

Effective  
Leadership for  
Science and  
Mathematics  
Excellence



Sheila Jones

# Wanted

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A miracle worker who can do more with less, pacify rival groups, endure chronic second guessing, tolerate low levels of support, process large volumes of paper, and work double shifts. He or she will have carte blanche to innovate, but cannot spend much money, replace any personnel or upset any constituency.

Michael Fullan, 1998

# PRISM Lead Teachers

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- Who are you?
  - Experienced leaders in science and mathematics from diverse schools in Georgia
  - Teacher leaders who are dedicated to enhancing the skills and knowledge of others in the fields of science and mathematics

# Purposes of this Academy

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- To help you - leaders of science and mathematics education reform:
  - succeed in your role of planning and improving instruction in science and/or mathematics.
  - gain knowledge, skills, and strategies for initiating, implementing, and sustaining reform that helps ALL students learn science and mathematics.
  - build a strong, supportive, and ongoing learning community for teachers of science and mathematics.



Partnership for Reform In  
Science and Mathematics  
(PRISM)

# PRISM Partners

- University System of Georgia
- Georgia Department of Education
- Atlanta - Metro P-16 Council
  - Georgia State University
  - Center for Education Integrating Science, Mathematics and Computing (CEISMC)
  - Atlanta Public School District
- Northeast Georgia P-16 Council
  - University of Georgia
  - Georgia Perimeter College
  - Clarke, Jackson, and Oconee School Districts
  - Satellite Districts: Barrow, Commerce City, Jefferson City, and Oglethorpe School Systems
- Southeast P-16 Council
  - Armstrong Atlantic State University
  - Coastal Georgia Community College
  - Bryan, Camden, Chatham, and Glynn School Districts
- East Central P-16 Council
  - Georgia Southern University
  - Bulloch, Candler, Effingham, Evans, Screven, Toombs, and Vidalia City School Districts

# Regional and State Partnerships

University System of Georgia

## Metro Atlanta Region

- Georgia State University
- Atlanta Public Schools
- CEISM—Georgia Institute of Technology

## East Central Region

- Georgia Southern University
- Bulloch, Candler, Effingham, Evans, Screven, Toombs, and Vidalia City School Districts

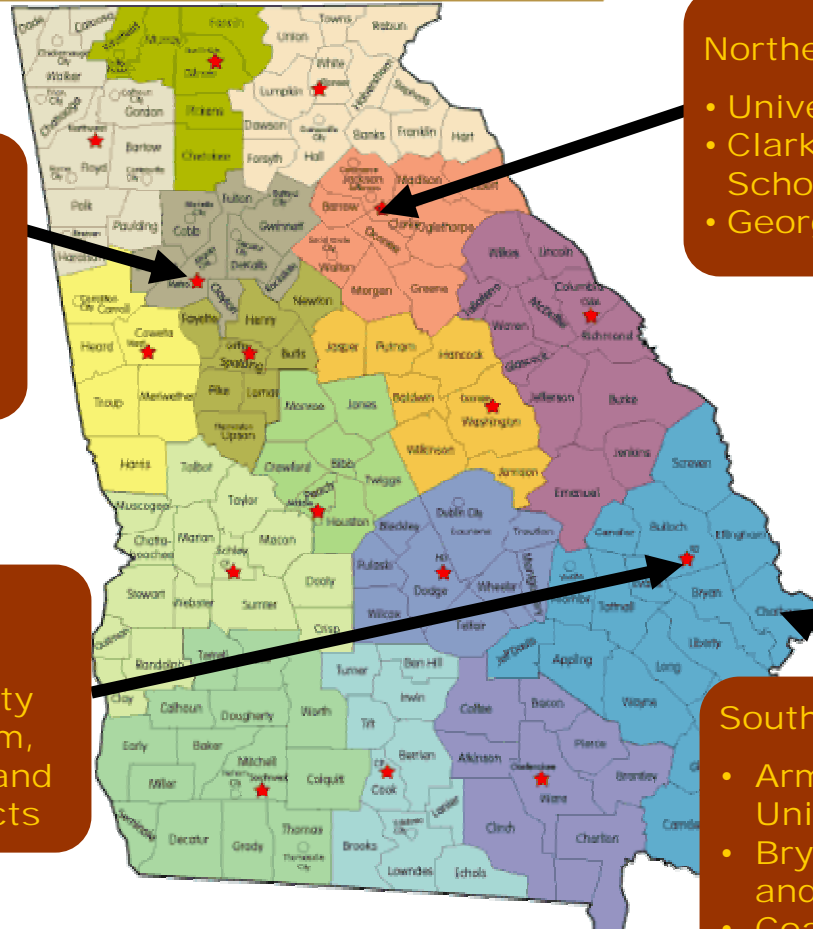
## Northeast Region

- University of Georgia
- Clarke, Jackson, and Oconee School Districts
- Georgia Perimeter College

## Southeast Region

- Armstrong Atlantic State University
- Bryan, Camden, Chatham, and Glynn School Districts
- Coastal Georgia Community College

Georgia Department of Education



# Partnership's Target Populations

## ■ Regional

- 170,000 K-12 students
- 10,000 K-12 teachers
- In 275+ urban & rural public schools
- 44% of teachers prepared in University System of Georgia

## ■ State

- 1.4 million K-12 students
- 100,000+ K-12 teachers
- 100% USG teacher preparation programs in science and mathematics (SM)



**GPS training with K-12 Teachers**



**Mathematics Awareness class  
SE Region 5<sup>th</sup> & 9<sup>th</sup> Graders**

# PRISM's Vision

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Increase science and mathematics achievement for all P-12 students in order to improve their readiness for post-secondary education and careers by enhancing teacher quality, raising expectation for all stakeholders, and closing the achievement gaps through the collaboration of P-16 partners.

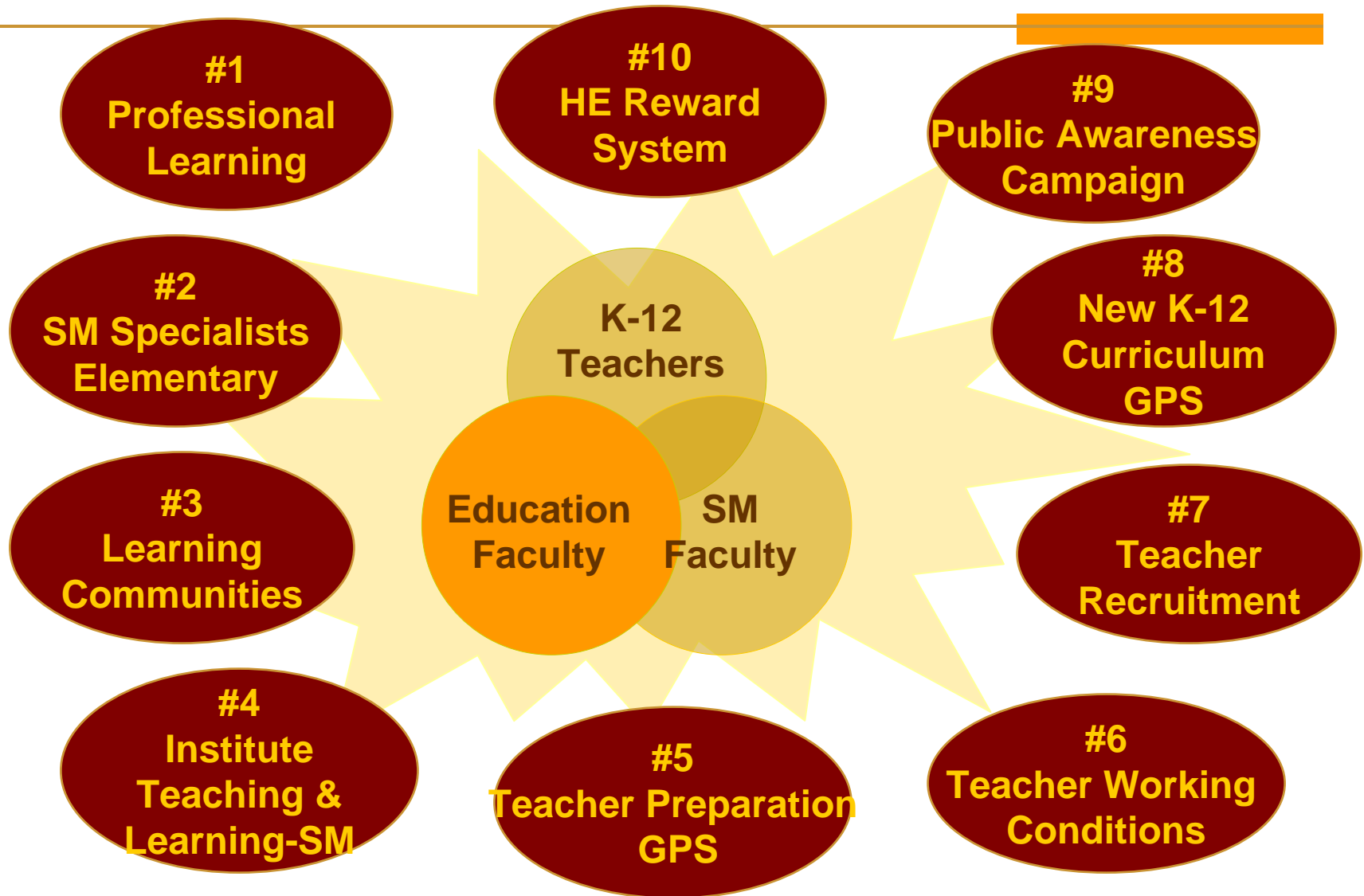
# Goals

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Raise expectations and achievement in SM in K-12 schools, while closing achievement gaps among demographic groups by

1. Requiring all students to complete challenging courses/curricula in SM
2. Increasing and sustaining the number, quality, and diversity of K-12 teachers teaching SM
3. Increasing the responsiveness of higher education to the needs of K-12 schools

# PRISM Design



# PRISM Strategies

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1. Provide quality professional development to P-12 teachers in science and mathematics.
2. Offer P-5 Endorsement science and mathematics courses for current teachers and continue to offer middle grades certification courses.
3. Implement P-16 Learning Communities focusing on science and mathematics.
4. Implement the Institute on the Teaching and Learning of Science and Mathematics for higher education faculty and high school teachers.
5. Add a science concentration requirement for P-5 pre-service teachers, work with SM education faculty to integrate the new GPS into teacher preparation programs and provide any needed GPS training for new teachers.

# PRISM Strategies cont.

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6. Initiate new policies that provide incentives and improved working conditions for teaching science and mathematics.
7. Implement strategies to recruit science and mathematics teachers.
8. Work with the Georgia Department of Education to create new standards and curricula in science and mathematics.
9. Conduct a public awareness campaign to ensure everyone understands the importance of taking challenging science and mathematics courses.
10. Create a higher education faculty rewards structure that supports work in K-12 schools.

# What is PRISM's PL Silver Bullet?

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- Customized
  - Individual teacher
  - Department, grade level or learning community
  - School
  - District
  - PRISM region
- Involves HE experts in the field working **WITH** K-12 teachers
- Developed using data (student and teacher)
- Delivered in ways that support teachers

# PRISM Professional Learning

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- Strategy 1
  - Provide high quality professional learning for K-12 SM teachers
- Strategy 2
  - Provide academic concentrations in SM for current K-8 teachers
    - P-5 Endorsement in S and/or M
    - Middle Grades Certification in S and/or M
- Strategy 3
  - Engage HE and K-12 faculty in learning communities
- Strategy 4
  - Engage SM and high school faculty in the Institute for the Teaching and Learning of SM
- Strategy 5
  - Provide teachers new to Georgia schools GPS training they missed during the 2004-05 academic year

# Learning Communities and PL

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## PL prior to PRISM:

- Teachers typically participate in PL that is recommended by the district with little input
- LCs are typically not in place and no HE involvement

## PL during and beyond PRISM:

- Teachers with a common interest work together in LCs, with content and pedagogical experts, to determine their own learning needs and seek appropriate expert to deliver the needed PL
- Districts empower teachers by allowing them to direct their own PL

# Creating Content Courses for K-8

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- P-5 Endorsement courses created through the USG SM Consortia
  - Mathematics completed in Year 1
  - Science completed in Year 2
- Middle Grades (6-8) Certification courses reviewed and revised
  - Mathematics recommendations completed in Year 1
  - Science to be completed in Year 2

# PL and the Institute

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- High school SM teachers have the opportunity to learn side by side with higher education faculty
  - Inquiry-based teaching strategies
  - Assessment

# PL and the GPS

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- New Teacher Symposium for GPS SM
  - A 5-day symposium offered during September through November

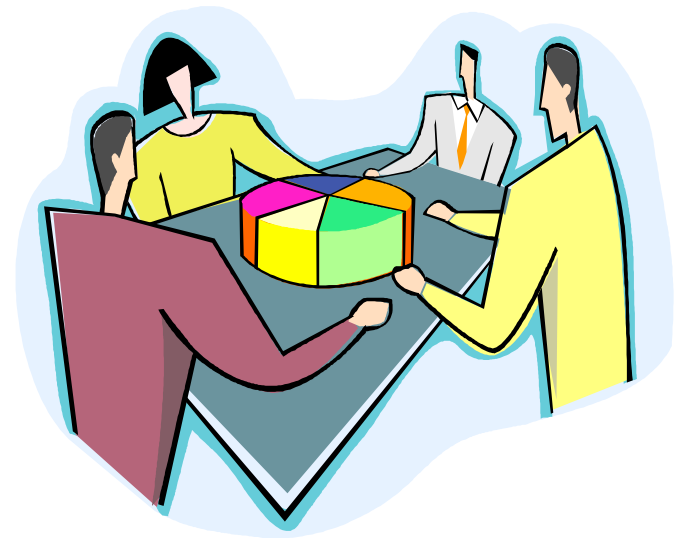
# PRISM Leadership

- Principal Investigator – Jan Kettlewell
  - [jan.kettlewell@usg.edu](mailto:jan.kettlewell@usg.edu)
- Project Director – Sheila Jones
  - [sheila.jones@usg.edu](mailto:sheila.jones@usg.edu)
- Associate Project Director for Higher Education– Dorothy Zinsmeister
  - [dorothy.zinsmeister@usg.edu](mailto:dorothy.zinsmeister@usg.edu)
- Associate Project Director for K-12 Education – Amy Mast
- Regional Co-PIs
  - Mike Padilla – [mpadilla@coe.uga.edu](mailto:mpadilla@coe.uga.edu)
  - Fred Rich – [frich@georgiasouthern.edu](mailto:frich@georgiasouthern.edu)
  - Sabrina Hessinger – [hessinsa@mail.armstrong.edu](mailto:hessinsa@mail.armstrong.edu)
  - Cookie Hanna – [nhanna@gsu.edu](mailto:nhanna@gsu.edu)
- Regional P-12 Coordinators
  - Dava Coleman – [dcoleman@coe.uga.edu](mailto:dcoleman@coe.uga.edu)
  - Penny Sikes – [pennysikes@georgiasouthern.edu](mailto:pennysikes@georgiasouthern.edu)
  - Vannie Walker – [walkerva@mail.armstrong.edu](mailto:walkerva@mail.armstrong.edu)
  - Adrian Epps – [aepps@atlanta.k12.ga.us](mailto:aepps@atlanta.k12.ga.us)
- Lead Evaluator – Judy Monsaas
  - [Judith.monsaas@usg.edu](mailto:Judith.monsaas@usg.edu)

# Management Plan

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- State Level Leadership Team
- Regional Coordinating Committee
- Lead Teacher Learning Community – face to face and electronic



# Questions ??

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[www.gaprism.org](http://www.gaprism.org)



What Does A Lead Teacher Do?

# Role of the Lead Teacher

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- Lead the development of a school improvement plan for science and mathematics
- Organize and facilitate school-based science and mathematics study groups/learning communities
- Collaborate and network with other PRISM lead teachers through the Lead Teacher Learning Community

# Role of the Lead Teacher

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- Professional Learning
  - Coordinate and facilitate teacher-managed professional learning
- Communication
  - Share professional learning plans and reports with school, district, and PRISM staff
  - Be an advocate for PRISM activities and strategies
- Evaluation
  - Serve as a contact between PRISM evaluators and PRISM teachers

# A Basic To-Do List

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## First task--

Share the PRISM Vision with all faculty and administrators in your school – especially with science and mathematics faculty

# To-Do List cont.

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## Second task--

Clarify opportunities that your faculty will have through PRISM to help them improve student learning in science and mathematics through inquiry and active learning

- Enrollment in the P-5 endorsement or middle grades certification courses
- Opportunities to work collaboratively with P-16 faculty through Learning Communities
- Other professional learning opportunities

# To-Do List cont.

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## Third task --

Be an active PRISM liaison between your faculty and regional leadership

- Schedule time to meet with and obtain perspectives of your faculty that they would want you to share with regional leadership
- Schedule time to meet (doesn't have to be face-to-face) regional leadership to find out what is currently being offered and sharing what needs to be offered for science and mathematics faculty



# Effective Leadership Practices

# Reflection on Personal Best as a Leader

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- What was the situation?
- What did you do that contributed to this being a personal best?
- What were the beliefs about leadership that guided you?



# Let's Watch Woody

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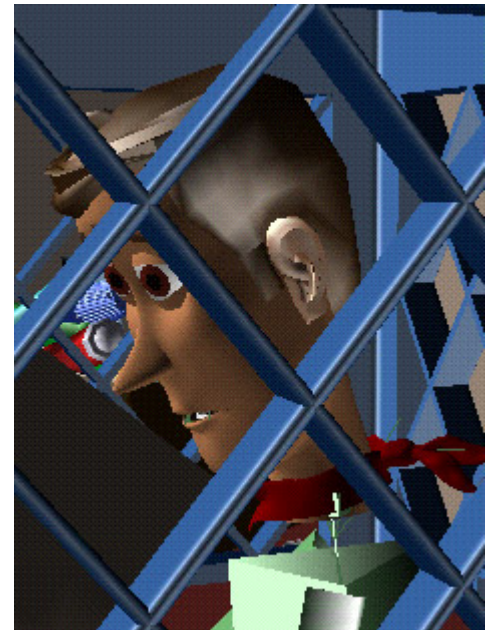
Identify examples of Woody's leadership characteristics and/or strategies in this first clip from "A Toy Story".



# What do you see this time?

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Identify examples of Woody's leadership characteristics and/or strategies in this second clip from "A Toy Story".



# Two types of leadership

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- Transactional: administers and controls systems by letting followers know what is expected.
- Transformational: develops systems by focusing on the needs of followers

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Transactional

Transformational

# Behavior Differences

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## Transactional

- Clarify goals and objectives to obtain immediate results
- Solve problems
- Create structures and processes for control
- Maintain and improve the current situation
- Plan, organize and control
- Guard and defend the culture
- Power comes from position and authority in the organization

## Transformational

- Establish long-term vision
- Create a climate of trust
- Empower people to control themselves; manage problem-solving
- Change the current situation
- Coach and develop people
- Challenge and change the culture
- Power comes from influencing a network of relationships

# Paradoxes of Leadership

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- Thinking abstractly
- Having direction
- Initiating change
- Encouraging innovation
- Fulfilling a national agenda
- Achieving goals
- Acting concretely
- Retaining flexibility
- Maintaining continuity
- Sustaining tradition
- Incorporating local mandates
- Enduring criticism

# Striving to Become a Transformational Leader

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Transformational Leaders strive to:

1. Help staff develop and maintain a collaborative, professional school culture.
2. Foster teacher development.
3. Help teachers solve problems more effectively.

# Leadership Practices

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- Challenging the Process
- Inspiring a Shared Vision
- Enabling Others to Act
- Modeling the Way
- Encouraging the Heart

# Challenging the Process

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- Effective leaders search for opportunities to change the status quo because they believe that the status quo breeds mediocrity.
- Effective leaders take risks and see mistakes as opportunities for learning and growth.



# Inspiring a Shared Vision

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- This practice is about envisioning the future and enlisting others in a common vision.
- Leaders create enthusiasm and commitment among followers to embrace the common vision by appealing to their personal visions, values, interests, hopes, and dreams.
- Leaders have a passion for their work.



# Enabling Others to Act

- This practice is about fostering collaboration and strengthening people.
- Leaders know that they cannot do it alone. They build teams and a culture of collaboration.



# Modeling the Way

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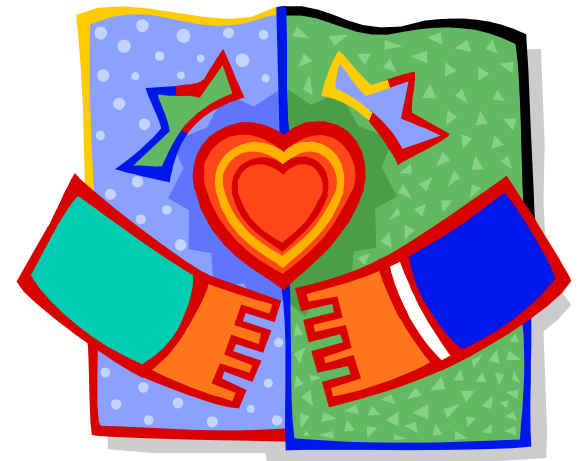
- Leaders set goals that enable followers to experience small wins as they work toward larger goals.
- They are conscious of possible roadblocks and take steps to remove them.



# Encouraging the Heart

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- This practice is about recognizing contributions and celebrating accomplishments.





# Collaborative Data Inquiry

# Lead Teachers will use Data to:

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- Assist in the development of the SM improvement plan
- Facilitate Learning Communities
- Support the school, district and RCC in the identification of Professional Learning/Development needs
- Support data gathering for the PRISM Evaluation

# Resources

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Love, N. (2002). *Using data/getting results: A practical guide for school improvement in mathematics and science*. Norwood, MA: Christopher Gordon.

<http://usingdata.terc.edu/toplevel/home.cfm>

# Definition

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Data – *n.pl.* facts or truths given or admitted and used as a basis for conclusions  
(from The New American Webster Handy College Dictionary).

# Examples of Data

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- Standardized test results
- State assessment results
- Performance assessment results
- Examples of student work
- Teacher surveys on classroom practice
- Teacher surveys on concerns and needs
- Surveys on student aspirations
- Mathematics and science classroom observations
- Interviews with administrators, teachers, parents, students

# Goals

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- Learn a process of collaborative inquiry for examining data.
- Identify how this collaborative inquiry process will benefit your school community.
- Describe how this collaborative inquiry process will contribute to the work of a professional learning community.

# Collaborative Inquiry

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- Step 1: Frame a question to investigate.
- Step 2: Collect and analyze data.
- Step 3: Draw conclusions.
- Step 4: Share results.

# Data-Driven Dialogue

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- Phase I: Assumptions and/or Predictions
- Phase II: Exhibitions and Observations
- Phase III: Explanations and Actions

# Phase I – Assumptions and/or Predictions

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- Do not refer to data.
- Make predictions about what will be seen.
- Discuss assumptions about the data.

# Phase II – Exhibitions and Observations

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- Clearly show significant pieces of data as a graph in order to focus the group.
- Describe patterns or trends that are emerging.
- Make observations, not inferences.

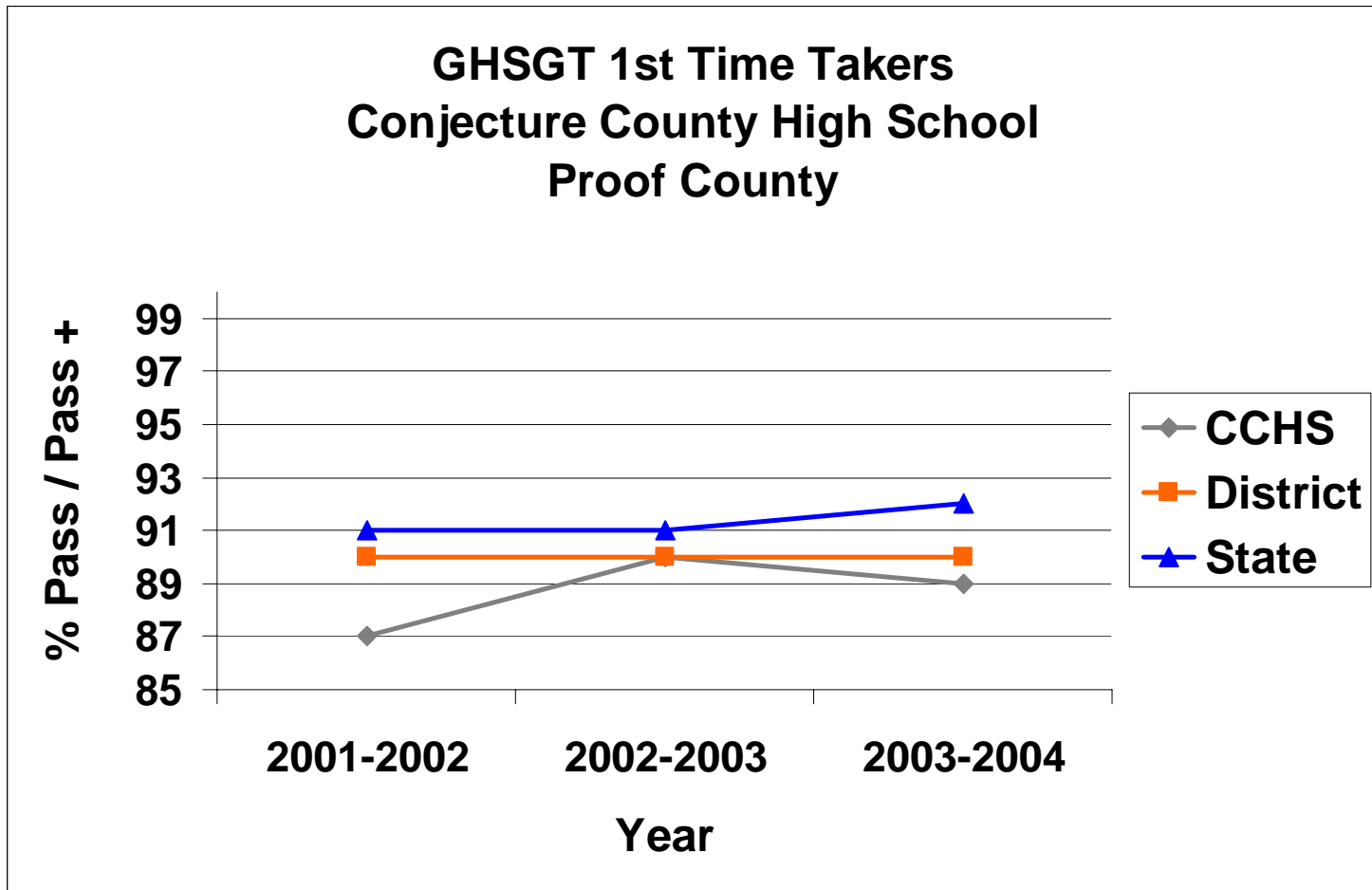
## **Observation**

45% of our students scored below proficiency in inquiry.  
The 3<sup>rd</sup> grade sub is wearing one blue shoe and one black shoe.

## **Inference**

We feel incredible pressure to cover the text & have no time.  
She must have dressed in the dark this morning.

# Data Graph



# Phase III – Explanations and Actions

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- Generate possible explanations.
- Decide if more data are necessary to validate these explanations.
- Consider questions, conclusions, solutions.

# Collaborative Inquiry

---

- Frame a question to investigate.
- Collect and analyze data.
- Draw conclusions.
- Share results.

# Collaborative Data Inquiry

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- Frame a question to investigate.  
Identify a student learning problem.
- Collect and analyze data.  
Use Data Driven Dialogue: phase I, phase II.
- Draw conclusions.  
Use Data Driven Dialogue: phase III.
- Share results.  
Implement action plan and monitor results.

# Multiple Measures of Student Learning Data

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- Classroom Assessments – formative and summative
- Common grade-level and course assessments
- School and district assessments
- State and national accountability assessments

# Multiple Levels of Student Learning Data

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- Aggregate
- Disaggregate
- Cluster / skill analysis
- Item analysis
- Student work

# Goals

---

- Learn a process of collaborative inquiry for examining data.
- Identify how this collaborative inquiry process will benefit your school community.
- Describe how this collaborative inquiry process will contribute to the work of a professional learning community.

# Benefits to School Community

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- Uncover hidden problems.
- Evaluate program effectiveness.
- Prevent over-reliance on standardized test scores.
- Respond to accountability questions.


# Contribution to a PRISM Professional Learning Community

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- Guide the work to be results oriented.
- Allow reflection and assessment of teaching practices.
- Build a foundation for collaboration with post-secondary faculty.
- Contribute to research.



# Effectively Leading Professional Learning in Science and Mathematics



If teachers are to teach for deeper understanding through processes that are more engaging of their students, professional development must mirror the type of instruction schools would like to see practiced in the classrooms.

*Dennis Sparks*

# Misalignment?

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## What we say

- Teacher learning is the centerpiece of effective change
- Students should be independent, self-directed learners
- Teaching is a complex process of decision making requiring a wide range of instructional strategies to meet individual learner needs

## What we do

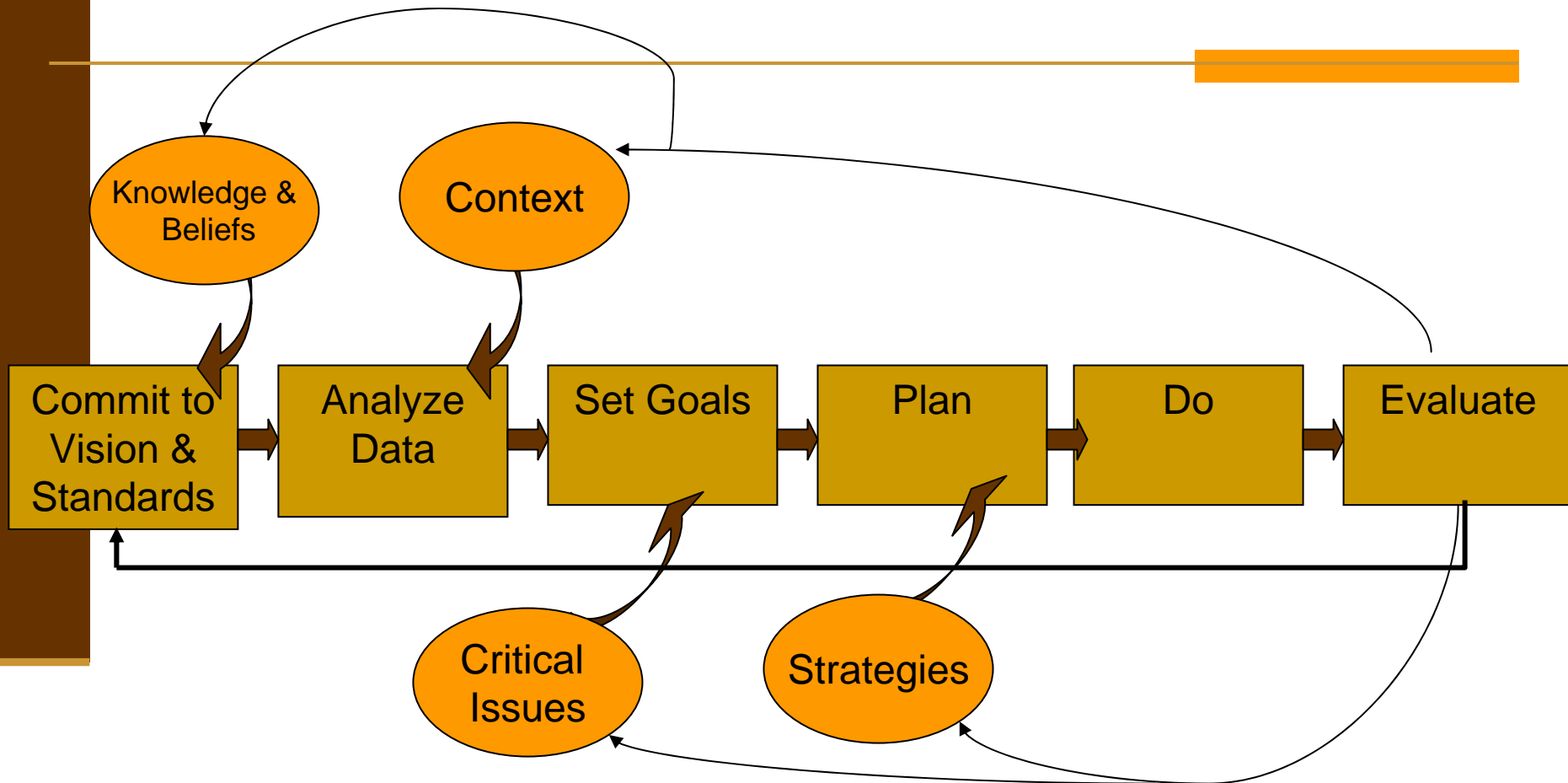
- Provide a few hours of in-service each year
- Give teachers little say regarding the content or process of their own professional learning
- Limit professional learning to workshops

# Powerful Professional Development

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- Driven by a clear image of effective teaching and learning
- Develops knowledge and skills
- Mirrors methods to be used by students
- Builds a learning community
- Develops teacher leadership
- Links to the system
- Is continuously assessed

# Professional Learning Framework



# Beginning the Design



## **Knowledge and Beliefs**

- Learners and Learning
- Teachers and Teaching
- The Nature of Science and Mathematics
- Change Process
- Effective Professional Development

# Questions to consider in committing to a vision and standards

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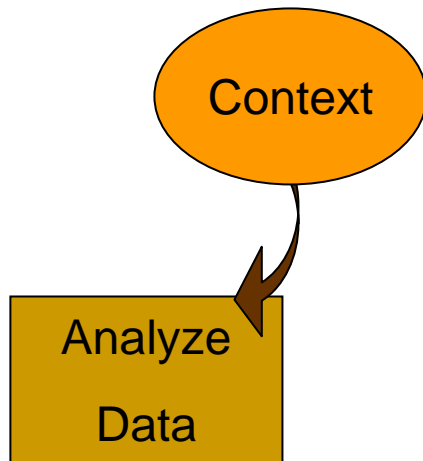
1. What is our vision for SM teaching and learning?
2. What do students need to know and be able to do in SM?
3. How will we know they have gained the knowledge?
4. What will we do if they do not gain this knowledge?
5. What do classrooms in which this new vision is playing out look like?

# Questions to consider in committing to a vision and standards

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6. What do teachers need to know and be able to do if students are to achieve these standards?
7. What is our vision for teachers' learning?
8. What does professional learning in which this new vision is playing out look like?
9. What kind of organization do we need to be to support this vision of science and mathematics teaching and learning?

# Studying the Data



## **Context**

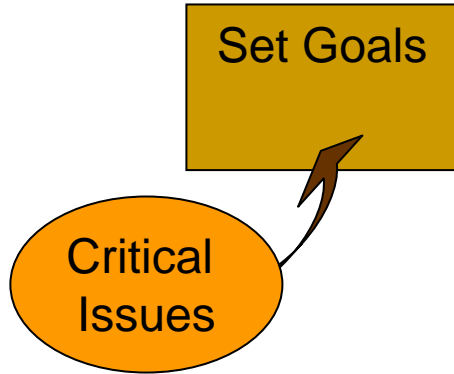
- Students and Standards in Place
- Teachers
- Curriculum, Instruction and Assessment
- Organizational Culture and Structure
- Policies
- Resources
- Past Professional Development
- Parents and Community

# Relevant Data

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- Demographic data about students and teachers
- Multiple measure of students' achievement of standards
- Student learning data disaggregated by racial, economic, language, and gender groups
- Data about classroom practice and students' opportunity to learn
- Data about professional learning, the school culture, and leadership

# Goals



## **Critical Issues**

- Finding Time
- Ensuring Equity
- Building Professional Culture
- Developing Leadership
- Scaling Up
- Public Support

# Four Kinds of Goals

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- Goals for student learning
- Goals for teacher learning
- Goals for teaching practice
- Goals for the organization

# Planning



Plan

Strategies

## Strategies

- Aligning and Implementing Curriculum (alignment & instructional materials, implementation, and replacement units)
- Collaborative Structures (partnerships w/scientists & mathematicians from business, industry and universities, professional networks, and study groups)
- Examining Teaching and Learning (action research, case studies, examining student work, and lesson study)
- Immersion Experiences (inquiry in science and problem solving in mathematics, world of scientists & mathematicians)
- Practicing Teaching (coaching, demonstration lessons, mentoring)
- Vehicles and Mechanisms (developing professional developers, technology, workshops, institutes, etc.)

# Teacher Learning Outcomes

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- Increase content knowledge
- Increase pedagogical content knowledge
- Develop professional learning community
- Develop leadership

# Professional Learning Strategy Purposes

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- Develop awareness
- Build knowledge
- Translate new knowledge into practice
- Practice teaching
- Reflect on teaching and learning

# Just DO it!

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- Effective professional learning is:
  - Designed to address a particular purpose;
  - Reflective of research-based knowledge and beliefs, local context, and critical issues;
  - Content-based; and
  - About teacher's real work

Do

# Evaluation

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- What are the goals or desired outcomes?
- How do you assess the accomplishment of the outcomes?
- How do you acknowledge and evaluate how a professional learning initiative and its participants change over time?
- How do you take advantage of evaluation as a learning experience in itself?

# Considerations

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- Multiple outcomes can be assessed using one evaluation tool/process
- Pre- and post-evaluation is critical
- Clarify what you want to learn before deciding on an evaluation tool?
  - Objective data: external information
  - Subjective data: internal, self-reported information

# Evaluating Changes in Teachers' Knowledge

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- Cognitive Learning (content):
  - Pre-post multiple choice test
  - Pre-post concept maps
  - Pre-post observation of content being taught
  - Pre-post case/video discussions
  - Pre-post open response writing
  - Pre-post learning logs/reflective journals

# Evaluating Changes in Teachers' Attitudes

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- Affective Learning (attitudes, beliefs, dispositions):
  - Pre-post interviews or surveys
  - Pre-post open response
  - Personal learning logs/reflective journals

# Evaluating Changes in Teachers' Practices

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- Classroom observations using a protocol
- Interviews with students
- Self-report data:
  - Surveys
  - Interviews, Focus Groups
  - Journal Entries
  - Implementation Logs
  - Portfolios

# Issues with Evaluating Adults

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- Adults are not used to being “assessed” on their content knowledge
- Environment of trust, collegiality and responsibility *versus* accountability and evaluation
- Need for understanding of purpose, use, and confidentiality of data gathered

# Evaluating Changes in Students' Knowledge

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- Cognitive Learning (content):
  - Achievement or proficiency assessments
  - Classroom assessments: end-of-unit/chapter, embedded unit, and/or common grade-level assessments
  - Performance-based assessments
  - Portfolios
  - Annual test scores
  - Examining student work and thinking using protocols and rubrics
  - Action Research

# Evaluating Changes in Students' Attitudes

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- Affective Learning (attitudes, beliefs, dispositions):
  - Pre-post questionnaires or survey
  - Pre-post interviews
  - Pre-post open response writing

# Evaluating Changes in Programs and Policies

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- Walk-throughs
- Course enrollment
- Course offerings
- Special program placement
- Tracking practices
- Graduation rates
- College attendance rates
- Retention rates
- Discipline or suspension data
- Absenteeism rates

# How do we use what we learn from evaluation of our professional learning?

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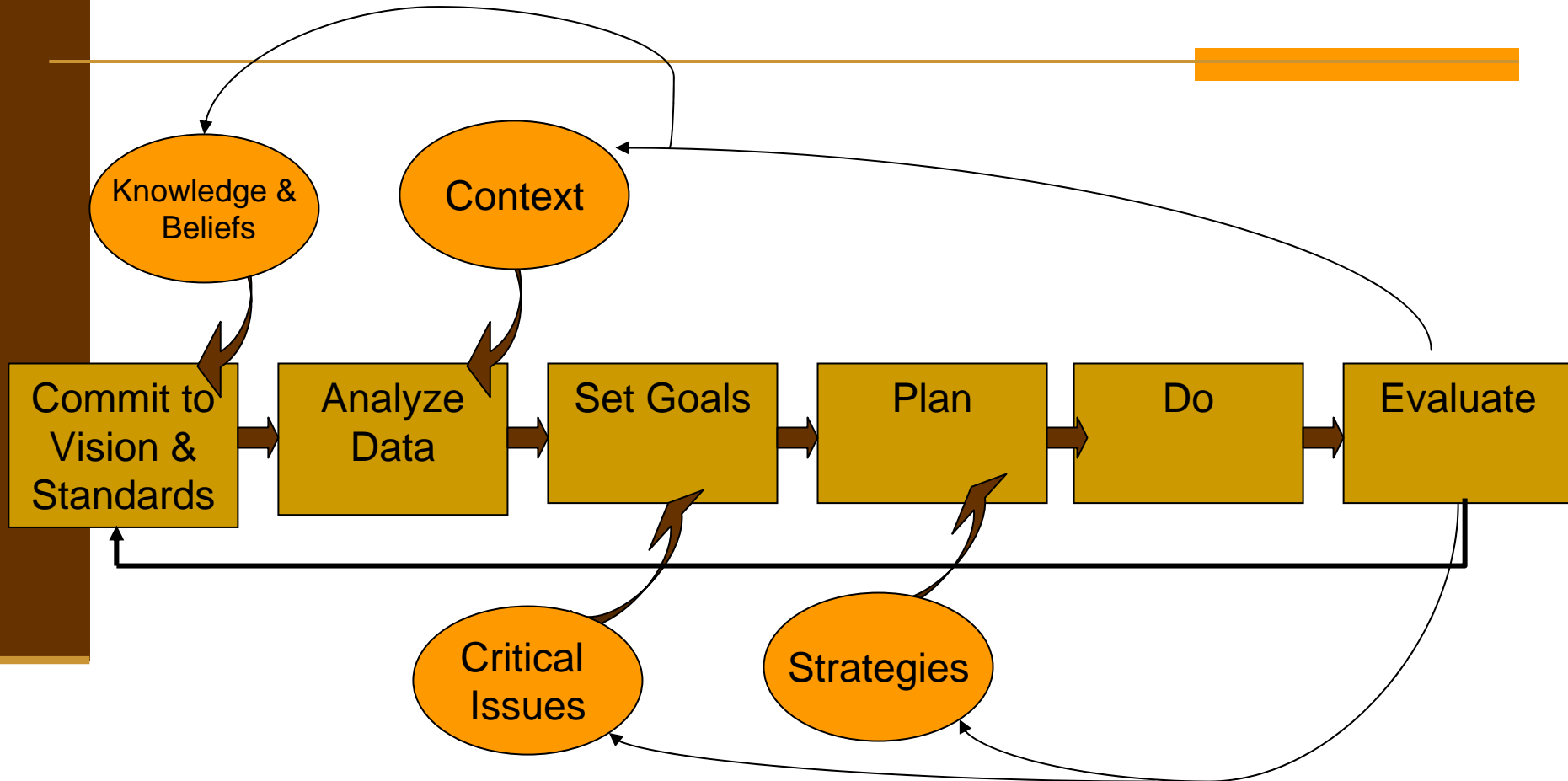
- Determine whether goals and objectives were met
- Improve the overall program
- Improve the delivery of professional learning strategies
- Test innovative ideas/strategies
- Support the use of one program over another
- Guide decisions of scale-up

# Evaluating

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- How will we know if we have met our outcomes?
- Could one evaluation tool be used to gather information on more than one outcome?

# Professional Learning Framework





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