PROMOTE EFFECTIVE STRATEGIES IN MATH AND SCIENCE: LOCAL AND REGIONAL STRATEGIES TO INCREASE STUDENT ACHIEVEMENT

BACKGROUND

How does a state improve the math and science learning performance of a million students?

Washington has signaled, by policy and allocation of resources, the importance of math and science. *Some* of the key investments the state has made or taken since 2007 include:

- Rigorous standards:
  - K-12 learning standards revised in 2008 (math) and 2009 (science).
  - College readiness math and science standards.
- Aligned curriculum materials and assessments:
  - Recommended curriculum materials aligned to standards.
  - Assessments aligned to new standards (end-of-course math, beginning 2011; end-of-course science, beginning 2012).
- Graduation requirements:
  - Increased math credit graduation requirements for the class of 2013.
  - Increased science credit graduation requirements approved in 2010, but not yet adopted.
  - Demonstrated proficiency on math assessment required for the class of 2013.
  - Demonstrated proficiency on science assessment required for the class of 2013, pending the outcome of deliberations by the 2011 Legislature.
- Professional development funding support:
  - Regional ESD Coordinators in math (beginning 2007-08) and science (beginning 2008-09) ($5 million 2007-09 biennium).
  - Coaches in math (beginning 2007-08) and science (beginning 2008-09) in selected districts ($5.4 million 2007-09 biennium).
  - Job-embedded professional development opportunities for math and science teachers in grades 4-12 ($22 million—2007-09 biennium).
  - Specialized training for one math and one science teacher in each middle and high school to build building-level expertise on the 2008/2009 math and science standards ($17.5 million—2007-09 biennium).
  - LASER (Learning and Assistance for Science Education Reform) expansion to 780 new classrooms ($9.4 million).
- Teacher credentials:
  - Clear pathways for certified teachers to add endorsements, including in math and science.
  - Funding to increase the number of math and science teachers through alternate routes and other strategies ($6.6 million—2007-2009 biennium).
  - Incentive bonuses for National Board Certified Teachers in all subject areas, including math and science.
- Support for Science, Technology, Engineering and Mathematics (STEM) education:

- Innovative high schools such as Delta High School, Pasco; Aviation High School, Des Moines.
- Lighthouse STEM schools ($75,000).

In addition, OSPI, with its stakeholders, has developed a tiered, integrated instructional system, the Mathematics Systems Improvement Framework, to “provide Washington’s school districts actionable steps and guidance around which a comprehensive K-12 mathematics system can be built.”

Despite this investment of resources in actions designed to improve math and science achievement, student performance on the state’s assessments of math and science is not yet at the levels attained in reading and writing. In 2009-10, the percentage of sophomores meeting standard on the math (41.7 percent) and science (44.8 percent) High School Proficiency Exam (HSPE) was approximately half of those meeting standard on the reading (78.9 percent) and writing (86 percent) HSPE. The math and science results are even less encouraging when disaggregated by race/ethnicity and students enrolled in special programs, such as free or reduced meals, special education, transitional/bilingual, migrant.

Still, pockets of excellence shine in the individual efforts of schools and districts, as evidenced by some of the winners of the Washington State Achievement Awards. One of those schools, Icicle River Middle School (IRMS) in Cascade School District (Chelan) will share their story with the State Board of Education (SBE). SBE will also have an opportunity to tour Delta High School, a one-of-a-kind STEM school (see separate tab for background on Delta). In addition, regional initiatives such as those led by the ESD Coordinators leverage the power of state leadership to build capacity within the state to improve student learning.

This presentation will showcase both school-based and region-based initiatives to provide an overview of what can be done with sustained leadership, coherent vision, expertise, will, and resources.

<u>Icicle River Middle School</u>

Icicle River Middle School embarked on a journey of reform beginning in the late 1990’s when the low performance of its students prompted the beginning of a systemic transformation. In the space of a decade, student performance on Washington State assessments has increased significantly. Although the percentage of IRMS students on free and reduced lunch decreased slightly over that time, the school’s free and reduced population still currently exceeds the state average. IRMS has 303 students; the majority of the students are White (67 percent) or Hispanic (30 percent).

Percentage of Seventh Grade Icicle River Middle School Students
Meeting Standard on State Assessments

	Math		Reading		Writing		Free & Reduced 2010
	1998-99	2009-10	1998-99	2009-10	1998-99	2009-10	
Icicle River	15	74.2	37.6	80.4	19.1	78.4	49.3
State	24.2	55.3	40.8	63.4	37.1	70.3	42.3

Source: Office of Superintendent of Public Instruction School Report Card

Performance on science assessment steadily increased as well, from 2002-03, the first year of the state’s science assessment to 2009-10.

Percentage of Eighth Grade Icicle River Middle School Students
Meeting Standard on State Science Assessments

	2002-03	2009-10
Icicle River	39.1	70.2
State	35.8	54.5

Source: Office of Superintendent of Public Instruction School Report Card

IRMS has been recognized twice with a Washington State Achievement Award for Overall Excellence, and has earned other recognition, as well. In a school where 67 percent of the students are White and 30.4 percent are Hispanic, IRMS' achievement gap score on the State Board of Education's Achievement Index was less than one, placing IRMS in the exemplary category (2009-10). (See Attachment A for Washington State Achievement Index tables for IRMS and Cascade High School).

IRMS Principal, Kenny Renner-Singer, identified several elements that have been integral to the school's success in helping students learn, including:

- Fidelity building-wide to implementation of a citizenship program where "expectations of behavior are modeled and made clear for all."
- A culture of reflective practitioners, enabled in part by over 40 percent of the teaching staff earning their National Board Certification and by a block schedule that provides time for teams of grade-level teachers to work together for 40 minutes daily.
- Implementation of a tiered model of intervention that assures every student experiences rigorous, standard-based core instruction, with enrichment (accelerated support or additional assistance) targeted individually, as needed.
- Teaching students to keep track of their progress toward clearly specified learning targets and performance expectations.
- Target-based assessments.

What happens after students leave IRMS? IRMS feeds into Cascade High School (CHS), where student performance exceeds state averages in all of the assessed areas but writing.

Percentage of Tenth Grade Cascade High School Students
Meeting Standard on State Assessments

	Math		Reading		Writing		Free & Reduced 2010
	1998-99	2009-10	1998-99	2009-10	1998-99	2009-10	
Cascade	32.2	56.8	54.6	87.8	33.6	85.4	38.5
State	33.0	41.7	51.4	78.9	41.1	86.0	42.3

Source: Office of Superintendent of Public Instruction School Report Card

Percentage of Tenth Grade Cascade High School Students
Meeting Standard on State Science Assessments

	2002-03	2009-10
Cascade High School	31.2	59.6
State	31.8	44.8

Source: Office of Superintendent of Public Instruction School Report Card

Percentage of Students Graduating from Cascade High School and
Going Directly to College

	On-time graduation (2009-10)	Extended graduation	College-Direct (2009)

		(2009-10)	
Cascade High School	87.3	98.3	56.1
State	76.5	82.6	59.4

Source: Office of Superintendent of Public Instruction Graduation and Dropout Statistics for Washington 2009-2010 Report, Appendix A; BERC Group College Tracking Data Services

Among the 24 Hispanic students graduating from CHS in 2010, 50 percent went directly to college, compared to 57.5 percent of CHS White students. By comparison, in 2009, Washington's college-direct rate for Hispanic students was 43.1 percent, and for White students, 61.2 percent.

Regional ESD Math and Science Coordinators

The 2007 Legislature's approval of SHB 1128 provided funding to each of the nine Educational Service Districts for regional mathematics coordinators. The coordinators were charged with providing regional professional development activities related to mathematics instruction. In 2008, funding was added for regional science coordinators.

Fiscal Year	Amount	
FY 08	$1.6775 million (mathematics coordinators only)	
FY 09	$3.355 million (math and science coordinators)	
FY 10	$3.355 million	
FY 11	$3.355 million	
FY 12	$4,219,000 proposed by House	No funding clearly specified by Senate
FY 13	$4,219,000 proposed by House	No funding clearly specified by Senate

The coordinators, in partnership with the Office of Superintendent of Public Instruction and other regional leaders have established an infrastructure that allows districts to leverage limited funds and to provide better professional learning experiences than they might have otherwise been able to do. The coordinators have also created a communication infrastructure that supports the rollout of policies and procedures that require technical support.

Initial goals and outcomes included the following:

1. Create common ground based on valid and reliable research.
2. Define and implement common practices and leverage resources among the ESDs.
3. Disseminate information equitably across regions in a timely, coordinated manner.
4. Build regional leadership capacity.[1]

The coordinators consult with each other and share ideas to provide a coherent package of professional development opportunities that advances the policy directions of the state, while taking into consideration the specific needs of the different regions. According to ESD 123 Regional Science Coordinator, Georgia Boatman, the coordinators seek to build capacity, avoiding "random acts of professional development" by bringing research-based practices to the attention of their local districts (See, for example, Attachment B: "Key Elements of Effective Science Instruction;" see also Attachment C describing coordinator roles).

[1] ESD Regional Mathematics and Science Coordinators 2008-2009 Accountability Report, October 2009.

Coordinators are also actively promoting Science, Technology, Engineering and Mathematics (STEM) education by helping districts to think about the implications of STEM in their schools.

In the spring of 2010, the Social and Economic Science Resources Center (SESRC) distributed a Regional ESD Mathematics and Science Coordinator survey to over 1,000 participating teachers. The SESRC found that 73 percent of the teachers applied the content of their professional learning to the classroom and 88 percent observed an increase in student learning as a result. While this self-report data affirms teachers' positive impressions, how the work might translate to improved student outcomes on state assessments is not yet known.

POLICY CONSIDERATIONS RELATED TO SCHOOL AND REGIONAL INITIATIVES

Icicle River Middle School is a story of committed leadership and resources over time to intentional, standards-based teaching and learning. SBE members will have an opportunity to explore with the IRMS principal and Cascade School District superintendent how school and district efforts to improve student achievement have been impacted by state policies and resources such as bonuses for National Board Certified Teachers, professional development support from ESD regional math and science coordinators, recommended math and science curriculum materials aligned to new standards, state assessments, funding for students needing additional assistance (e.g., transitional bilingual, special education), etc.

Stepping beyond a single school and district, the Regional ESD Mathematics and Science Coordinator program is a way to provide decentralized, coordinated professional development to advance the state's goals. This cadre of 18 people statewide provides intellectual leadership and practical guidance to local districts. They work in conjunction with district curriculum coordinators and math and science coaches[2], leveraging resources wherever possible.

The future of this four-year old Regional ESD Mathematics and Science Coordinator program is uncertain as of this writing, but it has been in existence long enough to build a following and a positive reputation. An analysis of impact, beyond teacher self-report, to document the program's effectiveness may be needed. Clear causal connections between improved student learning outcomes and professional development initiatives are difficult to establish because there are usually multiple, interrelated, and simultaneous initiatives occurring at any given time. However, the state needs a way to determine what initiatives are making a difference in student achievement in order to advocate thoughtfully for best practices.

SBE members will have the opportunity to explore the perspectives of the school representatives and the two ESD 123 Regional Math and Science Coordinators on issues such as the following:

- What state leadership, guidance, and/or technical expertise helps you—or would help you—improve student learning and achievement in math and science?
- Are there any state policies that hinder your efforts to improve student achievement in math and science?
- What advocacy or oversight from SBE would help you improve student achievement in math and science?

[2] 25 math coaches were funded in 2007; in 2008, 25 science coaches were added. The numbers were reduced to 17 (9 math; 8 science) in the 2009-2011 biennium. The coaches work in districts throughout the state. The state, through OSPI, funds approximately $80,000 to support each coach.

EXPECTED ACTION

For information only; no action expected.

Washington State Achievement Index

Enter School Code:	4403
District	Cascade
School	Icicle River Middle School

0 Achievement Award: (* indicates the school has won this award for two years)

Overall Excellence*

TIER	INDEX RANGE
Exemplary	7.00-5.50
Very Good	5.49-5.00
Good	4.99-4.00
Fair	3.99-2.50
Struggling	2.49-1.00

School Year 2009-2010

INDICATORS	OUTCOMES					Average
	Reading	Writing	Math	Science	Ext Grad Rate	
Achievement of non-low income students	7	5	6	6		6.00
Achievement of low income students	6	6	6	4		5.50
Achievement vs. peers	7	7	7	7		7.00
Improvement from the previous year	5	7	7	7		6.50
Index Scores	**6.25**	**6.25**	**6.50**	**6.00**		**6.25** **Exemplary**

2009 - 10 Achievement Gap

INDICATORS	Reading			Math			Ext Graduation Rate			Average
	Met Std	Peers	Imp	Met Std	Peers	Imp	Met Std	Peers	Imp	
Achievement of Black, Pacific Islander, American Indian/Alaskan Native, Hispanic stds	6	7	3	6	7	7				6.00
Achievement of white and Asian students	7	7	7	6	7	7				6.83
Achievement Gap										**0.83**

2008-2009 and 2009-2010 Averages

INDICATORS	OUTCOMES					Average
	Reading	Writing	Math	Science	Ext Grad Rate	
Achievement of non-low income students						6.00
Achievement of low income students						4.63
Achievement vs. peers						6.38
Improvement from the previous year						4.63
Index Scores	**6.13**	**4.38**	**5.75**	**5.38**		**5.41** **Very Good**

Attachment A

Washington State Achievement Index

District	Cascade
School	Icicle River Middle School
2009 Achievement Award:	Overall Excellence

School Year 2008-2009

INDICATORS	OUTCOMES					Average
	Reading	Writing	Math	Science	Ext Grad Rate	
Achievement of non-low income stds	7	5	6	6		6.00
Achievement of low income students	6	2	3	4		3.75
Achievement vs. peers	7	2	7	7		5.75
Improvement from the previous year	4	1	4	2		2.75
Index Scores	**6.00**	**2.50**	**5.00**	**4.75**		**4.56 Good**

2008-2009 Achievement Gap

INDICATORS	Reading			Math			Ext Graduation Rate			Average
	Met Std	Peers	Imp	Met Std	Peers	Imp	Met Std	Peers	Imp	
Achievement of Black, Pacific Islander, American Indian/Alaskan Native, Hispanic stds	6	7	4	4	7	4				5.33
Achievement of white and Asian students	6	7	3	5	7	4				5.33
Achievement Gap										**0**

School Year 2007-08

INDICATORS	OUTCOMES					Average
	Reading	Writing	Math	Science	Ext Grad Rate	
Achievement of non-low income students	7	6	5	6		6.00
Achievement of low income students	5	4	3	2		3.50
Achievement vs. peers	7	5	7	7		6.50
Improvement from the previous year	7	4	6	7		6.00
Index Scores	**6.50**	**4.75**	**5.25**	**5.50**		**5.50 Exemplary**

Washington State Achievement Index

Enter School Code:	3564
District	Cascade
School	Cascade High School

TIER	INDEX RANGE
Exemplary	7.00-5.50
Very Good	5.49-5.00
Good	4.99-4.00
Fair	3.99-2.50
Struggling	2.49-1.00

2[illegible]0 Achievement Award: (* indicates the school has won this award for two years)

-

School Year 2009-2010

INDICATORS	OUTCOMES					Average
	Reading	Writing	Math	Science	Ext Grad Rate	
Achievement of non-low income students	7	6	5	4	7	5.80
Achievement of low income students	6	6	1	2	4	3.80
Achievement vs. peers	5	3	7	7	6	5.60
Improvement from the previous year	4	1	7	7	7	5.20
Index Scores	**5.50**	**4.00**	**5.00**	**5.00**	**6.00**	**5.10 Very Good**

2009 - 10 Achievement Gap

INDICATORS	Reading			Math			Ext Graduation Rate			Average
	Met Std	Peers	Imp	Met Std	Peers	Imp	Met Std	Peers	Imp	
Achievement of Black, Pacific Islander, American Indian/Alaskan Native, Hispanic stds	6	7	3	1	7	7	5	7	4	5.22
Achievement of white and Asian students	7	4	7	5	5	7	6	7	7	5.78
Achievement Gap										**0.56**

2008-2009 and 2009-2010 Averages

INDICATORS	OUTCOMES					Average
	Reading	Writing	Math	Science	Ext Grad Rate	
Achievement of non-low income students						5.40
Achievement of low income students						3.50
Achievement vs. peers						5.40
Improvement from the previous year						3.70
Index Scores	**5.13**	**4.63**	**3.75**	**4.38**	**4.63**	**4.50 Good**

Washington State Achievement Index

District	Cascade
School	Cascade High School
2009 Achievement Award:	-

School Year 2008-2009

INDICATORS	OUTCOMES					
	Reading	Writing	Math	Science	Ext Grad Rate	Average
Achievement of non-low income stds	7	7	3	3	5	5.00
Achievement of low income students	5	6	1	1	3	3.20
Achievement vs. peers	5	5	5	7	4	5.20
Improvement from the previous year	2	3	1	4	1	2.20
Index Scores	**4.75**	**5.25**	**2.50**	**3.75**	**3.25**	**3.90** **Fair**

2008-2009 Achievement Gap

INDICATORS	Reading			Math			Ext Graduation Rate			Average
	Met Std	Peers	Imp	Met Std	Peers	Imp	Met Std	Peers	Imp	
Achievement of Black, Pacific Islander, American Indian/Alaskan Native, Hispanic stds	5	7	4	1	5	1	5	7	2	4.11
Achievement of white and Asian students	6	5	1	3	6	1	4	4	1	3.44
Achievement Gap										**-0.67**

School Year 2007-08

INDICATORS	OUTCOMES					
	Reading	Writing	Math	Science	Ext Grad Rate	Average
Achievement of non-low income students	7	7	5	4	7	6.00
Achievement of low income students	4	6	1	1	7	3.80
Achievement vs. peers	7	6	7	7	7	6.80
Improvement from the previous year	6	7	4	7	7	6.20
Index Scores	**6.00**	**6.50**	**4.25**	**4.75**	**7.00**	**5.70** **Exemplary**

Key Elements of Effective Science Instruction

Key Element of Effective Science Instruction	Description/Clarification	Teachers need to know	What do teachers do	What do students do	Research
1. Science Content	Student acquisition of the content of science involves opportunities to meet state crosscutting and domain standards and recognize how the big ideas fit within a large conceptual framework. Access to this learning is best achieved through sequencing learning objectives into learning progressions that inform teacher's instructional decision making.	• Acquire a deep understanding of science content • Know and understand the science standards for their grade band • Understand what content is appropriate for students at grade levels • Recognize the appropriate learning progression for a big idea	• Make science standards accessible through science content that is relevant and appropriate • Utilize learning progressions to drive instructional decisions • Clearly communicate the learning objectives in student friendly language • Craft essential questions related to the big ideas in the science standards	• Gain deep understanding of content appropriate to grade level • Be actively involved in formative assessment activities for that particular content • Know and understand their current progress towards the learning targets • Able to apply the science content	• How People Learn (HPL) Bransford, et al ▪ Key Finding #2, pp 12-13 • Effective Science Instruction Banilower, et al ▪ Intellectual Engagement, p8 • Designing Effective Science Instruction Tweed, ▪ Content Strategy 1: Identifying "Big Ideas" and Key Concepts, pp 24-37 • Ready, Set, Science! Michaels, et al ▪ Organizing Science Education Around Core Concepts, pp 59-86 • Science Classroom Observation Guide (SCOG) NCOSP IIA ▪ Science Content is significant, accurate, and worthwhile • Science Classroom Observation Guide (SCOG) NCOSP IIC ▪ Science content is intentionally connected to the classroom activities & experiences. • AAAS Atlas of Science Literacy, Vol. 1-2

Key Elements of Effective Science Instruction

Key Element of Effective Science Instruction	Description/Clarification	Teachers need to know	What do teachers do	What do students do	Research

2. Designing Instruction for Understanding	All students come to the classroom with ideas and beliefs about science concepts that can either facilitate or impede their learning. Effective instruction is built on understanding *of all* students' initial and developing ideas, identifying the gap between students' current understanding and learning targets. This evidence should inform instructional decisions and allow the teacher to provide specific feedback so that students become owners of their own learning.
	
	Students are intellectually engaged when they investigate reason, discuss, and make sense of science concepts.
	
	In order to construct understanding science experiences should help students make sense of the phenomena under study (claim), articulate that understanding (evidence), and defend that understanding (reasoning).
	Students should see science as a process.
		• A belief all students can learn
		• Awareness of student understanding
		• The learning targets
		• How scientists work
		• How to engage students in inquiry to develop understanding of science concepts and the nature of science
		• Conceptual sequence of the unit including:
		  • Content
		  • Order of concepts that students must experiences
			• Reveal and engage pre-conceptions and reasoning
			• Use student conceptual understanding data to inform instruction
			• Provide students with opportunities to confront or build upon conceptual understanding
			• Use the conceptual sequence of the unit to design instruction and develop formative assessments
			• Uses learning progressions to design formative assessments
			• Communicate the learning target in student friendly language
			• Engage students with scientifically oriented questions and use probing questions to clarify student thinking
			• Provide activities with opportunities for students to make claims, use evidence and communicate reasoning
			• Provide feedback so that students become owners of their own learning
				• Engage in science as scientists practice science
				• Use the learning targets to build their own understanding
				• Reveal preconceptions
				• Observe, investigate, collect data, think
				• Give priority to evidence
				• Formulate explanations from evidence
				• Communicate and justify explanations
				• Think about their thinking
				• Communicate how learning connects to the learning target
				• Recognize the evidence of understanding in their work and provide suggestions for what to work on next or where to go for additional resources
					• Effective Science Instruction Banilower, et al , pp5-13, p18
					• Classroom Assessment for Student Learning, Stiggins, pp3-18
					• Inside the Black Box, Black and Wiliam
					• How People Learn- Bransford, et al, pp14-16
					• Designing Effective Science Instruction Tweed,
					  ▪ Ch. 3, pp77-106, 112-120
					• Ready, Set, Science! Michaels, et al, pp127-133
					• LASER Classroom Observation Protocol
					• Transformative Assessment, Popham

Key Elements of Effective Science Instruction

Key Element of Effective Science Instruction	Description/Clarification	Teachers need to know	What do teachers do	What do students do	Research
3. Sense Making	To ensure sense making, instruction should intentionally facilitate an understanding of the connections between the activity and the intended learning targets and previous learning. Teachers must make certain that students draw appropriate conclusions and see the purpose of their activities. Additional opportunities should be given to apply the learned concepts to new situations. Instruction includes opportunities for learners to be aware of their thinking and learning and how it has changed over time (metacognition).	• How and when to provide time for students to make sense of what they are learning • How to make sure to leave enough time to wrap-up • What strategy to use for the wrap-up: ▪ conversations ▪ written reflections ▪ Nonlinguistic representation • How to guide collaborative discourse • How to structure cooperative learning activities	• Plan for sense-making opportunities throughout the lesson • Facilitate student talk and argument to understand the activity or topic. • Ask open ended questions and provide multiple explanations when appropriate to foster sense making. • Encourage students to explain their observations and data • Scaffold sense making opportunities so that students make connections between new learning and previous learning and big ideas. • Coordinate opportunities for students to apply learned concepts to new situations. • Provide time and encourages students to examine changes in their thinking. • Incorporate opportunities for sense-making in lesson wrap-up	• Engage in talk and argument around science concepts • Understand the targeted concepts underlying investigations and activities • Make connections between new learning and previous learning and big ideas. • Apply learned concepts to new situations. • Reflect on their thinking and changes in their thinking (metacognition) • Engage in scientific discourse and critique • Make claims and defend the claims with evidence • Continually review and revise their ideas to deepen their understanding	• Designing Effective Science Instruction Tweed, ▪ Understanding Ch. 3, pp107-126 • How People Learn, Bransford, et al, P 13-14, 18-19 • Ready Set Science, Michaels, et al, P 87-96 • Effective Science Instruction: What Does the Research Tell Us?- Banilower p 9-11 • LASER Classroom Observation Protocol

Key Elements of Effective Science Instruction

Key Element of Effective Science Instruction	Description/Clarification	Teachers need to know	What do teachers do	What do students do	Research
4. Classroom Culture And Environment	In order to provide effective science instruction the opportunity to learn science content is made accessible to each student in the class. The classroom should reflect the belief that all students can learn science. Science is a social enterprise that requires active participation in classroom discourse. It requires students to understand and practice the appropriate norms for presenting scientific arguments and evidence and to practice productive social interactions with peers in the context of classroom science investigations. The classroom environment should include motivation and attitudes that provide a foundation for students to be actively and productively engaged in science that is relevant and connected to students' lives.	• Understand students' context : ▪ interest ▪ background ▪ strengths ▪ challenges • The appropriate norms for engaging in scientific discourse • Understand that science is fundamentally a social enterprise • How to foster a collaborative learning environment • Understand how scientists think about and do science	• Structure classroom experiences that are meaningful, relevant and connected to the learner • Connect to students cultural background and life experience • Motivate and encourage students to be productively involved in the science classroom • Foster creativity and excitement/passion for learning science • Promotes a climate of trust and respect • Instruct and model effective discourse • Use collaborative strategies in the science classroom	• See themselves as learners of science • Share thinking and openly discuss their learning • Respect one another and value each other's ideas • Engage respectfully in scientific communication and critique • Engage collaboratively in the enterprise of science • Use evidence to support their argumentation	• Designing Effective Science Instruction Tweed, ▪ Environment Strategy 1, Believe All Students Can Learn, pp127-138 ▪ Environment Strategy 3: Develop Positive Attitudes & Motivation, pp150-160 • Ready, Set, Science, Michaels, et al, ▪ Making Thinking Visible: Talk & Argument, pp87-108 • Science Classroom Observation Guide (SCOG) NCOSP, IC, ▪ Science Content is Made Accessible to Each Student. • LASER Classroom Observation Protocol

EDUCATIONAL SERVICE DISTRICT 123

Delivering Collaborative Solutions that Promote Learning

Regional Mathematics and Science Coordinators

What we do...

equity... support... network...

ESD 123 Regional Mathematics and Science Coordinators work with teachers and administrators in 23 school districts across Southeastern Washington. Our work supports improved classroom instruction, connects educators, and builds leadership for strengthening K-12 math and science programs. Ultimately, the return on investment is improved learning for every student.

Provide Regional Professional Development

Creating Equity Across Districts -

- Provided regional math and science content trainings
- Developed a regional mathematics item bank aligned to the state standards
- Offered foundational kit trainings related to the science content and pedagogy of each unit
- Provided teacher leader, mentor and coaching learning opportunities
- Lead the implementation of classroom formative assessment practices through summer workshops and ongoing follow-up opportunities
- Provided onsite facilitation and implementation of formative assessment practices
- Provided training opportunities for the implementation of the newly adopted state math and science standards

equity

The Coordinators tailor their direct professional development services to fit the circumstances of the participating teachers. All districts in the region, regardless of size and composition, face huge obstacles in terms of student performance in science and math. Because the Coordinators have longevity and provide continuing services, not just one-time professional development activities, they serve as a key resource (perhaps the key resource for many districts) in boosting teacher competence in science and math.

Dale Ingram, Education and Outreach Coordinator
LIGO Hanford Observatory

Attachment C

EDUCATIONAL SERVICE DISTRICT 123

Delivering Collaborative Solutions that Promote Learning

Regional Mathematics and Science Coordinators

support

The work our Regional Math Coordinator, Cathey Bolson, has done with our 4th grade team has empowered them to truly look at math in a different light and be able to help their students become students who have the tenacity and drive to solve any problem they are presented with.*

Megan Nelson, Principal
Pasco School District

Supporting Classroom Instruction

Helping Districts -

- Align instructional materials to the state standards
- Create standards-based assessments
- Develop and implement scoring rubrics that support standards-based grading
- Design and implement Response-to-Intervention (RtI) at the classroom level
- Facilitate the adoption of new instructional materials
- Technical support on the implementation of state initiatives

Supporting Statewide Initiatives

Working As a Network -

- Synthesizing the current research and define the *Elements of Effective Science Instruction (EESI)*
- Coordinating the effort to align the most commonly used instructional materials in science to the state standards
- Collaborating with OSPI to create the Mathematics Systems Improvement Framework
- Acting as a conduit to provide timely information from OSPI to district leaders

The LASER Facilitator group and the Science Leadership Network have impacted my teaching greatly. I have a better understanding of what quality science education entails and a better understand of what resources are available to me as a science educator. My association with the Facilitator group, the Science Leadership Network, and specifically our coordinator, Georgia Boatman, is directly responsible for my improvement as an educator.

Mike Davis, Teacher
Finley School District

network

For more information contact:

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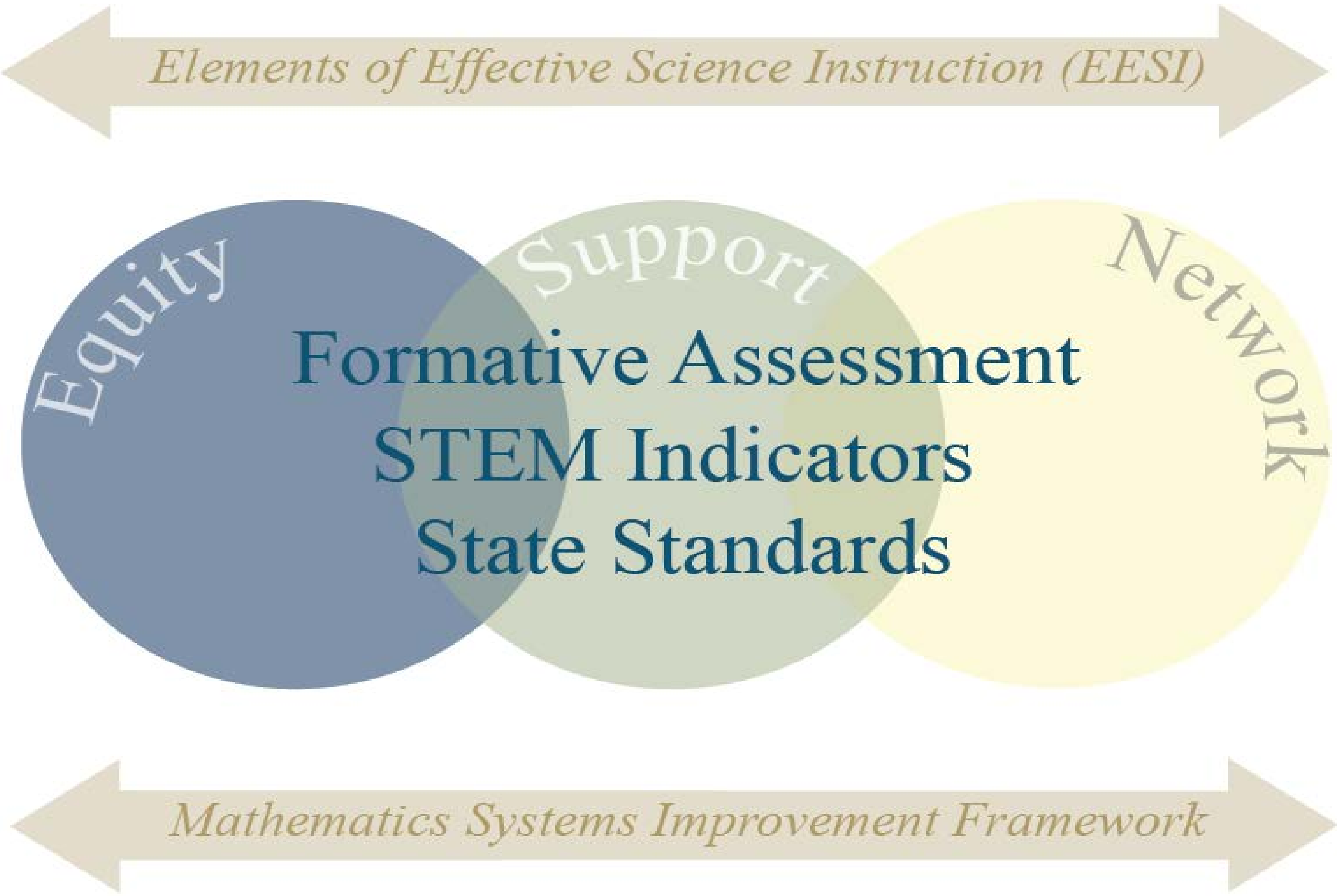
Georgia Boatman, Regional Science Coordinator
gboatman@esd123.org

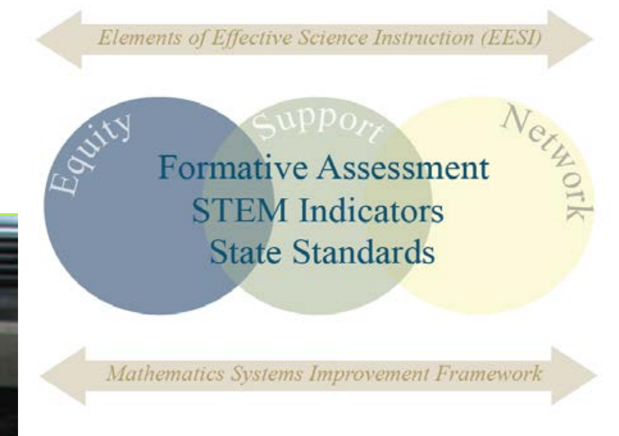
Regional Support for Math & Science

Cathey Bolson
Regional Mathematics Coordinator
Georgia Boatman
Regional Science Coordinator

EDUCATIONAL SERVICE DISTRICT 123
Delivering Collaborative Solutions that Promote Learning

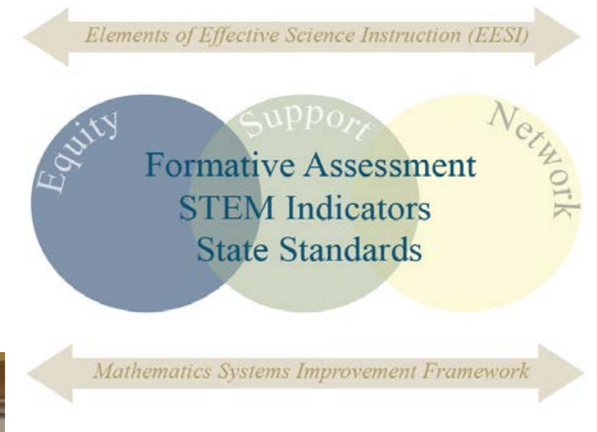

Elements of Effective Science Instruction (EESI)
Equity
Support
Network
Formative Assessment
STEM Indicators
State Standards
Mathematics Systems Improvement Framework

Formative Assessment
Support



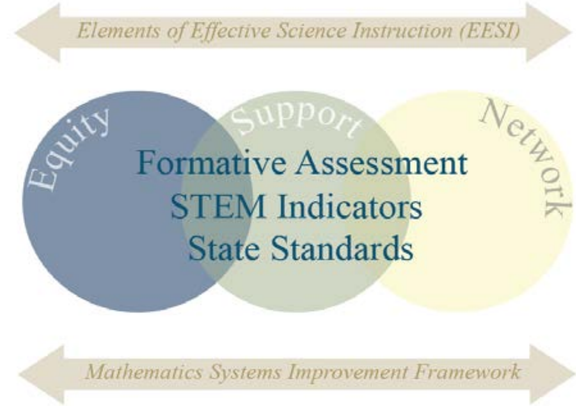
- **Relationships**
- **Superintendents**
- **Curriculum Directors**
- **Coaches**
- **Teachers**

Formative Assessment
Equity



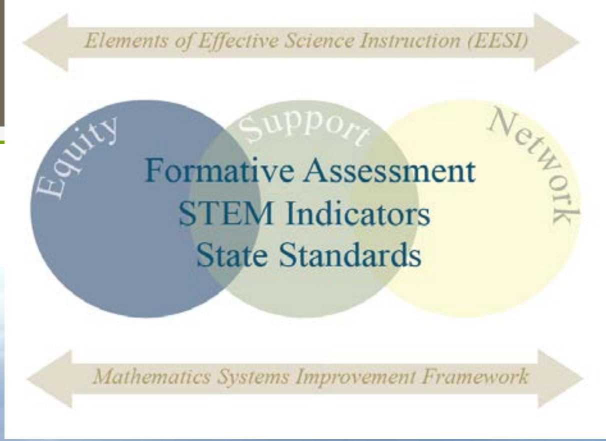
- Small Schools Consortium
- Coaches & Teacher Leaders
- Regional Delivery
- Regional Item Bank

Formative Assessment *Network*



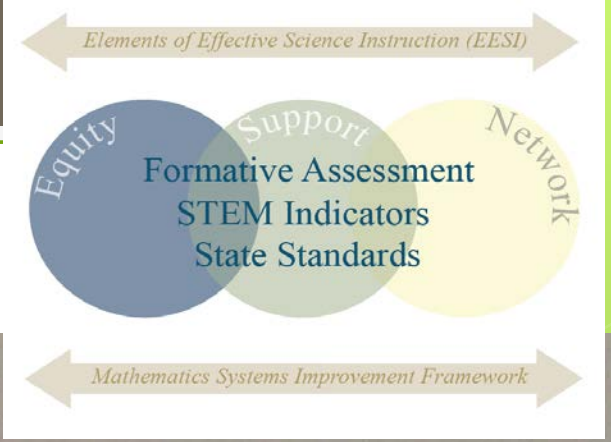
- **Statewide Item Bank**
- **Shared Best Practice Statewide**
- **Math Framework**
- **EESI**

STEM
Equity



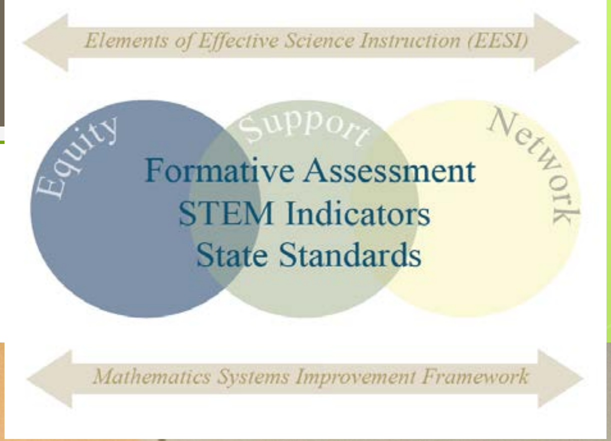
- Wind Farms
- Hanford Area
- Farming
- Fisheries
- Access for All Schools

STEM *Support*

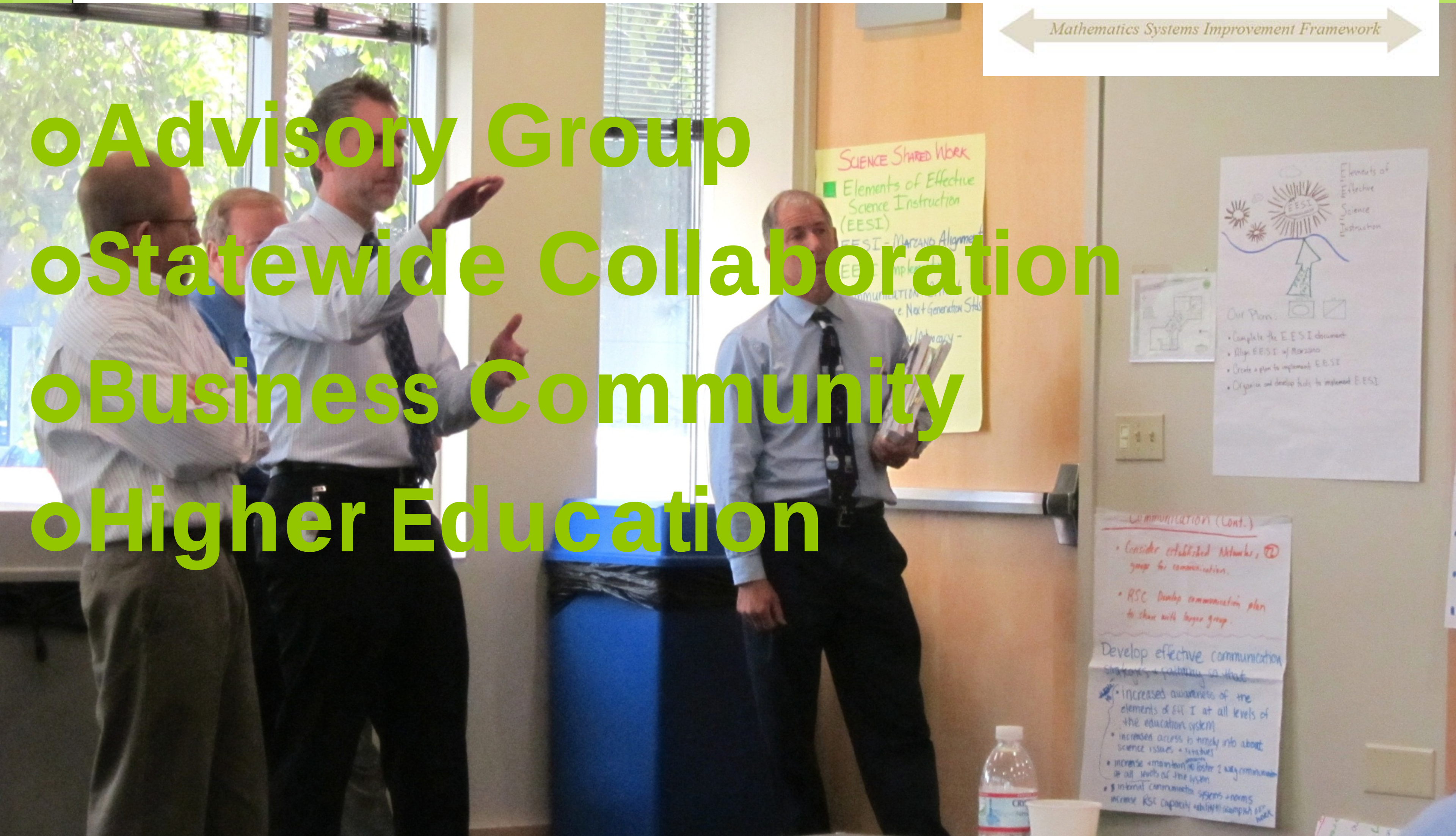


- **Readiness**
- **Indicators**
- **Grants**

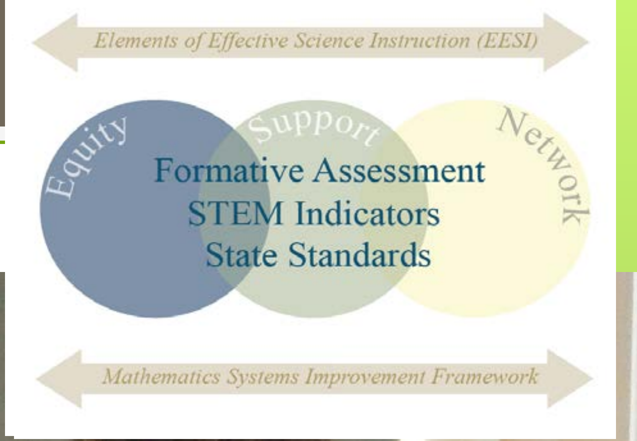
STEM *Network*



- **Advisory Group**
- **Statewide Collaboration**
- **Business Community**
- **Higher Education**

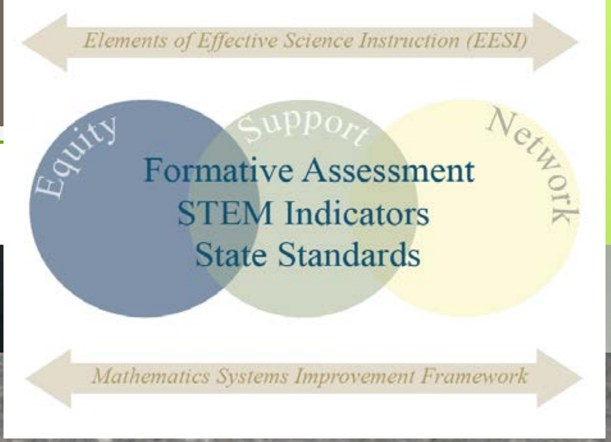


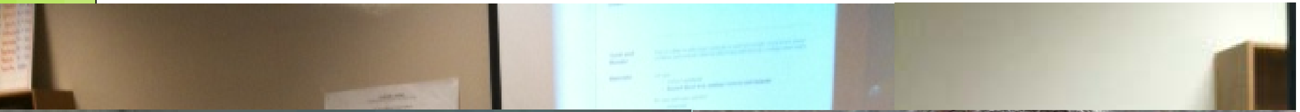
Standards *Network*



- **Statewide Collaboration**
- **Teacher Leaders**
- **Shared Resources**
- **Created Tools**
- **Professional Development Frameworks**

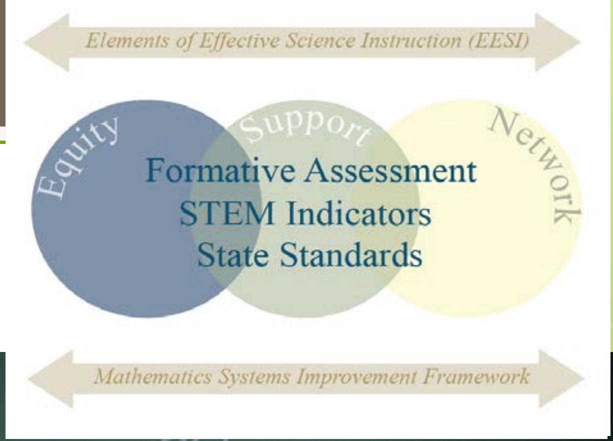
Standards Support





- Provided Tools to Districts
- Provided Regional Trainings
- Curriculum Adoptions
- Alignment Documents
- Technical Assistance

Standards
Equity



- **Every District**
- **Every School**
- **Every Student**




Thank you for this opportunity

Cathey Bolson
cbolson@esd123.org

Georgia Boatman
gboatman@esd123.org

PLCs in Action ~ Data, Dialogue & Collaboration

- Icicle River Middle School
  - Serves 6 rural NCW communities
  - Grades 6-8
  - 280-300 students

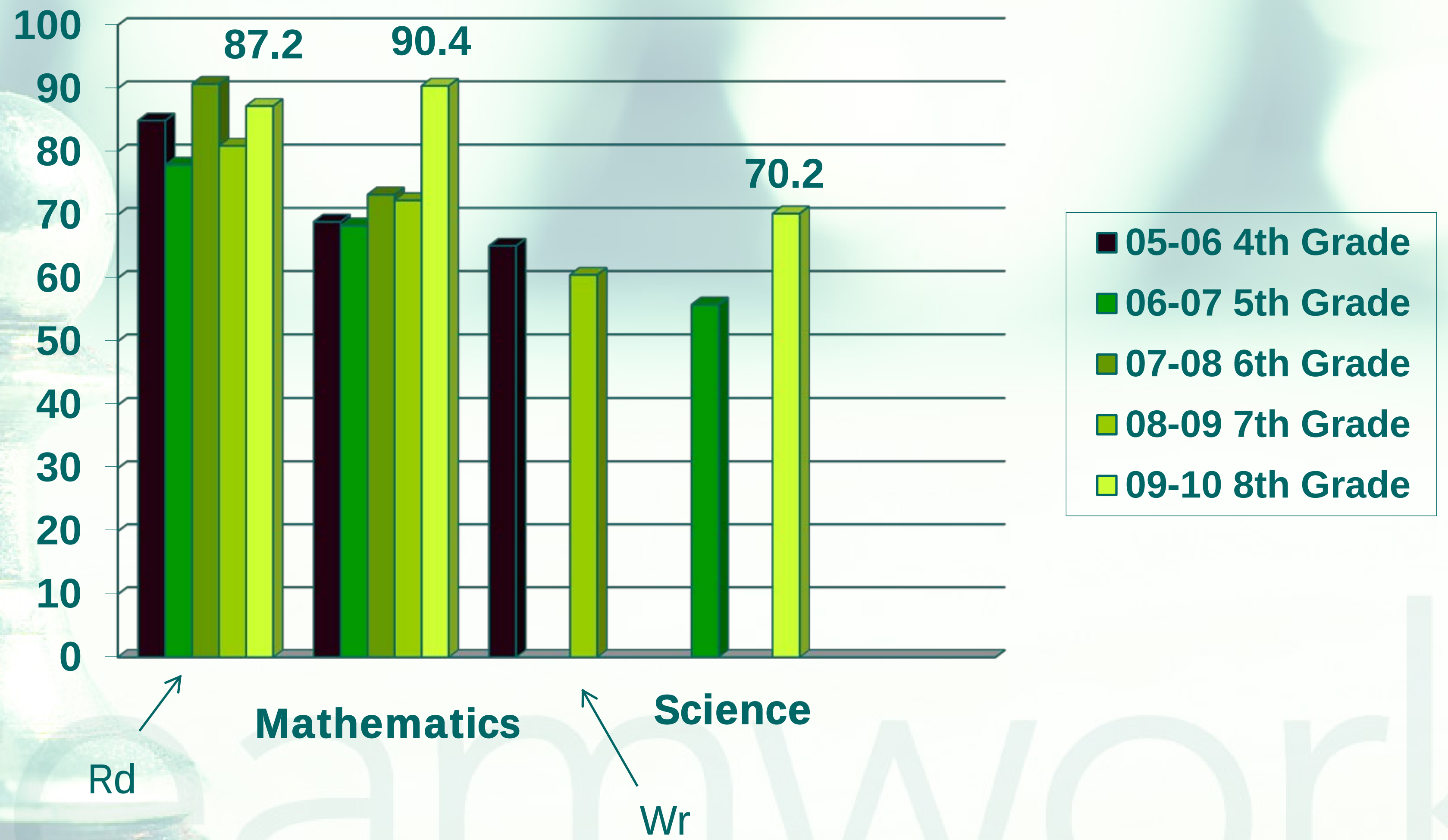
teamwork

School of distinction 2007-2010

- Top 5 percent of schools for Improvement over five years
- Only middle school in the state to win five statewide awards!

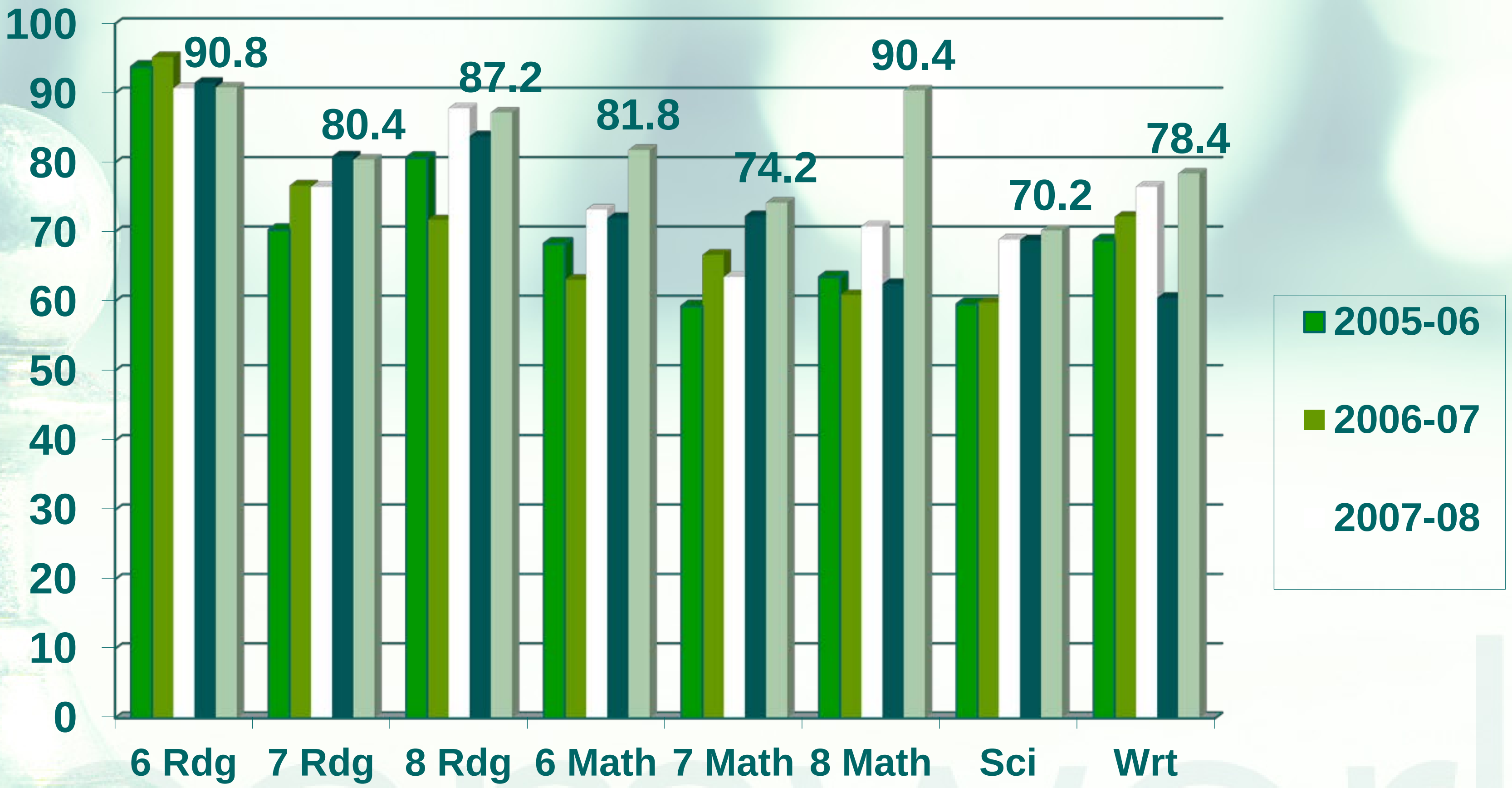
teamwork

Cohort Data for 8th Graders



teamwork

IRMS WASL 2005-10



teamwork

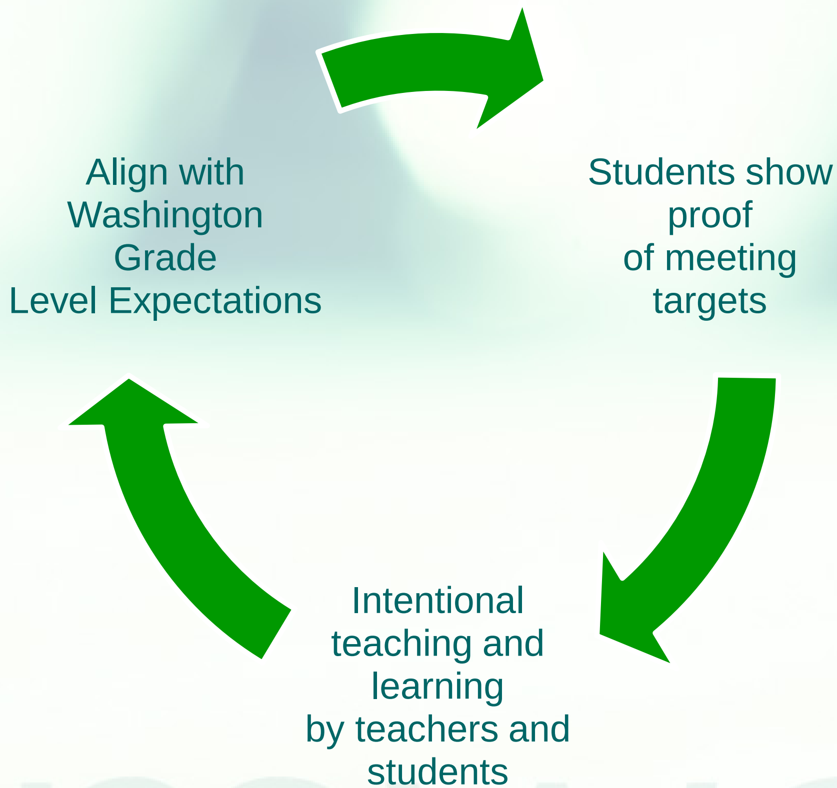
The 4 Pillars

- Mission
- Vision
- Common Commitments
- Goals

What do we expect students to Learn?

- Standards-based Learning Targets
  - State Standards: GLE's in all subjects
  - Our curriculum is the standards

Clear Learning Targets



Back to title page

teamwork

Quality Teaching and Learning

- Science:
  - Inquiry and application
  - Science conferencing
    - Modeling
    - Labs
    - Reflection
- Math
  - Standards-based targets
  - Conceptual mathematics

8th Grade Science Targets
Inquiry
Evidence of My Learning

Inquiry in Science Targets	**How well do you understand this target (0= not well; 5 = mastered)**	**Evidence:** Indicate the page number, quiz, or project.
1. I can generate a question that can be investigated scientifically.	0 1 2 3 4	
2. I can generate a logical plan for, and conduct, a scientific controlled investigation with the following attributes:	0 1 2 3 4	
a. I can make a **hypothesis** (prediction)	0 1 2 3 4	
b. I can **give reasons** for my hypothesis.	0 1 2 3 4	
c. I can list the **materials**, and tools needed for the experiment.	0 1 2 3 4	
d. I can identify the **controlled variables** (kept the same) in my procedures.	0 1 2 3 4	
e. I can identify the one **manipulated variable** (changed) in my procedures.	0 1 2 3 4	
f. I can identify the one **responding variable** (measured) in my procedures.	0 1 2 3 4	
a. I can gather, record and **organize data** using appropriate units, data table, and/or graphs.	0 1 2 3 4	
b. I can make my data reliable by including **multiple trials.**	0 1 2 3 4	
3. I can identify and explain safety requirements that would be needed in the investigation	0 1 2 3 4	
4. Generate a scientific conclusion that explains how the data supports the answer.	0 1 2 3 4	
5. Describe the difference between evidence (data) and conclusions.	0 1 2 3 4	
6. I can create a model to investigate the behavior of objects, events, and systems.	0 1 2 3 4	
7. I can explain the advantages and limitations of investigating with a model.	0 1 2 3 4	

teamwork

gets and Evidence of My Learning

Life Science

Big Idea: Structure and Function of Organisms

Core Content: From Cells to Organisms (Cells)

Target	How well do you understand this target?	Evidence: page number, quiz date, or project.
1. I can explain that cells are the basic units of life.	0 1 2 3 4 5	
2. I can use a microscope to draw, label, and describe plant and animal cells.	0 1 2 3 4 5	
3. I can explain a function of cells which helps to keep an organism alive: taking in nutrients.	0 1 2 3 4 5	
4. I can explain a function of cells which helps to keep an organism alive: photosynthesis.	0 1 2 3 4 5	
5. I can explain a function of cells which helps to keep an organism alive: respiration.	0 1 2 3 4 5	
6. I can explain a function of cells which helps to keep an organism alive: using energy to do work.	0 1 2 3 4 5	
7. I can explain a function of cells which helps to keep an organism alive: releasing waste materials.	0 1 2 3 4 5	
8. I can explain a function of cells which helps to keep an organism alive: producing materials that the organism needs.	0 1 2 3 4 5	
9. I can explain a function of cells which helps to keep an organism alive: cell division.	0 1 2 3 4 5	
10. I can draw concept maps which describe a cell as a system.	0 1 2 3 4 5	
11. I can describe how the structure of a specialized cell is related to its function.	0 1 2 3 4 5	
12. I can use labeled diagrams to show the similarities and differences between plant and animal cells.	0 1 2 3 4 5	

Sixth Grade Targets

	…gers using the number line, lists and
	…s using area models and the …quation.
6.1.D	Fluently and Accurately multiply and divide non-negative fractions and explain the inverse relationship between multiplication and division with fractions
6.1.E	Multiply and divide whole numbers and decimals by 1000, 100 10, 1 , 0.1, 0.01, and 0.001
6.1.F	Fluently and accurately multiply and divide non-negative decimals.
6.1.G	Describe the effect of multiplying or dividing a number by one, by zero, by a number between zero and one, and by a number greater than one
6.1.H	Solve single and multi step word problems involving operations with fractions and verify the solutions
6.2.A	Write a mathematical expression and equation with variables to represent information in a table or given situation.
6.2.B	Draw a first-quadrant graph in the coordinate plane to represent information in a table or given situation.
6.2.C	Evaluate mathematical expressions when the value for each variable is given.
6.2.D	Apply the commutative, associative, and distributive properties, and use the order of operations to evaluate mathematical expressions.
6.2.E	Solve one step equations and verify solutions.
6.3.A	Identify and write ratios as comparisons of part-to-part and part-to-whole relationships.
6.3.B	Write ratios to represent a variety of rates.
6.3.C	Represent percents visually and numerically and convert between the fractional, decimal, and percent representations of a number.
6.3.D	Solve single and multi step word problems involving ratios, rates, and percents and verify the solutions
6.3.E	Identify the ratio of the circumference to the diameter of a circle as the constant π, and recognize 22/7 and 3.14 as common approximations of Π.
6.3.F	Determine the experimental probability of a simple event using data collected in an experiment.
6.3.G	Determine the theoretical probability of an event and its complement and represent the probability as a fraction or decimal between 0 and 1 or as a percent between 0 and 100.

6.4.A	Determine the circumference and area of circles.
6.4.B	Determine the perimeter and area of a composite figure that can be divided into triangles, rectangles, and parts of circles.
6.4.C	Solve single and multi – step problems involving the relationship among the radius, diameter, circumference and area of circles and verify the solutions.
6.4.D	Recognize and draw two-dimensional representations of three-dimensional figures.
6.4.E	Determine the surface area and volume of rectangular prisms using appropriate formulas and explain why the formulas work.
6.4.F	Determine the surface area of a pyramid.
6.4.G	Describe and sort polyhedra by their attributes: parallel faces, types of faces, number of faces, edges and vertices.
6.5.A	Use strategies for mental computations with non-negative whole numbers, fractions
6.5.B	Locate positive and negative integers on the number line and use integers to represent quantities in various contexts.
6.5.C	Compare and order positive and negative integers using the number line, lists and the symbols <, >, or =.
7.1.A	Compare and order rational numbers using the number line, lists, and the symbols <,> or =.
7.1.B	Represent addition, subtraction, multiplication and division of positive integers visually and numerically.
7.1.D	Define and determine the absolute value of a number.
7.4.A	Represent the sample space of probability experiments in multiple ways, including tree diagrams and organized lists.
7.4.B	Determine the theoretical probability of a particular event and use theoretical probability to predict experimental outcomes.
7.4.C	Describe a data set using measures of center (median, mean and mode) and variability (maximum, minimum and range) and evaluate the suitability and limitations of using each measure for different situations.
7.4.D	Construct and interpret histograms, stem-and-leaf plots and circle graphs.
7.5.A	Graph ordered pairs of rational numbers and determine the coordinates of a given point in the coordinate plane.
7.5.B	Write the prime factorization of whole numbers greater than 1, using exponents when appropriate.

teamwork

How do we know students have learned?

- Assessment
- Data

Assessment: Math and Science

Screening: All Students

- MSP
- MAP
- Pre-testing targets

Outcome Assessment

- MSP
- MAP

Progress Monitoring

- Target benchmarks and quizzes

teamwork

How do we respond when students do or do not learn?

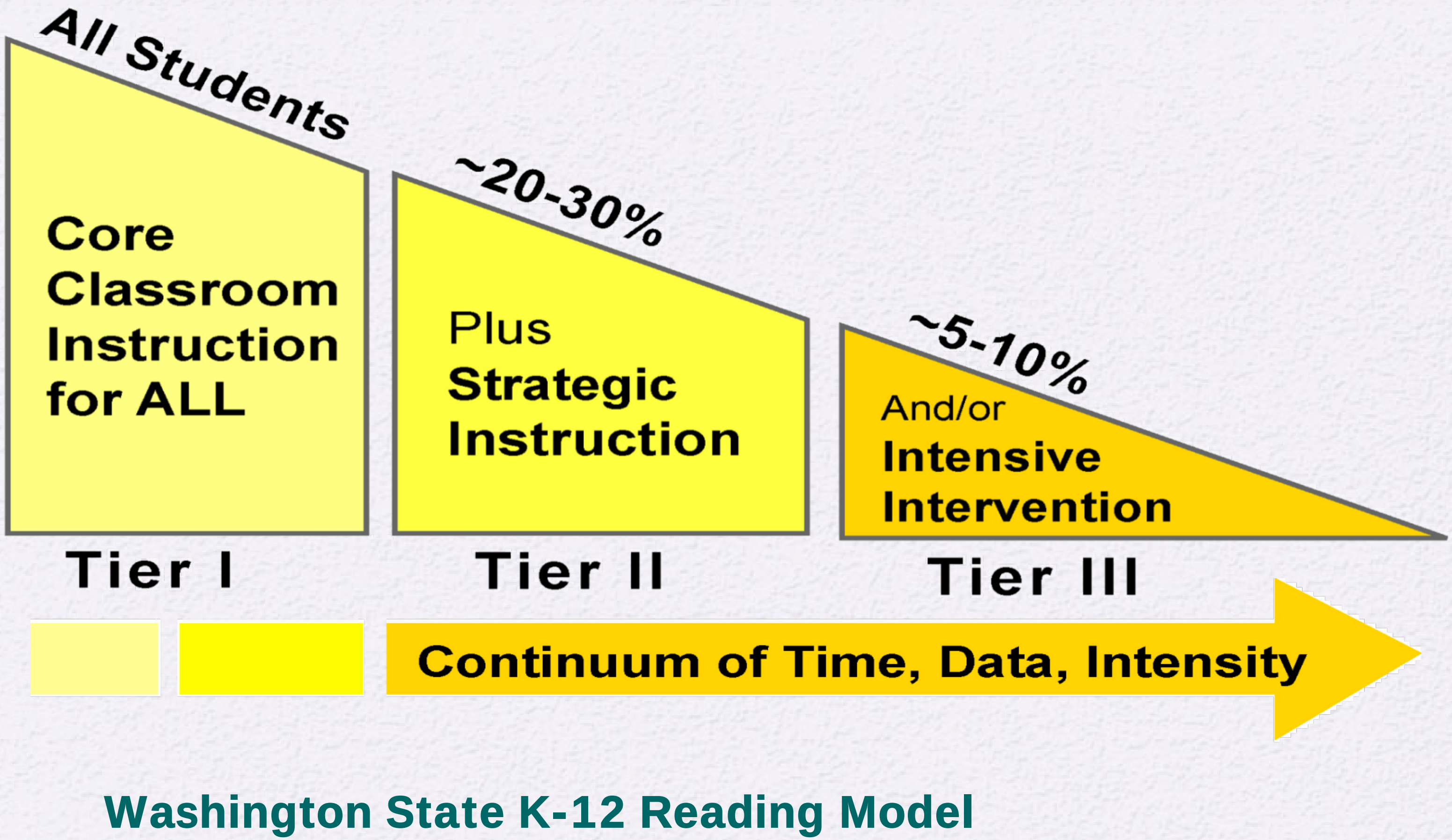
- 3 Tier Model
- Enrichment
- In-class interventions

teamwork

Learning Emergencies

- Children not reading at grade level by age nine are 10 times more likely to drop out of school
- They will have the earning power of about $12,000
- 43% of people with lowest literacy skills live below the government poverty line
- 70% of all prison inmates are functionally illiterate or below 4^{th} grade reading level

A system-wide response to learning emergencies….Three Tier Model



teamwork

How do we respond?

- Tracking data
  - Student Ownership of learning

- Re-teach and extend
  - Go back and ensure mastery of standards
    - Depth on Breadth

"Additional support is directive, NOT invitational" PLC

- **Example Schedule**
- 8:05-9:45 Tier I Language Arts, Social Studies Block
- 9:50-11:30 Tier I Math & Science Block
- 11:30-12:00 Lunch
- 12:05-1:20 Tier III & Exploratory

  A Day: Choir, Band, PE, or Art

  B Day: Special Ed, ELL
- 1:25-2:00 Tier II Enrichment (Intervention or Acceleration)
- 2:00-2:35 Tier II Enrichment (Intervention or Acceleration)
- 2:35-2:45 MYDC Wrap-Up

Collaboration

- Time
- Resources

A flexible day

- Flexible Block
- Collaboration built into the day

Teaming

- 40 minutes per day—Required
- Team Room
- Curriculum, schedule, student issues and meetings
- Empowerment

teamwork

School-wide management

- Make Your Day Count Citizenship Program (1997)
- Discipline to Citizenship
  - Student Planner
  - Staff Committee
  - Student Committee

Name	Exploratory	1	2	3	4	5	C.A	Points	MYD ?
Points Possible	50	50	50	50	50	50	50	350	
Mr. Janski									
Mrs. Brixey									
COURTNEY									
ELIJAH									
MICHAEL									
JUAN									
ANTONYA									
HAILEY									
CAITLIN									
EDITH									
JUAN									
JULIEN									
ELI									
MARIO									
JASMINE									
JOE									
ROSA									
NICHOLAS									
TRISTIN									
BRANDON									
JORDAN									
JOHNNA									
ALAN									
PAIGE									
JENNI									
TYLER									

Continuous Improvement @ IRMS

Short Term

- Vertical Teaming
  - Professional Development
- Data Collection
  - Assessments in Math, Reading, Writing, and Social Studies to inform instruction
- Targeted Support—Differentiated Instruction
  - Extra Time for Level 1 & 2's
- Instructional Coaching—Best Practices

Long Term

- State/NCESD Professional Development
- National Boards
- Continue grade-level and vertical teaming, flexible block scheduling, and MYDC
- Instructional Framework—Best Practices

teamwork

Policy Implications

- Clear standards
- Flexibility to meet standards
- Collaboration time built into the day
- Support National Board Certification

Washington State Achievement Index

Enter School Code:	4403
District	Cascade
School	Icicle River Middle School

2010 Achievement Award: (* indicates the school has won this award for two years)

Overall Excellence*

TIER	INDEX RANGE
Exemplary	7.00-5.50
Very Good	5.49-5.00
Good	4.99-4.00
Fair	3.99-2.50
Struggling	2.49-1.00

School Year 2009-2010

INDICATORS	OUTCOMES					Average
	Reading	Writing	Math	Science	Ext Grad Rate	
Achievement of non-low income students	7	5	6	6		6.00
Achievement of low income students	6	6	6	4		5.50
Achievement vs. peers	7	7	7	7		7.00
Improvement from the previous year	5	7	7	7		6.50
Index Scores	**6.25**	**6.25**	**6.50**	**6.00**		**6.25** **Exemplary**

2009 - 10 Achievement Gap

INDICATORS	Reading			Math			Ext Graduation Rate			Average
	Met Std	Peers	Imp	Met Std	Peers	Imp	Met Std	Peers	Imp	
Achievement of Black, Pacific Islander, American Indian/Alaskan Native, Hispanic stds	6	7	3	6	7	7				6.00
Achievement of white and Asian students	7	7	7	6	7	7				6.83
Achievement Gap										**0.83**

2008-2009 and 2009-2010 Averages

INDICATORS	OUTCOMES					Average
	Reading	Writing	Math	Science	Ext Grad Rate	
Achievement of non-low income students						6.00
Achievement of low income students						4.63
Achievement vs. peers						6.38
Improvement from the previous year						4.63
Index Scores	**6.13**	**4.38**	**5.75**	**5.38**		**5.41** **Very Good**

Washington State Achievement Index

District	Cascade
School	Icicle River Middle School
2009 Achievement Award:	Overall Excellence

School Year 2008-2009

INDICATORS	OUTCOMES					Average
	Reading	Writing	Math	Science	Ext Grad Rate	
Achievement of non-low income stds	7	5	6	6		6.00
Achievement of low income students	6	2	3	4		3.75
Achievement vs. peers	7	2	7	7		5.75
Improvement from the previous year	4	1	4	2		2.75
Index Scores	**6.00**	**2.50**	**5.00**	**4.75**		**4.56** **Good**

2008-2009 Achievement Gap

INDICATORS	Reading			Math			Ext Graduation Rate			Average
	Met Std	Peers	Imp	Met Std	Peers	Imp	Met Std	Peers	Imp	
Achievement of Black, Pacific Islander, American Indian/Alaskan Native, Hispanic stds	6	7	4	4	7	4				5.33
Achievement of white and Asian students	6	7	3	5	7	4				5.33
Achievement Gap										**0**

School Year 2007-08

INDICATORS	OUTCOMES					Average
	Reading	Writing	Math	Science	Ext Grad Rate	
Achievement of non-low income students	7	6	5	6		6.00
Achievement of low income students	5	4	3	2		3.50
Achievement vs. peers	7	5	7	7		6.50
Improvement from the previous year	7	4	6	7		6.00
Index Scores	**6.50**	**4.75**	**5.25**	**5.50**		**5.50** **Exemplary**

Washington State Achievement Index

Enter School Code:	3564
District	Cascade
School	Cascade High School

TIER	INDEX RANGE
Exemplary	7.00-5.50
Very Good	5.49-5.00
Good	4.99-4.00
Fair	3.99-2.50
Struggling	2.49-1.00

2010 Achievement Award: (* indicates the school has won this award for two years)

-

School Year 2009-2010

INDICATORS	OUTCOMES					Average
	Reading	Writing	Math	Science	Ext Grad Rate	
Achievement of non-low income students	7	6	5	4	7	5.80
Achievement of low income students	6	6	1	2	4	3.80
Achievement vs. peers	5	3	7	7	6	5.60
Improvement from the previous year	4	1	7	7	7	5.20
Index Scores	**5.50**	**4.00**	**5.00**	**5.00**	**6.00**	**5.10** **Very Good**

2009 - 10 Achievement Gap

INDICATORS	Reading			Math			Ext Graduation Rate			Average
	Met Std	Peers	Imp	Met Std	Peers	Imp	Met Std	Peers	Imp	
Achievement of Black, Pacific Islander, American Indian/Alaskan Native, Hispanic stds	6	7	3	1	7	7	5	7	4	5.22
Achievement of white and Asian students	7	4	7	5	5	7	6	7	7	5.78
Achievement Gap										**0.56**

2008-2009 and 2009-2010 Averages

INDICATORS	OUTCOMES					Average
	Reading	Writing	Math	Science	Ext Grad Rate	
Achievement of non-low income students						5.40
Achievement of low income students						3.50
Achievement vs. peers						5.40
Improvement from the previous year						3.70
Index Scores	**5.13**	**4.63**	**3.75**	**4.38**	**4.63**	**4.50** **Good**

Washington State Achievement Index

District	Cascade
School	Cascade High School
2009 Achievement Award:	-

School Year 2008-2009

INDICATORS	OUTCOMES					Average
	Reading	Writing	Math	Science	Ext Grad Rate	
Achievement of non-low income stds	7	7	3	3	5	5.00
Achievement of low income students	5	6	1	1	3	3.20
Achievement vs. peers	5	5	5	7	4	5.20
Improvement from the previous year	2	3	1	4	1	2.20
Index Scores	**4.75**	**5.25**	**2.50**	**3.75**	**3.25**	**3.90** **Fair**

2008-2009 Achievement Gap

INDICATORS	Reading			Math			Ext Graduation Rate			Average
	Met Std	Peers	Imp	Met Std	Peers	Imp	Met Std	Peers	Imp	
Achievement of Black, Pacific Islander, American Indian/Alaskan Native, Hispanic stds	5	7	4	1	5	1	5	7	2	4.11
Achievement of white and Asian students	6	5	1	3	6	1	4	4	1	3.44
Achievement Gap										**-0.67**

School Year 2007-08

INDICATORS	OUTCOMES					Average
	Reading	Writing	Math	Science	Ext Grad Rate	
Achievement of non-low income students	7	7	5	4	7	6.00
Achievement of low income students	4	6	1	1	7	3.80
Achievement vs. peers	7	6	7	7	7	6.80
Improvement from the previous year	6	7	4	7	7	6.20
Index Scores	**6.00**	**6.50**	**4.25**	**4.75**	**7.00**	**5.70** **Exemplary**