

# Business Intelligence For Education

## A Journey Worth Taking

Shaun Taylor - Chief Information Officer  
Tacoma Public Schools  
2 December 2015

# A CIO's Prospective on Business Intel, Machine Learning, Azure and other stuff

- Data – What makes is Valuable
  - Business Information vs. Business Intelligence
- Tacoma's Journey on Using Data
  - Path to Successful Business Intelligence
- Azure and Machine Learning
  - Hybrid Between Cloud and On Premise
  - Data Scientist vs SQL Analysts
- Final Thoughts

# Tacoma Public Schools

- Located in the City of Tacoma, Washington, USA
- Urban City District
  - 29,000+ students
  - 65 Schools
  - 70% + Free and Reduced population
- Large Industrial Port
- 2010 TPS High Schools Listed as Drop-out Factory
  - On Time Graduation at 55%
- 2015 TPS On Time Graduation Rate +80%



# My Vision

- Help Transform Education Through the Use of Real Time Business Intelligence
- Have a Student Centered Decision Support System
  - Leverages All Data that Influences a Student's Success
    - Beyond Attendance, Grades and Discipline
  - That Brings Relevant Student Trend Information to the Fingertips of ALL Educators and Other Stakeholders **in REAL-TIME.**
- Minimal Barriers to Use the Solution.
- Consistency From a Look/Feel/Use for the End User

# Business Information

VS

# Business Intelligence

**BI**  $\neq$  **BI**

# BI vs BI

- **Business Information: Informative**
  - **Benchmarks between similar organizations**
    - Example: Top 10 comparisons of student performance
      - By program; By school; By .....
  - **Often Not Actionable**
  - **Comparative Analysis at a High Level of Comparable Districts**
  - **Most Common Benchmarks in K12**
- **Business Intelligence: Informative AND Actionable**
  - **Helps to determine specific course of action**
  - **Possibly identify a needed intervention in a real time basis**
    - Before it is too late to act effectively
  - **Possibly identify specific PD for specific staff that has a demonstrated success pattern in the classroom.**

# A Perfect Blend of

Leadership + Business Intel.

**Results  
For  
Students**

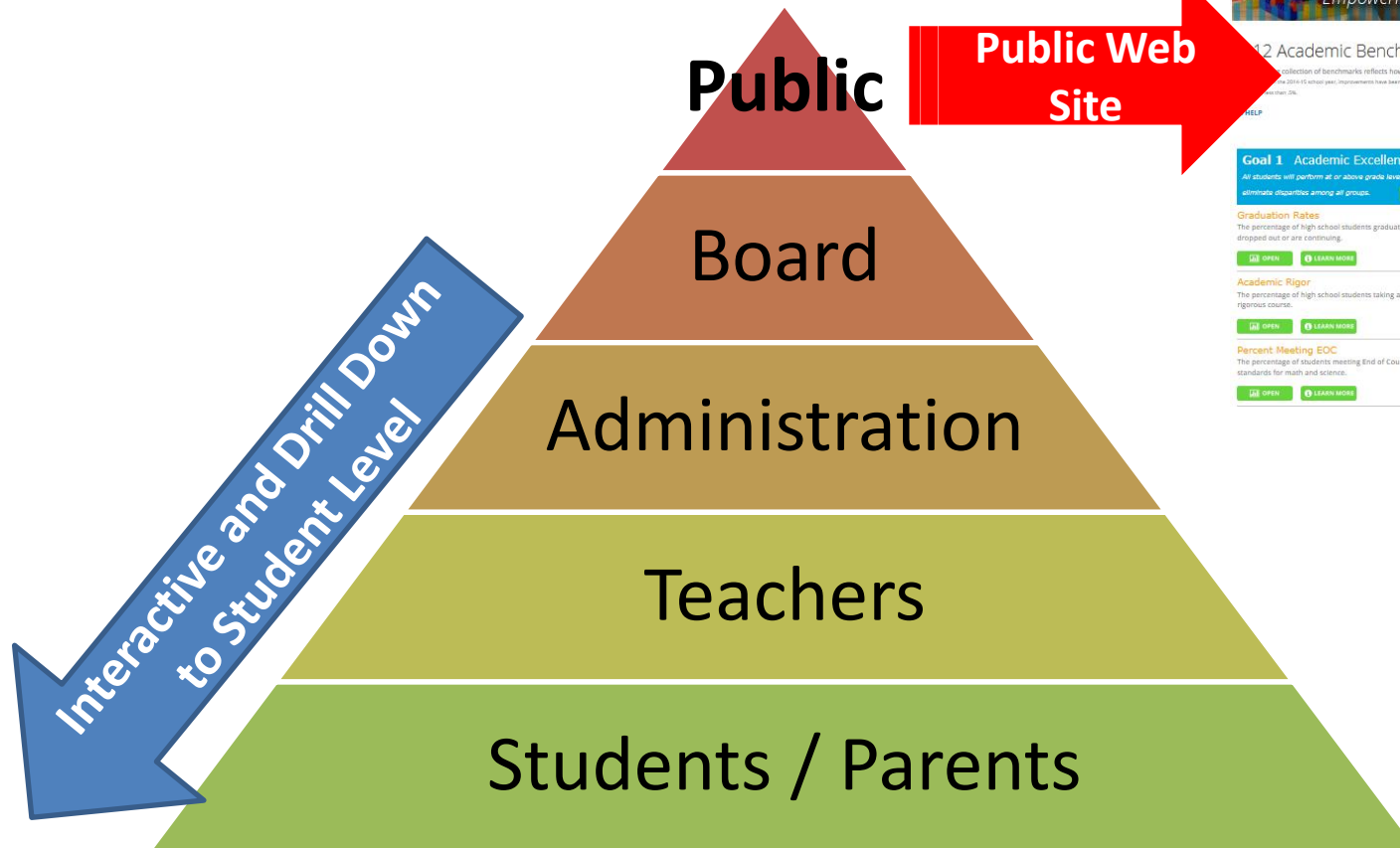


# Board Adopts Benchmarks To Support Strategic Goals

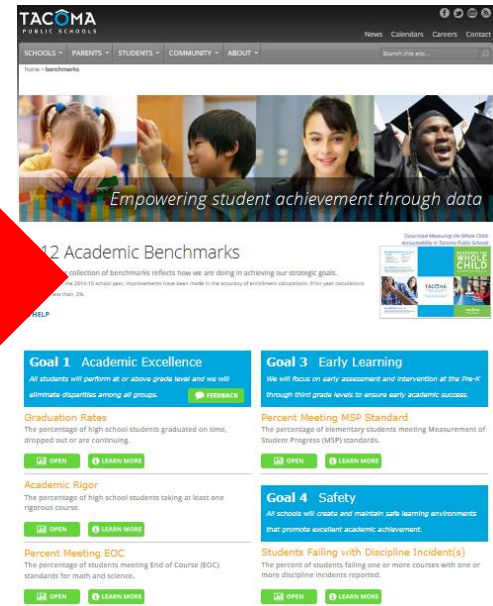




# Official Benchmarks

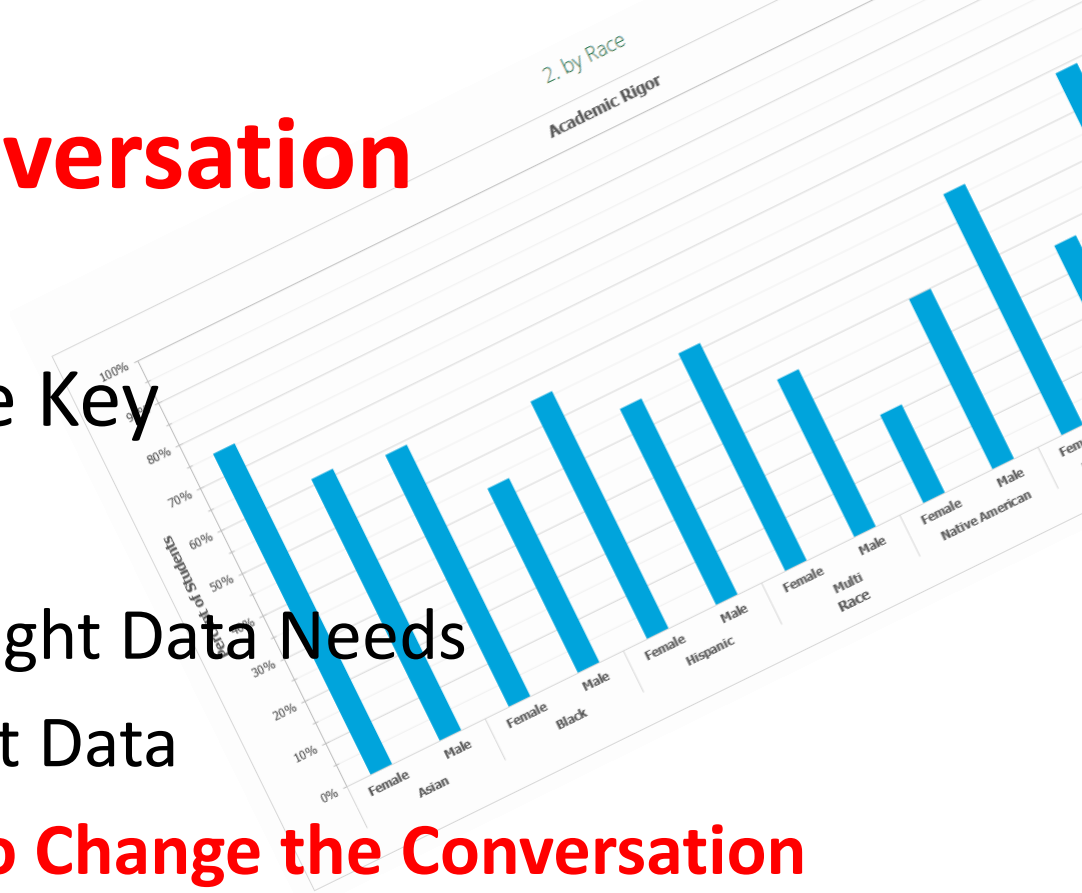


**Public Web Site**



# Data Driven Conversation

- Transparency is the Key
- The Journey
  - Determining the Right Data Needs
  - Capturing the Right Data
  - Sharing with ALL **to Change the Conversation**
- Once the Data is Ready – Show the Truth with all



# DEMOGRAPHICS

- Eastside vs Westside
- Zip Code
- Family Status
- FRL
- Mobility

- ELL
- Birthdate
- Age Yr. Mo.
- Major Life Events  
re: divorce, death in family, etc.

# Interventions

- Teacher Intervention: Warning, Discipline, Lunch Detention, After School
- Parent Contact: Warning, Detentions, ISS, Exp., Expulsion, Exp.
- Principal: Warning, Detentions, ISS, Exp., Expulsion, Exp.
- Beck Referral
- TPD - SRO
- Security Warning

# Time

- Year
- Month
- Date
- Week
- Day
- Period
- Cycle of Moon
- Time of Semester
- Length of Time
- Between Referrals Calculated
- Color-Coded

# Student

# Discipline

# Discipline

# Program

- McKinney Vento
- At-Risk/Athletics
- After School Support
- Honor
- College Bound
- Mentor/Mentee

# TEACHER

- Type of Endorsement
- Years Experience
- Teacher Endorsed Area
- Type of Cert.
- Years in Bldg
- Years in Tacoma
- Years in Education
- "Major Age of Teacher"

# Subject

- Subject Type
- Compare to Curriculum Maps Use
- When Last Reviewed
- Subject Area: Sci, Eng, Math, SS, CTE, MEds, PE, Health
- Required Class vs. Elective
- SpEd vs. Reg. Ed.

# Demographics

- Mobility
- Ethnicity
- SPED
- Years in Bldg
- Years in Tacoma

# TESTING

- STATE TESTING - MSP/MSPE
- LOCAL Testing - Math/Reading
- FSI
- SRI
- Read 180
- DIBELS

# Intervention for GRADE SUPPORT

- Tutoring
- Mentoring
- Manner in which Capture Information
- LAP/TITLE
- College Bound Aff
- SPED. Support
- Co-Curricular

# TEACHERS

- Attendance (staff)
- Timeliness of Grade Entering
- Number of E Grade
- % of Students Failing
- Years of Teaching
- Endorsement

# GRADES metrics

Real-Time DATA

# SUBJECTS

or Elem Standards

- LIST OF CLASSES
- Weekly Grades
- Assignments

# Grades

# SCHOOL

# TRADITIONAL K12 DASHBOARDS

Traditional 3<sup>rd</sup> Party Solutions

Not Flexible

Proprietary

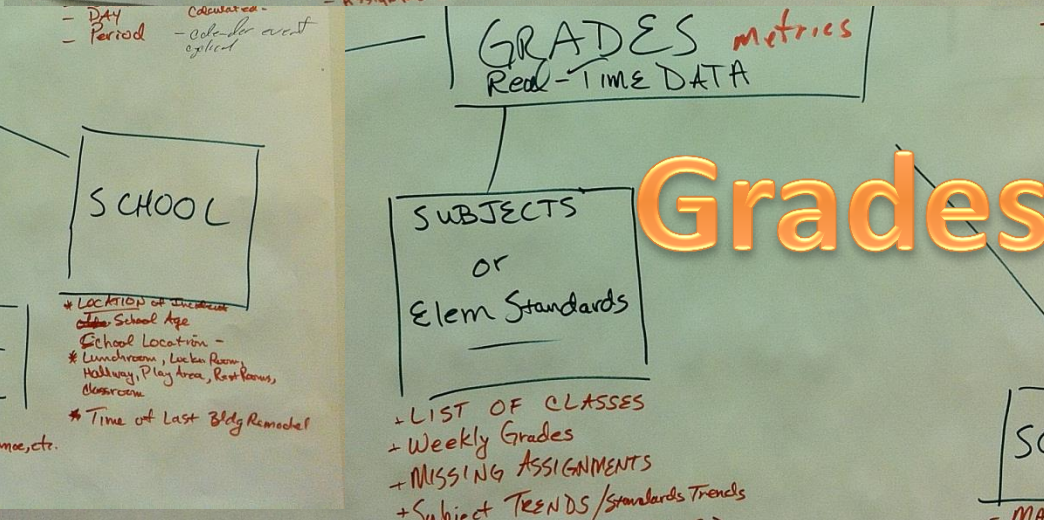
Too Restrictive in the Data Set

**Decided to go with MCS**

**SharePoint and**

**SQL on Everything**





# A Key Decision Point

- **Data Integrity is Critical.**
- Two Different Approaches
  - a) Ensure All Data is Accurate and consistently entered correctly Before Building the Solution
  - b) Use the existing Data and Clean Up Data as you go.**
- ★ • **Tacoma decided on “b” – Clean up as we go.**  
This approach Highlighted the importance of consistent data entry to the staff as we rolled out the solution in phases.



# Multiple Initiatives Underway

- Expanding existing BI
  - To include Staff Attributes and Correlations.
  - Data Sharing with Community Partners
- Predictive Analytics
  - Use of Azure, Machine Learning and Power BI
  - Initial Proof of Concept Proved the Tool Set Works
  - Effort is to Expand Data Set to determine if enough Data exists to **predict changes** in student trajectory in near real time
    - In Time for Effective Intervention

# Predictive Analytics

- Conducted initial Proof of Concept with Microsoft Consulting Services - using end of semester data
  - Proved Successful – however the time sequence was not frequent enough
  - The Results were very accurate and the user interface via PowerBI was excellent
- Currently two thirds through our next Proof of Concept
  - Moving the time sequence to every week.
    - Attempting to see more real time indication of the trajectory of the students on a weekly basis – so that intervention can be more real time.
    - Plan to use PowerBI to display results down to the teacher level

# Predictive Analytics (cont)

- Collaborative approach with MCS
- MCS Data Scientist are key resources for this effort
- Steep Learning Curve for Tacoma Staff (TPS) on:
  - Use of Azure
  - Machine Learning (ML)
  - Data Factory
  - PowerBI

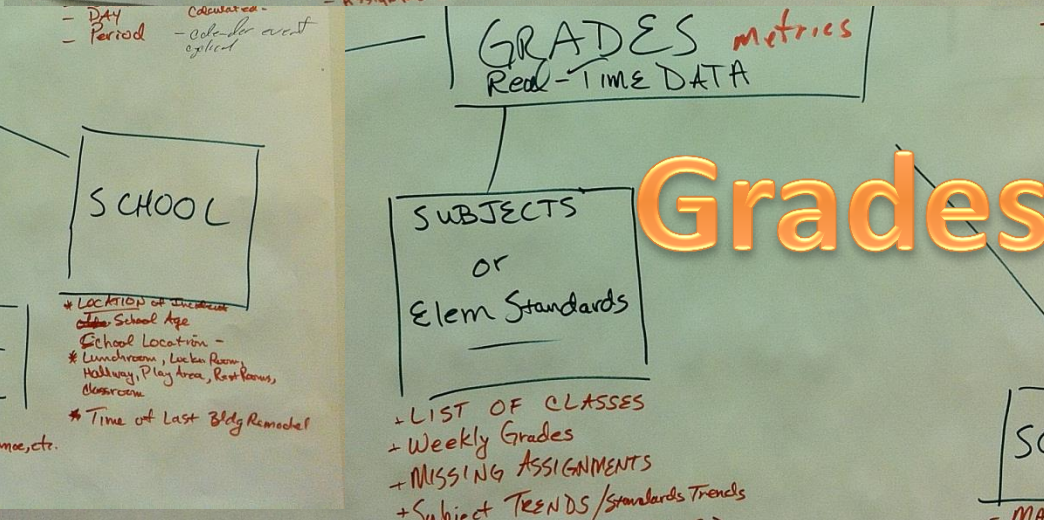
# Predictive Analytics (cont)

- Data Extraction and Quality of Data verification by TPS
  - Huge Resource Commitment
  - Very Time Consuming
  - If Pulling from Multiple Systems, Those System Owners are Also involved for proper Data Definitions
- Data Scientist Provided by MCS
  - Availability Limited Due To High Demand
  - Significant Time Required by TPS for Assisting the Data Scientists in Understanding the Industry and the Definitions of the Data
    - Not always intuitive.

# Predictive Analytics (cont)

- Data Scientist Topic
  - Microsoft's Data Scientists are Fantastic and we Appreciate their support.
  - A tough aspect of education is the low investment into the accuracy and completeness of data in the various systems
    - This is a hurdle that the Data Scientist Need to take into account. Most educational institutions can not afford the costs associate with perfect data integrity.
    - Models must be able to deal with missing data.
  - Having a Full Time Data Scientist is Critical in the future ... If you can afford it.
    - Without it, progress will be slow
    - This person needs to be apart of the core team of data specialists – on a routine basis.
  - Some of the most valuable data in the various systems are Non-SQL data sets
    - Being able to mine and interpret on a real-time basis is necessary



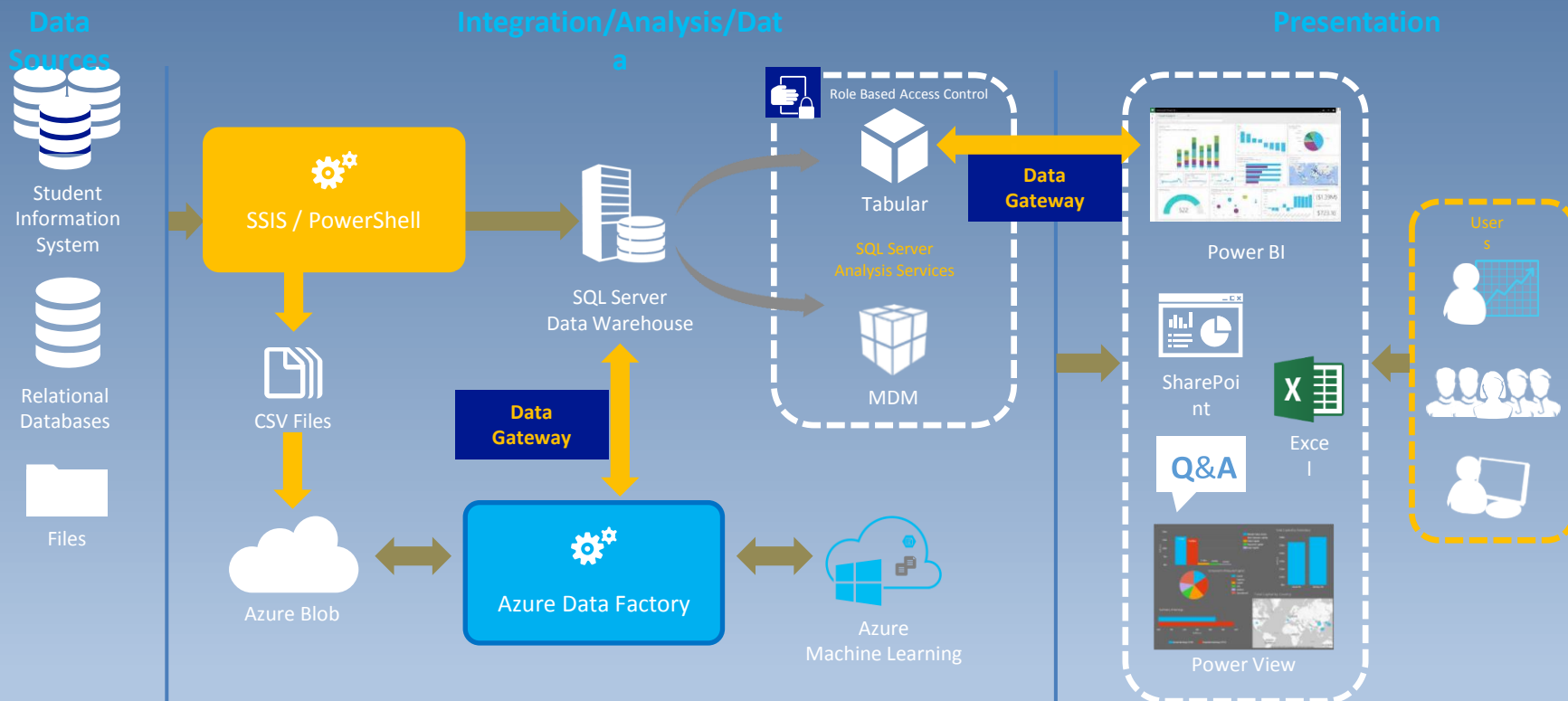




# The Approach with ML

- Onsite TPS Analysts pull and stage the data for Uploading into Azure
- Data Scientist Work to Develop a Baseline Model for ML
- The Results are Integrated with our On Prem Data Warehouse
- The Results are Passed via a Gateway to Azure PowerBI for Enduser Access.

# Student Analytics Architecture (Future)



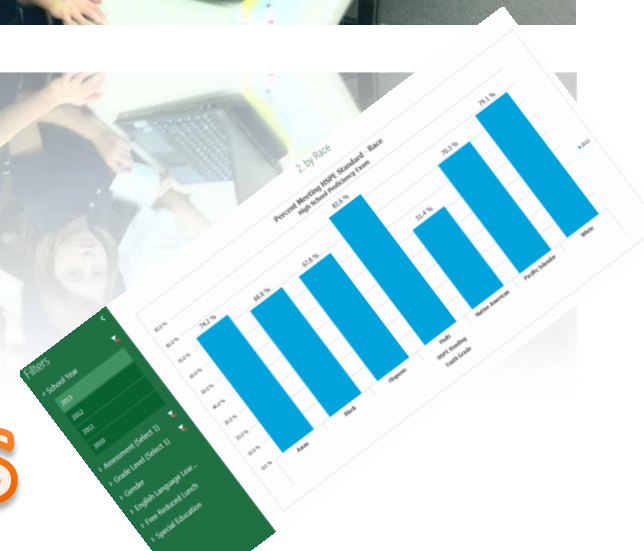
# For The Techies

- Proof Of Concept: Azure; utilizing Machine Learning and Data Factory – leveraging Power BI
- SQL 2012 on Prem
- SharePoint 2013 for Portals and Security
- Forefront Identity Mgmt for Active Directory
- O365 for both staff and students – Federated with District AD
- Excel Services
- SSRS

# The Conversation Has Shifted



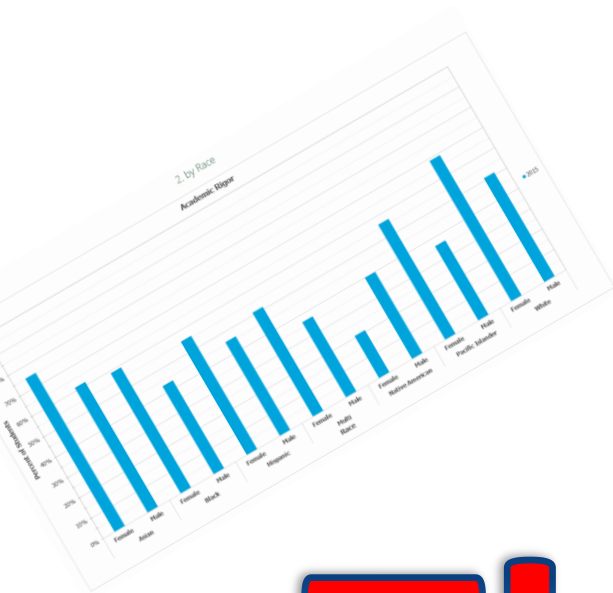
New Insights  
New Decisions

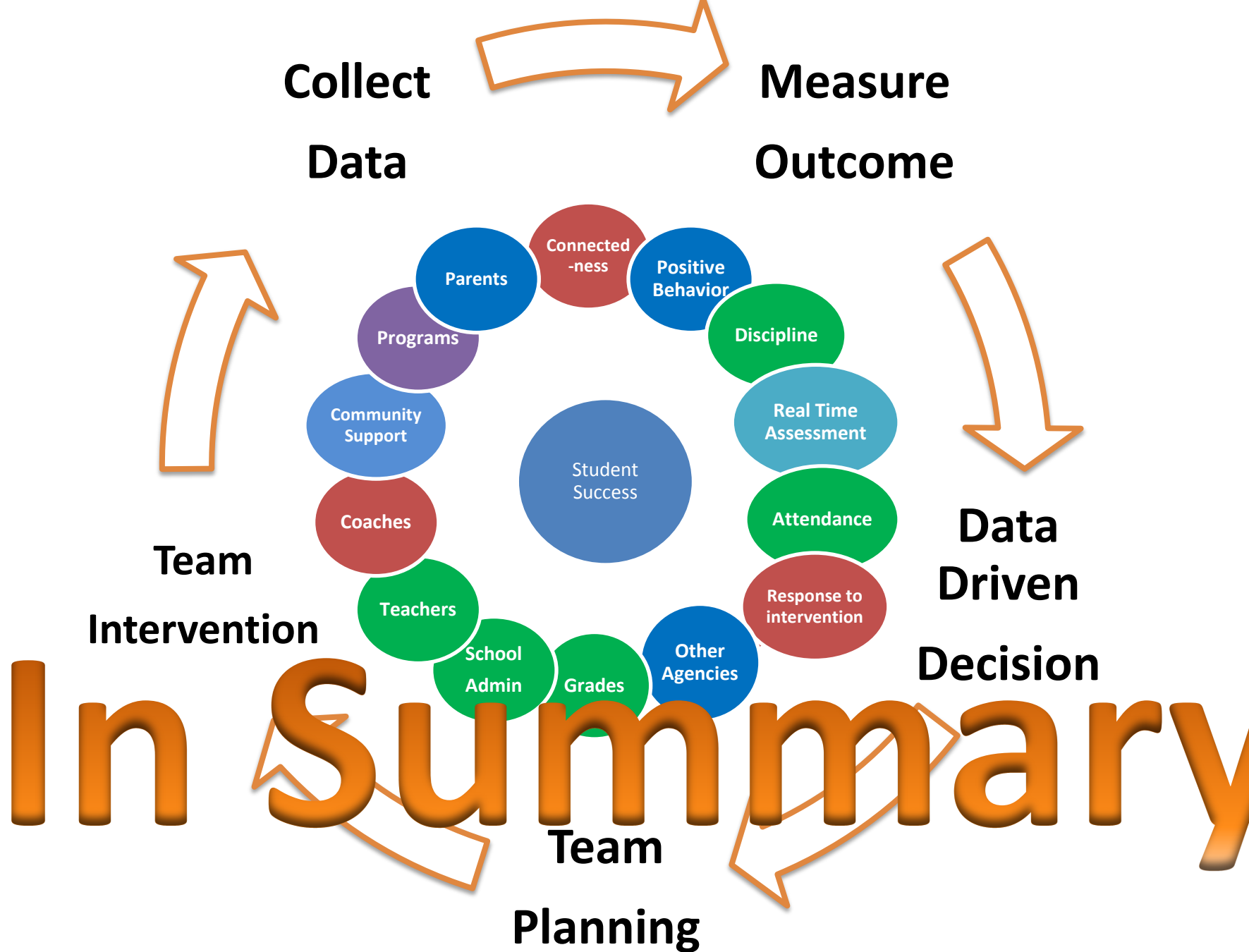


# The Story

# Is In

# The Data







# Contact Info

- Shaun Taylor - CIO Tacoma Public Schools
  - [staylo2@tacoma.k12.wa.us](mailto:staylo2@tacoma.k12.wa.us)

Office 253-571-1160

Direct 253-571-1307

TPS website: [www.tacoma.k12.wa.us](http://www.tacoma.k12.wa.us)