is built on mutual trust and respect.

A shared vision integrating people, processes and data are the core of Megan's, her staff's and her students' success. The goal of the STEM approach is equal access and opportunity for the ALL students of Rocket STEM Academy. Together, Megan, staff, students, and the community have created a school climate that is rooted in rigorous academic and social learning that supports staff and students in a collaborative learning culture. The result leads to improved student performance. That is at the heart of the principal's role and the target of the Pivotal Practices.

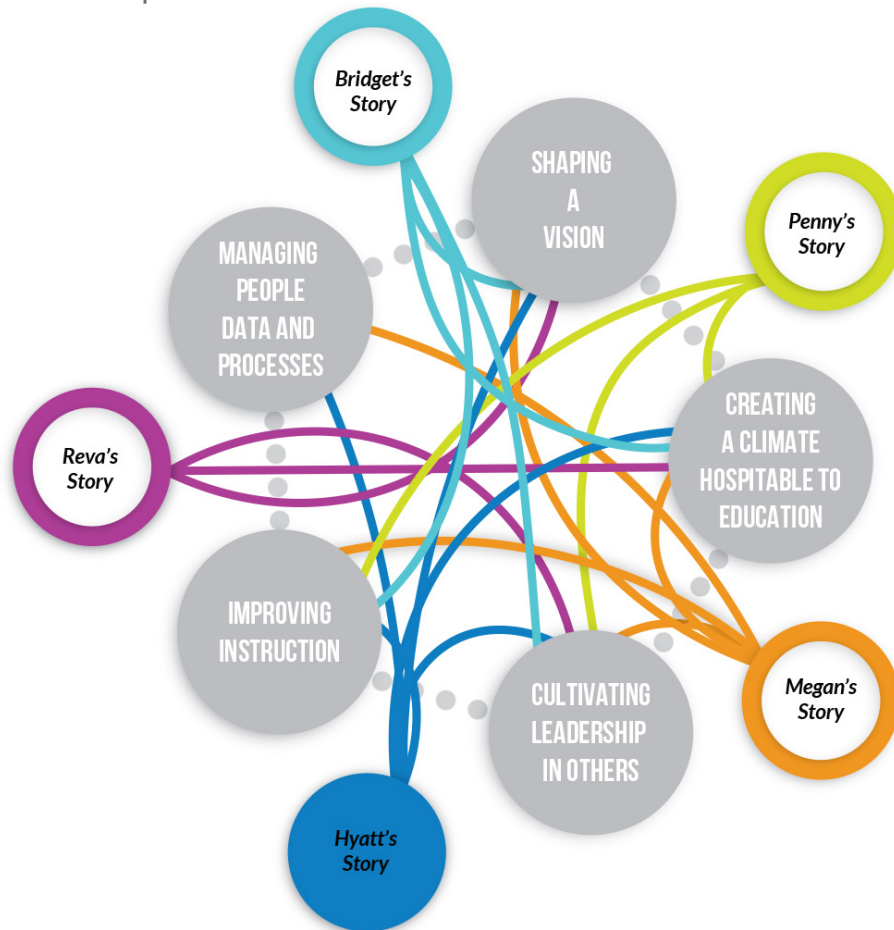
That collaborative learning culture spans school wide. While core STEM instruction happens in grades 3 through 8, Rocket STEM Academy has been involved with grants to institute Pre-K and K-2 themes for STEM and hands-on problem-based learning. Recognizing that teaching in an innovative STEM environment is not part of pre-service teacher training, the leadership team at Rocket STEM created a summer "STEM Boot Camp" for new teachers and for those returning teachers who want to deepen their content knowledge. The original STEM Leadership team is now a cabinet level team who drive the action plan and professional development. These leaders are the "guardians" of STEM instructional leadership planning and implementation. Each cabinet member also is part of other leadership teams at the site. Teaming, communication and collaboration are 24-7 and what the Rocket STEM Academy thrives on.

Their work continues to evolve. They share and celebrate their instructional breakthroughs. Students play an active role in their own learning, using numerous digital tools and tackling relevant big real world issues in ways they never have before. The district and community are excited and proud to support the Rocket STEM Academy as evidenced by construction of a new multi-million dollar STEM Wing slated to be added to the school.

Megan, the principal in our story, was issued a design challenge that grew in scope and intensity, in a field where she needed to be a learner, leader and an ultimately a huge risk taker. Her courage, tenacity and determination along with her staff's steadfast commitment to the vision are the reason why the Rocket STEM Academy is a success today and continues to focus on the learning of tomorrow. As Megan told us at the end of her interview, "I am an innovator, much to my surprise."

Hyatt's Story

Shaping a vision, creating a climate hospitable to education, cultivating leadership in others, improving instruction and managing people, data and processes



“Sorry Hyatt, the staff would like you to leave so we can process our concerns without you.” That statement by the school’s teacher union leader the day before the staff retreat, and Hyatt’s response to the potential crisis is at the heart of our story of his leadership as principal and the emerging vision and path forward for his school. This moment was one of many that would define a strong culture of shared leadership and value for all staff and student learners at the school.

Hyatt is the principal of an innovative and successful STEM high school with a highly skilled staff and major support from industry partners in their community. He is a committed leader with a strong science background and a deep understanding of the power of meaningful science instruction in students’ lives. He loves the adventures and the risks of learning itself- the process of exploring something important and not knowing the answer, testing out ideas and failing and trying again and then defending the solution you have

discovered. On the flip side, he also understands the risks and vulnerabilities of being that kind of learner, so he strongly supports teachers and students as they learn and solve problems in that deep way. He has brought that passion and compassion to his education leadership roles. That vision is at the heart of the science learning and STEM curriculum at Telecom Academy.

As a kid Hyatt was bursting with curiosity about our planet and beyond, begging his parents early on for a telescope for Christmas. His scientific curiosity was rarely nurtured in school from elementary through high school with the exception of a lone middle school teacher who had him “doing science” with hands-on lab work in class and participation in a Science Fair. But somehow his curiosity and love of science learning never diminished and was strengthened with his growing desire to help people learn. He started as a geology major in college and later shifted his undergraduate program to math and science education.

After college, Hyatt jumped into some in-depth science work at an intense summer institute sponsored by a national STEM Industry. Then he got involved with the University of Washington’s ground monitoring of seismic activities at local scientific stations. That ground monitoring work coincided with the Washington State 2001 Nisqually earthquake, so he saw the power of the science process supported by finely engineered tools to measure and record an event with major impact on the real world. He learned early on the underlying power and purpose of STEM learning: tying science and other related content to real problems and connecting that learning to the work of people doing that scientific work in the community beyond the classroom. He strongly believes that kind of learning prepares you to become a thinker and a doer in pursuing your life goals and opportunities, and this belief has guided his teaching and his science instructional leadership.

Hyatt defines true science teaching and learning as a process that is rigorous, relevant, standards-based and driven by authentic inquiry. Prior to his role at Telecom Academy, he honed that vision with a number of “post holing” experiences as an instructional leader. After 21 years of teaching high school physics and mathematics, Hyatt’s next big insights were about leading school change. In his first “postholing” experience, he worked side by side in a variety of school settings with teachers and principals for two years as an Educational Service District (ESD) Science Instructional Leader. There he really began to see the big picture beyond teaching to instructional leadership that can change a school culture and implement a stronger vision of student learning. Those experiences and the strong mentoring he received helped prepare him for the eventual role of principal.

Before landing a building leadership position at Telecom Academy, Hyatt moved on from the ESD to work as a K-12 school district science coordinator. He worked with K-2 and upper elementary students and teachers and deepened his understanding of how people—both teachers and their young students—really learned science. He saw the developmental leap in students thinking in the 4th grade and got his district’s elementary schools involved in a science inquiry project with a local zoo.

During the project’s professional development, the teachers used the schoolyard as an entry point for discovery about nature. Teachers experienced hands-on discovery

and science inquiry and had to defend their projects to the staff at the zoo. Armed with this personal experience, teachers were able to transfer this authentic learning to their students through the curriculum. That front-end learning experience set the stage for teachers to let go of the controls when they taught the unit and to give their students the same opportunity to explore, figure out an authentic problem, design their solution and defend their work to the experts at the zoo. As an instructional leader, Hyatt helped teachers keep the science content in a unit connected to the science inquiry processes and the application to a real world solution.

After three years as a district science coordinator, Hyatt became Telecom Academy's Assistant Principal. There he dealt with the complex management issues of high school leadership but was also able to use his instructional leadership in professional development activities with staff. As always for Hyatt, "content independent professional development in science and STEM was not enough." He helped the talented teachers on staff to see the connection between what they do in teaching and what makes the learning come alive in an authentic way to students. Because of their school's commitment to rigorous and relevant STEM education and a college and career focus for students, teachers at Telecom Academy had much more access than a typical high school to industry partners who supported their work and wanted to be involved.

Their professional development was built around a project-based learning template driven by essential questions and supported by an industry partner. Telecom teachers were accountable to work with their chosen industry partner on "signature" projects they designed for their students. They worked together to validate authentic, real-world problems they wanted their students to tackle and/or to vet such things as specific engineering solutions they wanted to include in projects. That critical step was a way to ensure that the projects addressed an authentic work-place challenge, and the industry expert's guidance made that possible. Hyatt believes teachers benefit tremendously when they are nudged to wrestle with novel problems similar to those found in industry. In addition, it helped them as science instructors to bring rigor and relevance to their students' learning experiences.

When he moved into the role of principal, ten years into Telecom Academy, Hyatt knew the school culture needed to change to achieve the full potential of their vision of rigorous and authentic lifelong learning for their students. That new vision would require building a deeply collaborative learning environment. His talented but independent staff needed to coalesce into a strong team with a willingness to move forward together. He also understood that implementing this vision for new and deeper collaboration would require substantial buy-in and trust not only in the process, but in him as a leader and in each other. Their school had to be a place where it was truly safe to try and fail and where working together was valued. And Hyatt had some painful and troubling data from a staff climate study that had to be addressed to build that trust.

Deep teamwork does not come easily to any high school because of the traditional academic siloed approach to departments and content. In spite of the unique context at Telecom Academy, it was just as difficult. Their entrepreneurial beginnings attracted very

talented but independent teachers- some might even be called mavericks. They had not experienced the power of pushing independent work to the level of interdependence as a team, and at least a substantial group had misgivings about this new direction and the leadership transition.

Hyatt is a focused and driven leader, but he also has the humility and honesty to understand that the insights and caring of his staff and their talented teaching were the key to building the success of the school. To build on that talent, he had to earn their trust. They needed a new start including dealing honestly with the survey data together, so he planned an off-site retreat to open their year.

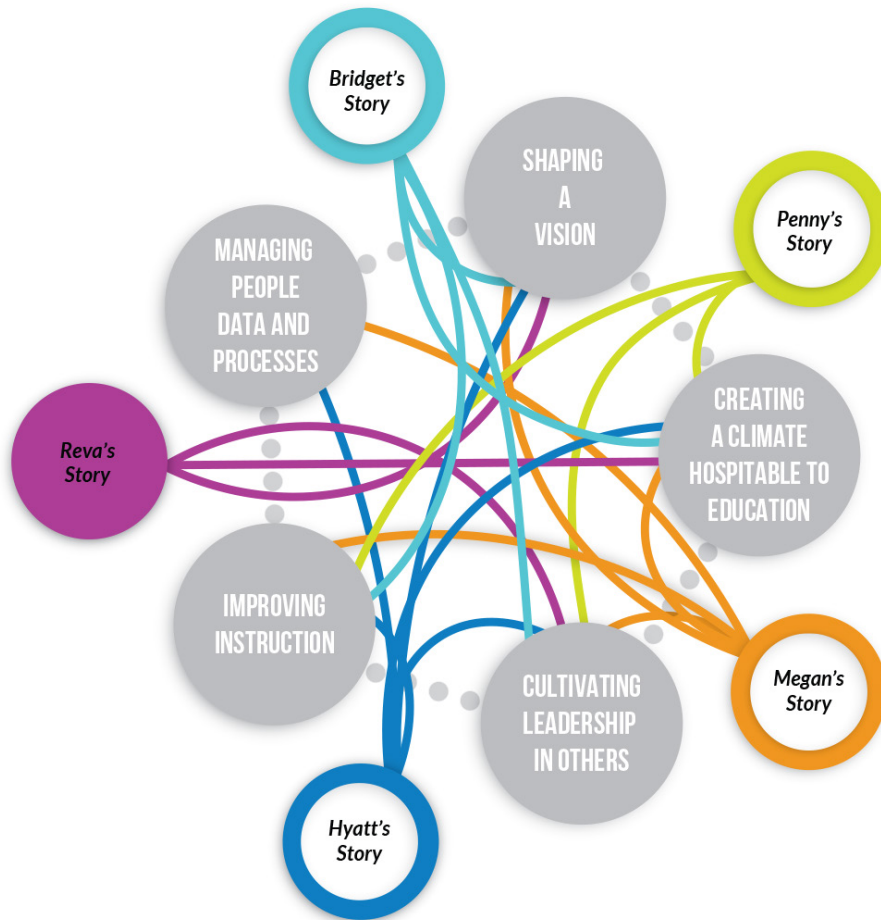
Then, as we shared earlier, just as they were about to begin the retreat, the building union leader came to him and said the staff wanted him to leave so they could process these concerns without him. He struggled with supporting the idea and considered that this step might doom his very short career as a principal. However, he agreed to walk away and let them work it out. That was a humbling and scary experience, because everything he dreamed of at his school was on the line. But his response to that crisis made all the difference. He trusted them and they, in turn began to trust him and each other. They now have a distributed leadership model with 100% buy-in. The key issues at the school now involve getting agreement from a strong majority. As mutual trust, respect and collaboration grows so do their results with their students. The school and its vision of STEM learning are flourishing.

Hyatt leads a special school initiated with an exciting model of STEM learning and career pathways and with deep support from the community and industry partners. However, these high expectations increased the challenge the whole school community faced. They had to unify their efforts and shape a strong and constantly emerging STEM vision and implementation strategy together- staff and students, district, community and industry partners. They are striving to meet their challenges together so that everyone involved can learn and grow.

That first year was very challenging but rewarding. In the second year under Hyatt's leadership they are sustaining and strengthening their rigorous and collaborative teamwork and outcomes continue to improve. Their changes need more time and support and an ongoing analysis of impact on student learning. As Telecom Academy's story continues to unfold, however, new possibilities are emerging for students and their college, career and life choices, for the roles and focus of teacher and staff teams and for new and deeper partnerships with industries and community partners in support of the school. Hyatt's vision, shared instructional leadership and the collaborative learning culture he and the staff and students have developed continue to undergird this positive change.

Reva's Story

Shaping a vision, creating a climate hospitable to education, and cultivating leadership in others



Three large gray containers had lingered in the foyer outside the Teacher's Prep Room for two weeks. As the supervisor for the math and science content areas, Assistant Principal Reva knew these materials tubs contained the 4th grade science units delivered for this semester's science instruction. Reva had empathy for the amount of work on the 4th grade teachers' current agenda, but she could not compromise on her vision for STEM (Science, Technology, Engineering, and Mathematics) at Sage Elementary. Science was needed for every student. If her rural, low socio-economic students were going to be a part of the world's technology- and information-age, they needed regular science, as well as math and language arts in every grade. Therefore, it was imperative that Sage students have rich experiences to nurture their curiosity, talents and aspirations in the STEM content areas. Reva's story focuses on shaping a vision, creating a culture and climate of professional growth for teachers and science learning for all students, and cultivating leadership within and outside the school in support of STEM teaching and learning.

Reva's vision for science instruction was shaped throughout her 13 years as an elementary teacher including primary grades and middle school math and science experiences. When she became a district math coach, her office mate, the district science coach, significantly influenced her trajectory as a science instructional leader including her awareness of the newly emerging Next Generation Science Standards (NGSS). The NGSS Science & Engineering Practices had many similarities with the Math Practices in the Common Core State Standards (CCSS). Over their 6-year partnership, Reva and the science coach explored commonalities in the math and science practices in the new standards – such as developing and using models and computational thinking; engaging in argument from evidence; reasoning abstractly; constructing viable explanations and designing solutions. They created joint book studies for math and science teachers and professional development that helped teachers link math and science concepts and develop more opportunities for student pondering, independent thinking, and discourse – these strategies would be needed for student conceptual understanding of content required in both sets of standards. They often partnered on teacher training through the district, regional educational service district (ESD) and the Office of Superintendent of Public Instruction (OSPI).

These years of learning and coaching gave Reva the perspectives and skills she would need to drive deep integrated student learning in her first administrative position at Sage. The new Sage Principal had spent the previous year as Assistant Principal and hired Reva in part for her strengths in math and science instruction. For both administrators, the Sage community, teachers and students, were relatively new. The school had not met Adequate Yearly Progress (AYP) under the No Child Left Behind for many years. Staff turnover to neighboring schools or districts with less rural settings and higher performing students was a yearly occurrence. It was common for 7-10 teachers out of 35 certified staff members to leave the school each year. Many student families were itinerant during the winter months contributing to uneven classroom experiences throughout the year. The recently state-mandated Teacher Principal Evaluation Program was also “new” for everyone which created angst but also provided the administrators leverage for staff professional growth.

The two new administrators knew their context made it essential to position Sage students on a solid path to career and college-ready with a strong vision of STEM. This vision was only attainable if they could change the school culture together and build the trust, support and optimism among staff and students to make it happen. They could build on the rigor and relevance of the district Common Core work in math, which Reva knew well. Reva's willingness to “posthole” in science as a math expert prepared her for leadership in science. The inclusion of quality science experiences, linked to other subject matter would be a key driver for instructional change across the school.

Their plan included three key parts: supporting individual teacher's professional growth; holding the students accountable for 21st century learning encompassed in the new math, ELA, and science standards; and increasing the parent and community presence and participation within the school. In her first year, Reva deliberately took a “listen and learn” approach to build trustful relationships with teachers; she wanted to foster a confidence

and a desire to learn in the teaching staff. Specifically, she figured out how to ask a question that didn't point at something the teacher was doing wrong, but would get them thinking and wanting to move forward in their practice. This was especially important and pertinent as the school was transitioning to the new teacher evaluation system.

Throughout Reva's first year she continued to notice the science materials tubs left unopened in the hallway and the lack of science topics and vocabulary on classroom bulletin boards. During classroom visits it was apparent that there was lots of work on math, but science was being pushed to the side. Teachers were commenting that they "didn't have time to teach science". Reva knew why: science not being assessed yearly; the district's focus on meeting federal mandates in reading and math; and many teachers' discomfort with teaching science. However, her vision for integrated learning in science and math remained steadfast. Science was still essential for every student's life. Not every Sage student would become a scientist, but the 21st century thinking skills taught through the math, science and engineering practices would be needed to keep opportunities open for all of them. The dilemma was how to support teachers offering science experiences and modeling these thinking skills routinely in every grade to meet this goal.

Reva championed new initiatives in her second year at Sage. With support from the Principal, math and science instructional time was blocked together in all grades, (one STEM teacher responsible for math and science, paired with another teacher responsible for Reading, Writing, and Social Studies.) This change could allow more seamless integration of content standards and practices within the blocks, providing more time for science and importantly providing stronger conceptual connections learned by students. Both women acknowledged that a change in the master schedule would not equate to change in instructional practice without teacher professional learning. Using Reva's professional science and math network, they found the support they needed.

The first step was getting teachers more comfortable with science content and up to speed on the new standards. Reva planned with the state regional Science Coordinator to provide professional development to help teachers' bridge understanding of the new science standards (NGSS) with their current science kits. This initial work was well received, and with readiness by the staff, a 4-part workshop series was created to provide training and resources for the teachers in science. Additionally, Reva leveraged work using Marzano's Scales of Learning in math from the previous year as a similar instructional strategy for science. During this crucial time, Reva remained a frequent presence in the newly created STEM block classes. She looked for examples of science-math integration on bulletin boards and in student discussions. During formal post-observation interviews or simple classroom walk-throughs, she was gentle but relentless in asking the questions, "Where's the science?" coupled with, "How can I support?"

As a school-wide approach, the Principal and Reva established weekly collaboration meetings for staff by subject area. The meetings were strategically held in the same room at the same time to allow for common conversations across grade bands. These meetings provided time for teachers to analyze student data, discuss integration of curriculum, and share standards-based instructional practices. Reva and the Principal

were integral members of the teams, asking the driving questions, looking for readiness to grow, providing resources, and removing roadblocks. As follow-up to the collaboration meetings, the administrators published a weekly Instructional Letter for staff including best practices in science instruction to show support and keep the STEM vision active. Teachers' confidence in the administrators' content expertise and instructional leadership grew stronger as the two continued to "come along side" the teachers to look closely at their instruction and to provide them needed support. That kind of respect, collaboration and consistent modeling helped the staff improve their integrated science practice and build their leadership capacity and it bolstered the entire school. They were all building a culture where teachers learn from each other and their students.

Moving into her third year at Sage, Reva has the same STEM vision now as when she started, but her pathway is more realistic. The work of instructional leadership in science and STEM was harder than she thought it would be. Today, she stays available for openings, the teaching moments when her staff is ready to move forward; "gentle pressure, relentless applied" remains her adage for both student and teacher learning. Reva understands that not all content areas of the acronym in STEM are happening equally- many teaches are still teaching science and math in separate "chunks" – but it is getting better as staff gain more training, time and experience with integration. As a great example, the Art Teacher is heading work to integrate the Sage Community Engineering Fair by blending math, science, and the arts through problem-based projects.

Through the efforts and modeling of Reva and the Principal, the culture at Sage is changing to one of "doing the hard work together". Open collaboration and shared leadership among staff and administration is fostering change in individual teacher practice and leading to new science opportunities for students. Teacher retention has improved. 4th and 5th grade teachers are beginning standards alignment work to ensure continuity across grade bands, especially in preparation for state-level science assessments. Pride and ownership of the STEM vision is spreading. A new monthly newsletter is connecting families to the school vision, including a STEM highlight in each issue. Contributing to this effort, Reva will continue to partner with staff on their instructional practice, using her knowledge, resourcefulness, and relentless pursuit of an integrated STEM program for student learning to drive her work. All 5 Pivotal Practices- shaping a vision, building a safe learning environment, shared leadership, managing people, processes and key data toward the vision of improved instruction – will be a part of the story of Sage's growing success.

About: Resource Development

WHAT: A gateway to instructional leadership for science education

Principles of Science for Principals is an ongoing project purposed to create resources and experiences designed to support principals as instructional leaders for science.

WHY: STEM is at the core to our students' future

The Principles of Science for Principals project was launched in response to the pervasive growth of STEM in our region — from issues related to sustaining the quality of the Puget Sound, to our growing computer science based economy, and health care topics such as the necessity of vaccines. STEM is, and will continue to be key to the future of today's students. A strong foundation in the STEM disciplines will provide students with:

- Access to exciting and fulfilling careers
- Ability to adeptly engage in community and personal decisions

Core to growth of STEM is quality science education for our students. With the Washington State's adoption of the Next Generation Science Standards (NGSS) increasing opportunities for teacher professional development have emerged. While ongoing support for teachers is essential, we know from research that principals are second only to teachers in impacting student learning and achievement, however most principals do not have expertise in science or STEM education. To assure a robust STEM foundation for every student, classroom teachers as well as principals must be capable of leading science education for our students.

HOW: Emergent in design reliant on input from practitioners and researchers

The Principles of Science for Principals project was launched with modest support from the Nesholm Family Foundation and the Franklin and Catherine Johnson Foundation. This support allowed staff from the Logan Center for Education to partner with the University of Washington's Center for Educational Leadership in visiting schools and talking with school leaders regarding their needs in serving as instructional leaders for science education.

Subsequently, funding from the Boeing Company has allowed the project to more formally emerge. Starting in summer 2015, the Logan Center for Education hosted a series of experiences purposed to define and develop resources aligned to the project.

Ideation Session

On June 1, 2015 the Logan Center launched the project by way of hosting a daylong *Ideation Session*, a forum that convened a diversity of expertise for fostering the generation of new ideas. The Ideation Session included 30 forward thinkers representing a cross section of the community – school system practitioners, STEM professionals, policy makers, entrepreneurs, systems thinkers and motivators – who conceived approximately 6 strategies in support of principals as instructional leaders for science.

Participant Panels

Through July and August of 2015, seven individuals identified by their peers as having expertise in instructional leadership participated in two rounds of Participant Panels, an online strategy for gathering and then reviewing the strategies for the project identified in the June Ideation Session. The core outcome of the Participant Panels was recommendation to develop a resource to distinctly illustrate a vision of “science instructional leadership”.

Resource Development

Stories of Science Instructional Leadership

The Logan Center for Education worked with five principals identified by colleagues as having experience as instructional leaders for science. This cohort of principals represents elementary, middle and high school from regions across Washington State. The principals were interviewed by Logan Center staff who created a collection of authentic stories that illustrate a variety of contextual leadership strategies for science. Each story exemplifies one or more of the 5 Pivotal Practices of Instructional Leadership identified in the 2012 Wallace Report, *The Effective Principal*. Go to the Stories section of this website to explore this resource.