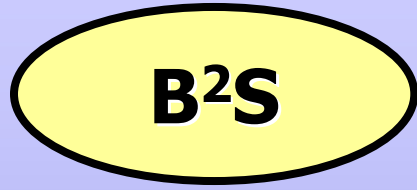


Data-Driven Decision-Making



A Comprehensive Integrated Strategy for K-12 Education

Ronald R. Bowsher, Ph.D.

Beech Grove City Schools, Board Member

Bowsher, Brunelle & Smith, LLC, President

21-July-2003

Outline

- 1. Intro. to Bowsher, Brunelle & Smith**
- 2. Intro. to DDDM**
- 3. Overview of Data & Statistical Data Analysis**
- 4. B²S and SAS Collaboration**

Bowsher, Brunelle & Smith, LLC (B²S)

- **A data analysis & statistical consulting company formed in 2002 to serve clients in K-12 Education**
- **Our staff (Eli Lilly retirees):**
 - Ron Bowsher, Ph.D. (Biochemistry)
 - Rocco Brunelle, M.S. (Statistics)
 - Wendell Smith, Ph.D. (Statistics)
- **B²S has the following combined experience:**
 - Nearly 20 yrs. as school board member
 - About 75 yrs. statistical consulting & data analysis
 - Nearly 600 scientific publications

B²S Mission

To provide stakeholders in K-12 education with convenient access to experienced, professional statistical consulting services and data management solutions to enable them to make higher quality and cost-effective data driven decisions.



Introduction to DDDM



Goal of DDDM

From a school board member's perspective the goal of DDDM should be about...

using data to enhance the ability of stakeholders to make high quality & cost-effective decisions to maximize the operational effectiveness of their school district.

Superior decision-making benefits everyone, including students, teachers, administration, staff, patrons, taxpayers, city, and state

Definition¹

DDDM is a process for making decisions about curriculum and instruction based on the analysis of classroom data and standardized test data. It is based on the assumption that scientific methods used to solve complex problems in industry can effectively evaluate educational policy, programs and methods.

¹North Central Regional Educational Laboratory

DDDM

**“DDDM is not a problem-solving strategy;
it’s a problem-finding strategy¹.”**

**¹McLeod Scott, DDDM. Urban leadership academy,
10-Dec-2002.**



DDDM vs. Accountability

DDDM is NOT the same as Accountability

- **Accountability** refers to policies that hold districts, schools, students and staff responsible for performance
 - It's the "what" (goal)
- **DDDM** is a proven process for making decisions based on improved data analysis
 - Requires statistical thinking
 - Important for continuous improvement
 - It's the "how"

DDDM Benefits

Can provide unbiased & objective answers to the following common questions:

- **How is our district doing?**
- **Are we serving all of students well?**
- **What's working; what's not working?**
- **In what areas do we need to improve?**
- **What are the important temporal trends?**
- **Do the benefits justify the costs and/or allocation of resources?**
 - Money, people, time and energy

Some Common Reasons Why K-12 Educators Fail to Embrace DDDM

- **Some trust their intuition more than data**
- **Often data are viewed as “the enemy”**
- **Others see data as a burden, not an asset**
- **Usually educators are trained to be subject oriented, not data oriented**
- **The district’s culture doesn’t support DDDM**
- **Outdated technology & poor infrastructure**
- **Currently, there are few good examples of schools benefiting from DDDM**

Overview of Data & Statistical Data Analysis

Types of Educational Data

- **The type of data dictates the nature of the statistical analysis**
- **From the statistical perspective, education has 2 types of data**
- **Continuous**
 - Numeric and quantitative
 - **ISTEP+ & NWEA scores, enrollments, attendance/graduation rates, % in AP classes, & % with honors academic diploma**
- **Categorical**
 - Discrete and qualitative (descriptive)
 - Two types

Types of Categorical Data

■ Ordinal

- Semi-quantitative or qualitative results that can be ranked in a logical order
- Students' grades & responses to surveys

■ Nominal

- Nonnumeric, lack order
- Used for classification or grouping
- Demographic and socio-economic data, gender, grade level, and team

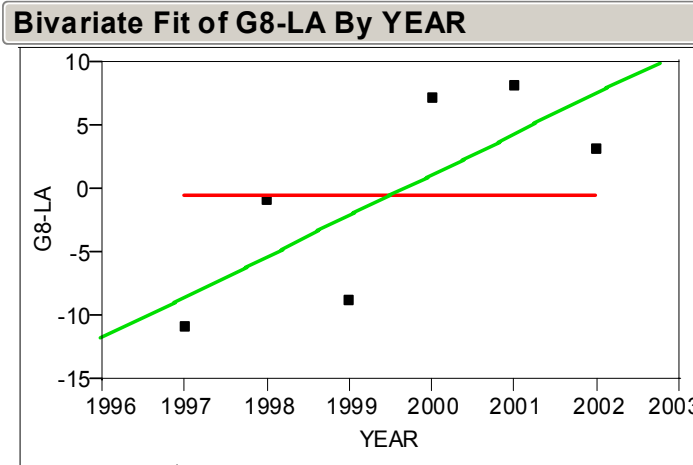
Education Data Disaggregation

- **Demographic information**
 - Gender, race, & age
- **Socio-economic**
 - Free & reduced lunch
 - Family & community
- **Attendance rates**
- **Mobility**
- **Special needs (IEP)**
- **ESL**
- **Students enrolled in Core 40, AP, & Honors**
- **Standardized tests scores**
- **Building / grade/ team / teacher**

Data Transformation

How do we evaluate for a performance trend after Renorming of the ISTEP+ test scores in 2002?

Computed difference in scores between BGCS & other MC districts



— Fit Mean
— Linear Fit

Linear Fit

$$G8-LA = -6456.029 + 3.2285714 \text{ YEAR}$$

Summary of Fit

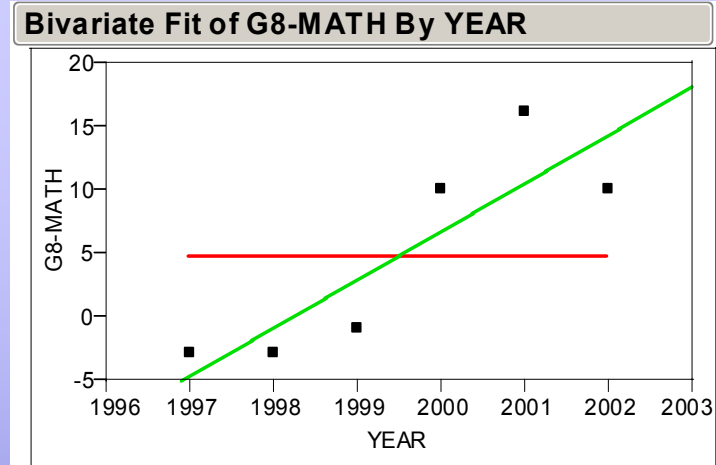
RSquare	0.563877
RSquare Adj	0.454847
Root Mean Square Error	5.938975
Mean of Response	-0.5
Observations (or Sum Wgts)	6

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	182.41429	182.414	5.1717
Error	4	141.08571	35.27	Prob > F
C. Total	5	323.50000		0.0853

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	-6456.029	2838.665	-2.27	0.0853
YEAR	3.2285714	1.419687	2.27	0.0853



— Fit Mean
— Linear Fit

Linear Fit

$$G8-MATH = -7593.267 + 3.8 \text{ YEAR}$$

Summary of Fit

RSquare	0.754704
RSquare Adj	0.69338
Root Mean Square Error	4.531372
Mean of Response	4.833333
Observations (or Sum Wgts)	6

Analysis of Variance

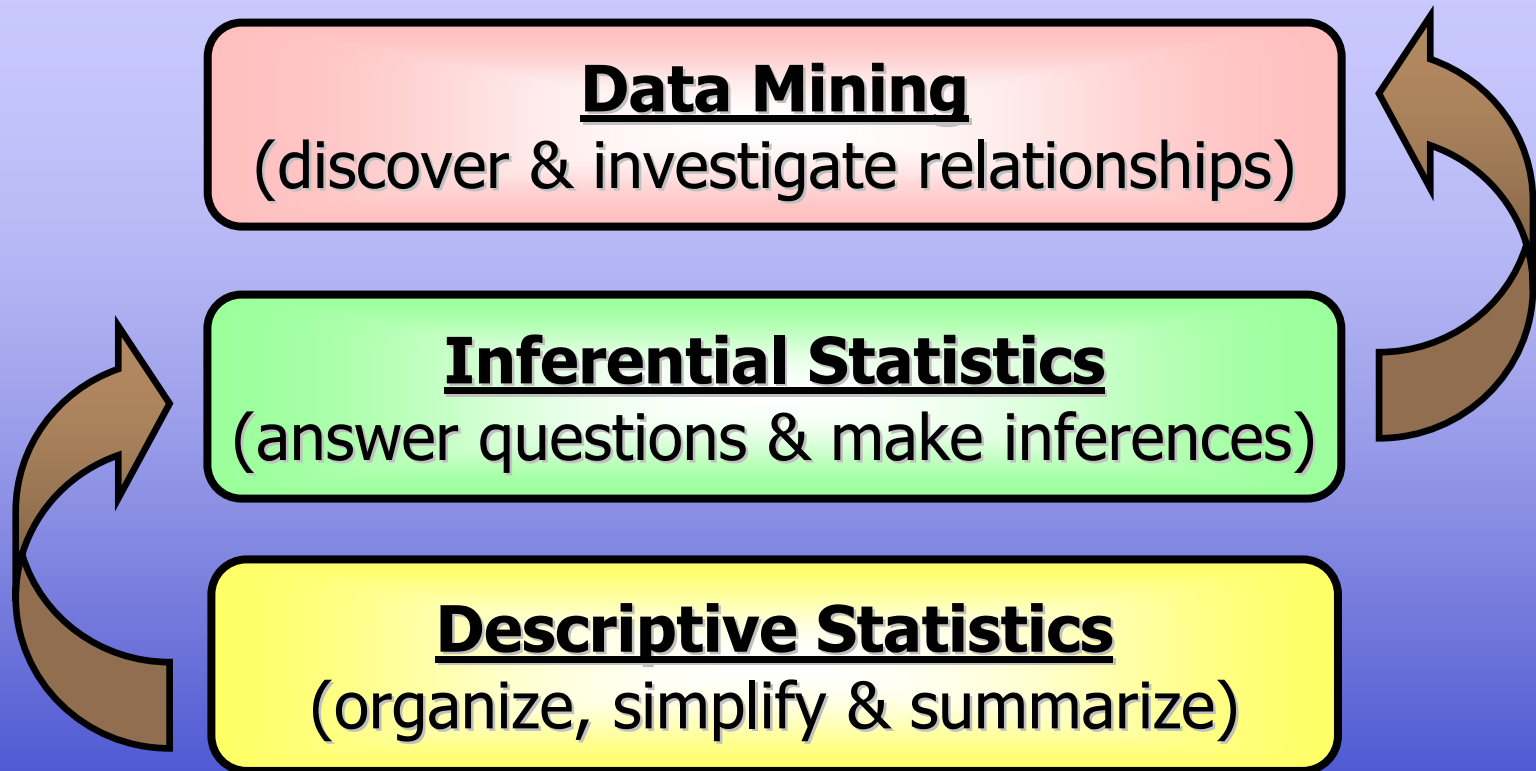
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	252.70000	252.700	12.3068
Error	4	82.13333	20.533	Prob > F
C. Total	5	334.83333		0.0247

Parameter Estimates

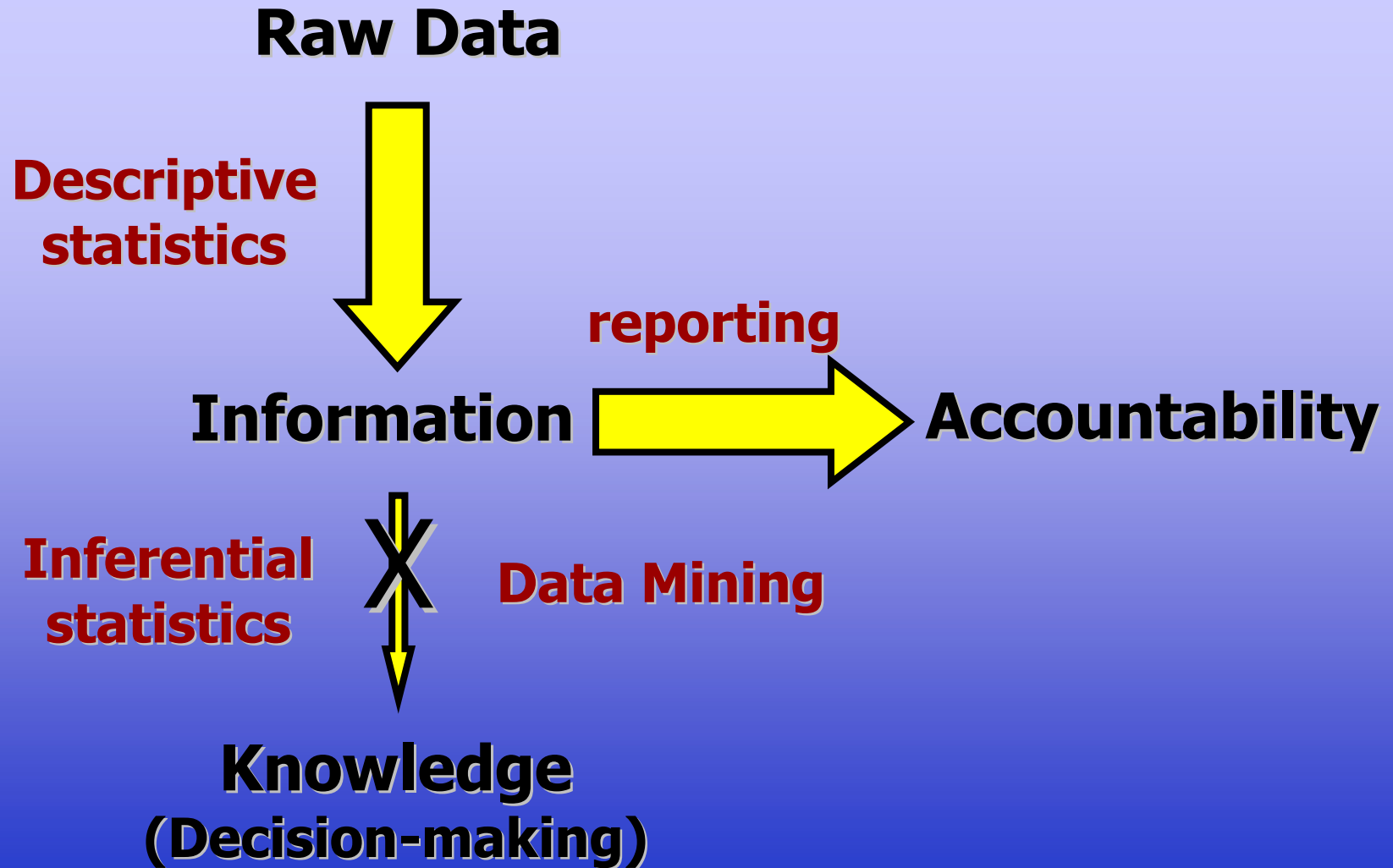
Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	-7593.267	2165.869	-3.51	0.0248
YEAR	3.8	1.083205	3.51	0.0247

Is the trend Significant?

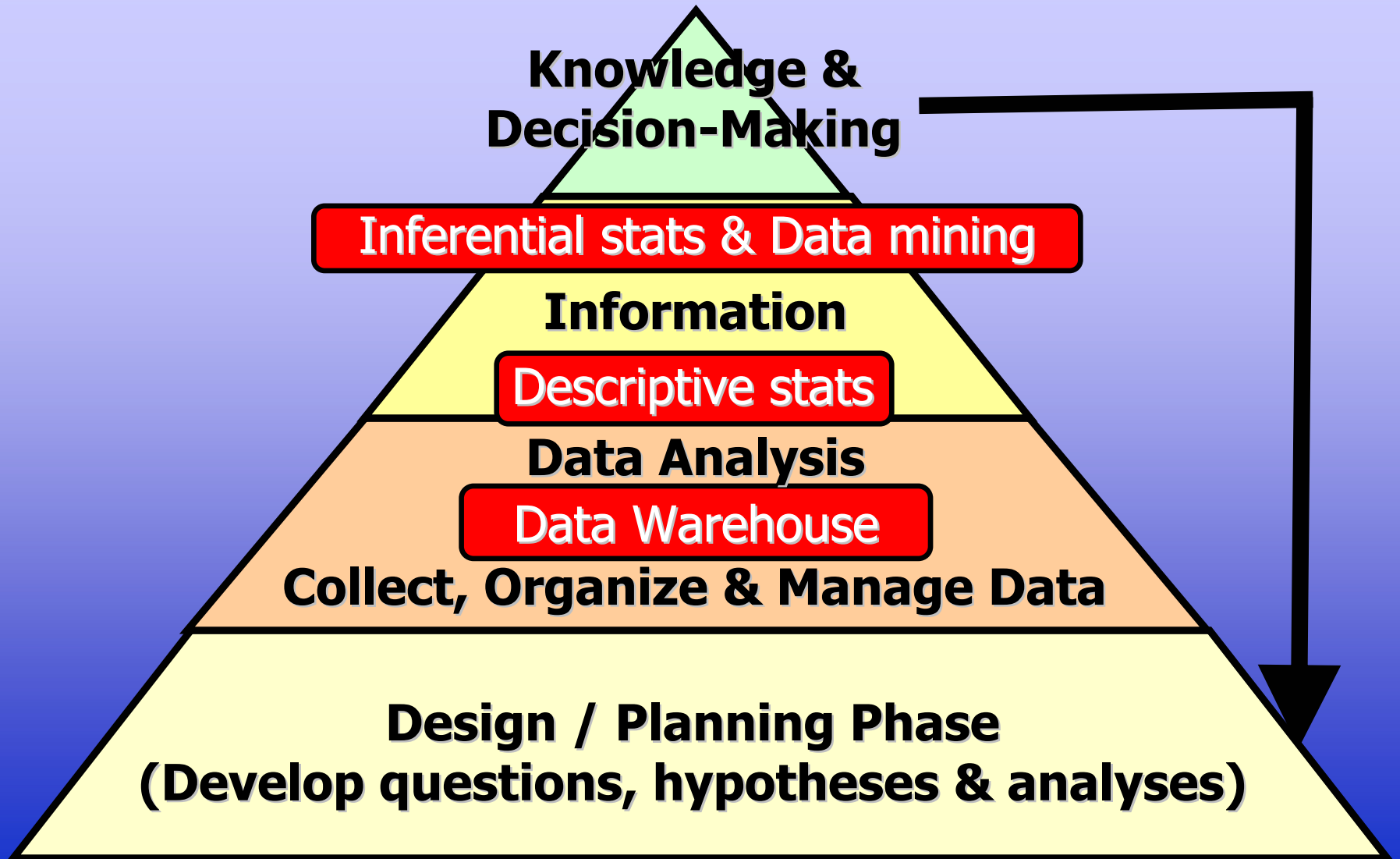
Types of Statistical Data Analysis



Current DDDM Status in Many Districts



Optimal Process for K-12 DDDM



Descriptive Statistics: Example

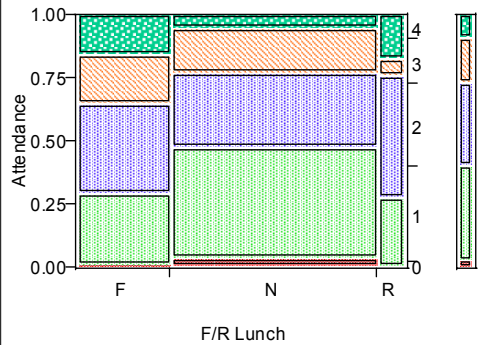
Snapshot of BGCS Central Elementary

Ethnicity	90.6% white
2 nd graders	77.8% of nonwhites are female
3 rd graders	41.2% of nonwhites are female
Attendance	40.4% missed < 5 days 73.3% missed < 10 days
2 nd graders	No difference between males & females
3 rd graders	28.3% of female missed ≥ 11 days 22.4% of males missed ≥ 11 days
Free/Reduced Lunch	36.8%
2 nd graders	28.9 % of females & 46.7% of males
3 rd graders	38.0 % of females & 31.8% of males
Team & Gender	No gender differences
2 nd graders	No gender differences
3 rd graders	Team 1 has 59.6% females
Team & Attendance	33.3% of 2 nd graders in Team 2 missed ≥ 11 days No appreciable differences in grade 3
Team & F/R Lunch	46.8% of 2 nd graders in Team 1 were on F/R lunch No appreciable differences in grade 3

Inferential Statistics

Contingency Analysis of Attendance By F/R Lunch

Mosaic Plot



Contingency Table

		Attendance					
		0	1	2	3	4	
Count							
Total %							
Col %							
Row %							
F		1	30	38	21	17	107
		0.27	8.09	10.24	5.66	4.58	28.84
		10.00	21.43	31.15	32.81	48.57	
		0.93	28.04	35.51	19.63	15.89	
N		9	102	70	41	13	235
		2.43	27.49	18.87	11.05	3.50	63.34
		90.00	72.86	57.38	64.06	37.14	
		3.83	43.40	29.79	17.45	5.53	
R		0	8	14	2	5	29
		0.00	2.16	3.77	0.54	1.35	7.82
		0.00	5.71	11.48	3.13	14.29	
		0.00	27.59	48.28	6.90	17.24	
		10	140	122	64	35	371
		2.70	37.74	32.88	17.25	9.43	

Tests

Source	DF	-LogLike	RSquare (U)
Model	8	12.60937	0.0251
Error	359	490.74954	
C. Total	367	503.35891	
N	371		

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	25.21	0.0014
Pearson	24.142	0.0022

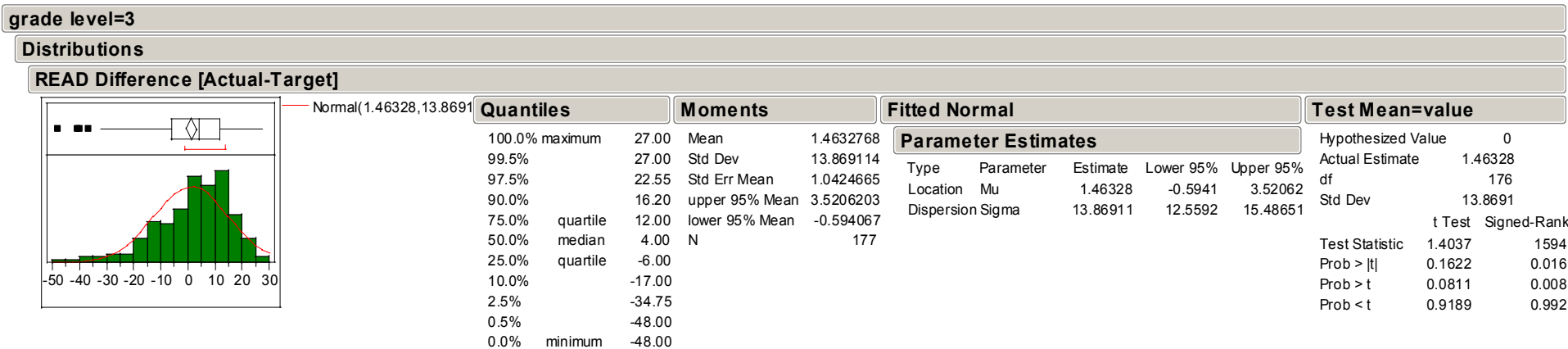
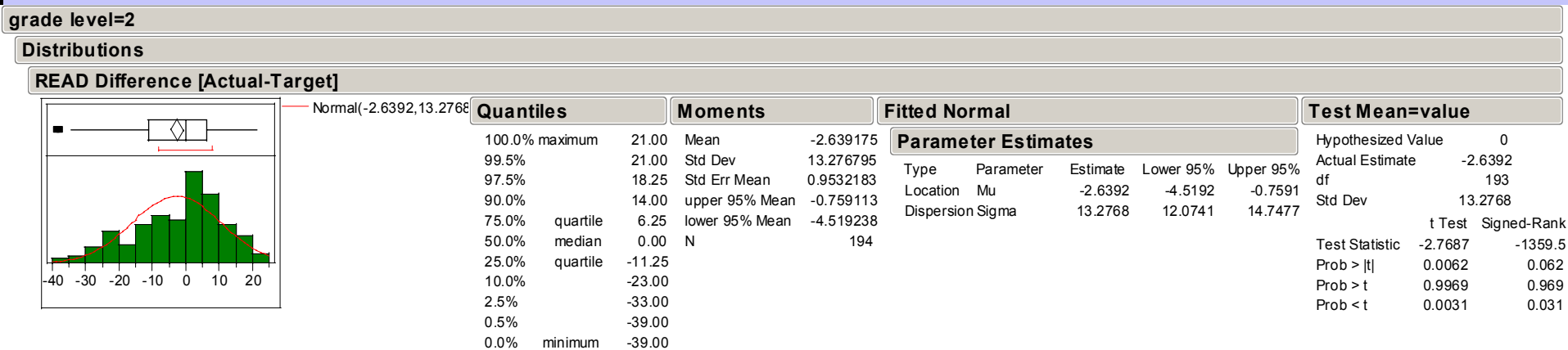
Is there an association between free & reduced lunches and the attendance rate at BGCS Central Elem.?

YES

Inferential Statistics

Evaluation of NWEA Reading Scores (spr. '03)

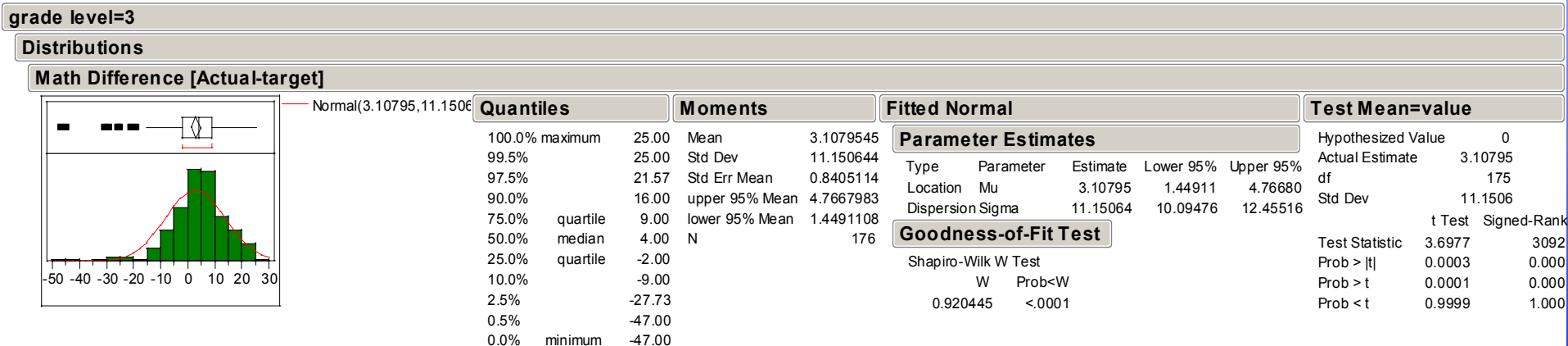
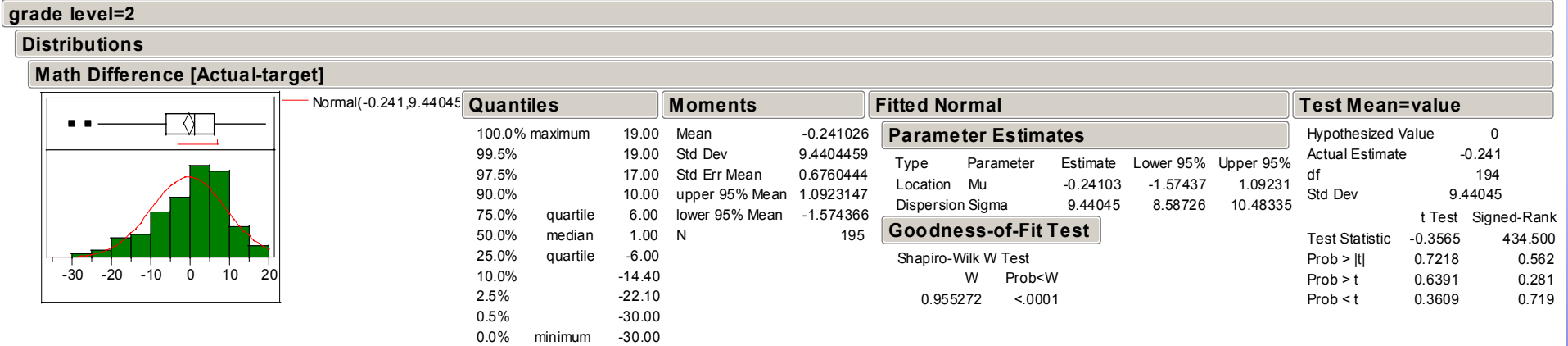
Difference = test result – target value



Inferential Statistics

Evaluation of NWEA Math Scores (spr. '03)

Difference = test result – target value

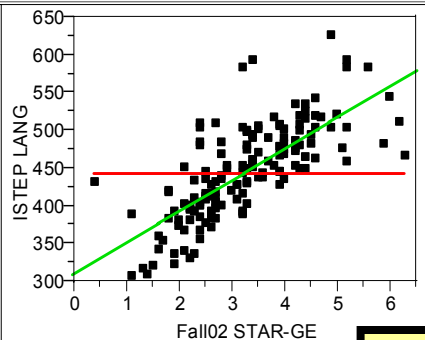


Inferential Statistics

Correlation of ISTEP+ & STAR Results

What's the degree of association in the results from the STAR Reading Assessment & the ISTEP+ test?

Bivariate Fit of ISTEP LANG By Fall02 STAR-GE



— Fit Mean
— Linear Fit

$r=0.74$

Linear Fit

$$\text{ISTEP LANG} = 308.67082 + 41.466324 \text{ Fall02 STAR-GE}$$

Summary of Fit

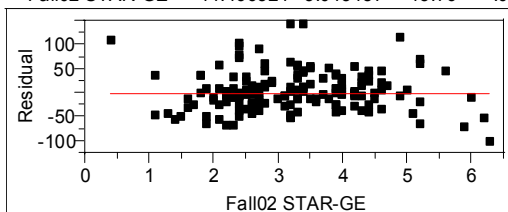
RSquare	0.548326
RSquare Adj	0.545431
Root Mean Square Error	41.28865
Mean of Response	443.8038
Observations (or Sum Wgts)	158

Analysis of Variance

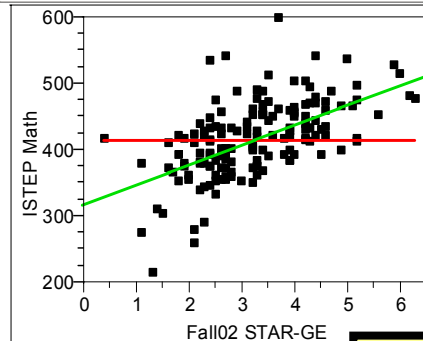
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	322849.53	322850	189.3821
Error	156	265941.39	1705	Prob > F
C. Total	157	588790.92		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	308.67082	10.35438	29.81	<.0001
Fall02 STAR-GE	41.466324	3.013187	13.76	<.0001



Bivariate Fit of ISTEP Math By Fall02 STAR-GE



— Fit Mean
— Linear Fit

$r=0.58$

Linear Fit

$$\text{ISTEP Math} = 316.91699 + 30.068198 \text{ Fall02 STAR-GE}$$

Summary of Fit

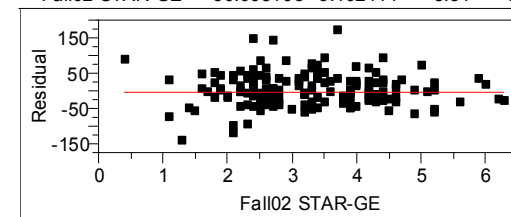
RSquare	0.333652
RSquare Adj	0.329381
Root Mean Square Error	46.61793
Mean of Response	414.9051
Observations (or Sum Wgts)	158

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	169755.51	169756	78.1120
Error	156	339024.06	2173	Prob > F
C. Total	157	508779.58		<.0001

Parameter Estimates

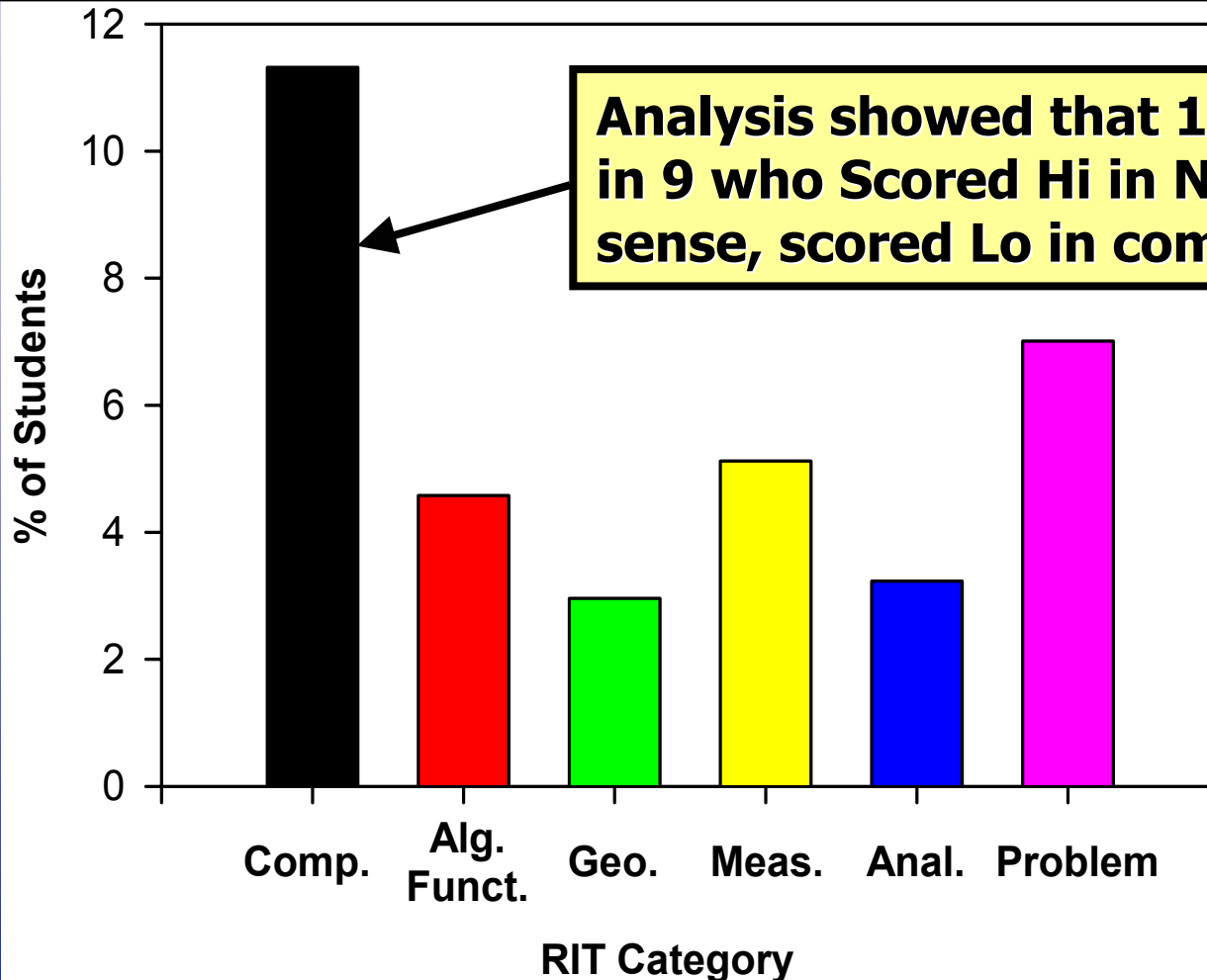
Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	316.91699	11.69086	27.11	<.0001
Fall02 STAR-GE	30.068198	3.402111	8.84	<.0001



Data Mining

Performance on Various Categories of Math NWEA

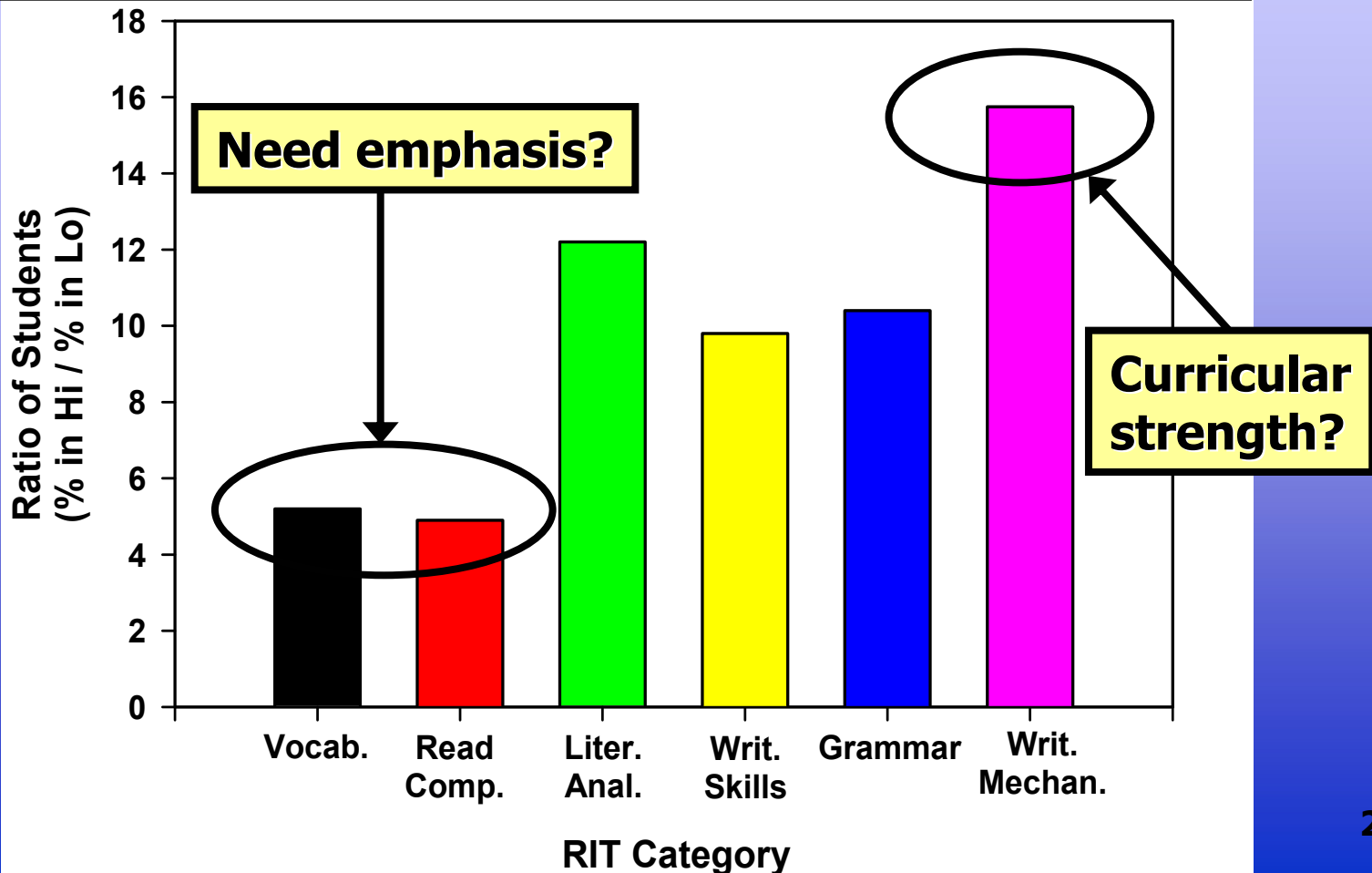
% of 2nd & 3rd grade students who scored Hi in Number sense, but Lo in other RIT categories



Data Mining

BGCS Students who Passed 3rd Grade ISTEP⁺

For Students who passed the Lang. Arts portion of the ISTEP⁺ test, how did they perform in various categories on the spring '03 NWEA?



B²S and SAS Collaboration

Some Common Barriers to DDDM Implementation in K-12 Education

■ **Inadequate data management capabilities**

- Despite being a data rich environment, a suitable data management strategy is often lacking
- Difficulty in dealing with diverse & dynamic data
- Lacks centralization
- Not suited well for assessing temporal changes
- Technology & infrastructure are outdated/lacking

■ **Lack of expertise in statistical data analysis**

- Background, training & inexperience of staff
- Major paradigm shift for organization
- Lack of availability of advanced software tools
- Too little time; competing priorities

Our Solution for Overcoming the Common DDDM Barriers

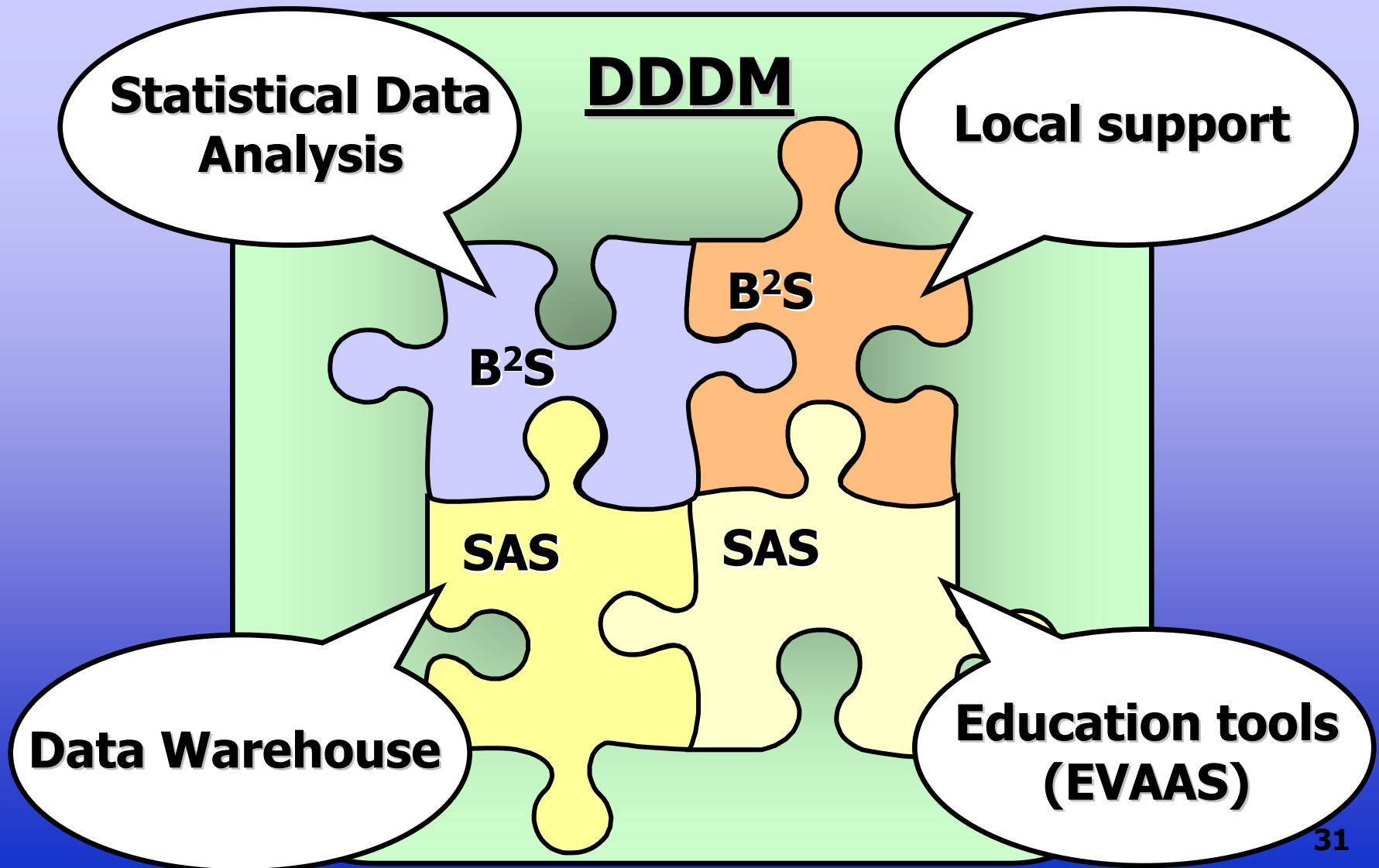
B²S and SAS have established a collaborative strategy to provide stakeholders in K-12 education with a comprehensive & integrated set of solutions to meet all of their DDDM needs.



Why the B²S & SAS Collaboration?

- Provides K-12 clients with “one-stop shopping” for solutions to solve both their data management & statistical data analysis needs
- SAS, the world leader in statistical software, offers proven technology for data management and is dedicated to serving K-12 education
- B²S has a combined 75 years experience in using SAS products to perform statistical data analysis
- B²S is committed to serving K-12 educational stakeholders and clients in IN

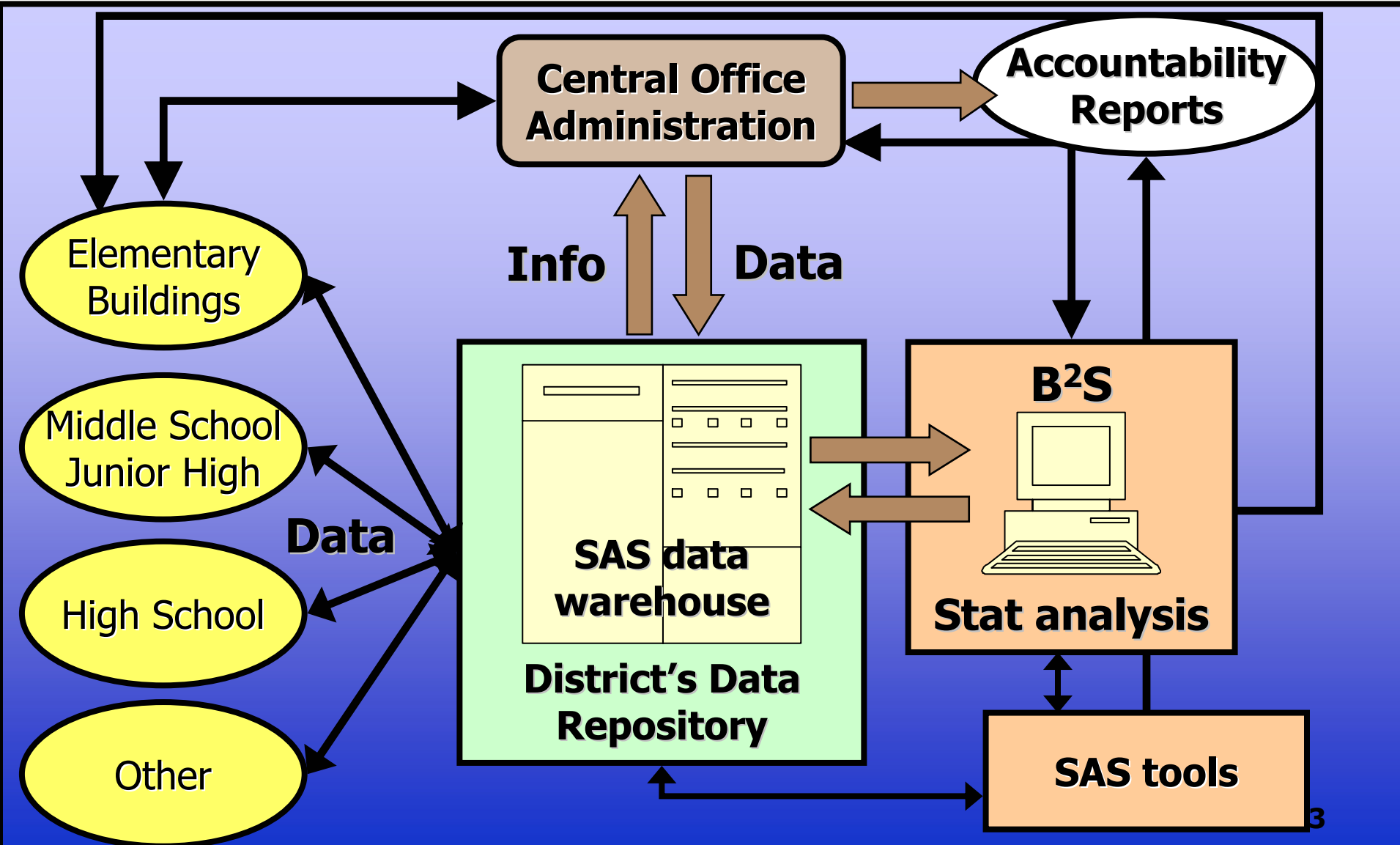
Our Strategy for K-12 Education



Why should School Districts Invest in Statistical Consulting Services?

- **Help ensure optimal implementation of DDDM**
- **Partnership during planning & design phase**
- **Experience is needed for data-rich environment**
- **Expertise will help avoid statistical pitfalls:**
 - Lack of normality
 - Parametric vs. nonparametric analysis
 - Outlier assessments
 - Variance homogeneity
- **Cost effective:**
 - Training & experience in statistical data analysis
 - Access to advanced software tools
 - Reduced costs for internal resources

Possible DDDM Strategic Configuration



Conclusions

- **As is the case for numerous other disciplines, DDDM has the potential to enhance the ability of stakeholders in K-12 education to make higher quality and cost-effective decisions.**
- **For optimal implementation, the key common barriers of inadequate data management and lack of statistical data analysis expertise need to be overcome.**
- **The unique strategic collaboration between B²S and SAS offers clients in central IN with convenient access to a comprehensive and integrated set of solutions for education DDDM.**

B²S Contact Information

B²S

- **Website: www.b2s-stats.com**
- **e-mail: ronb@b2s-stats.com
rocco@b2s-stats.com
wendells@b2s-stats.com**
- **telephone: 317-787-2213**
- **Fax: 888-769-2017**