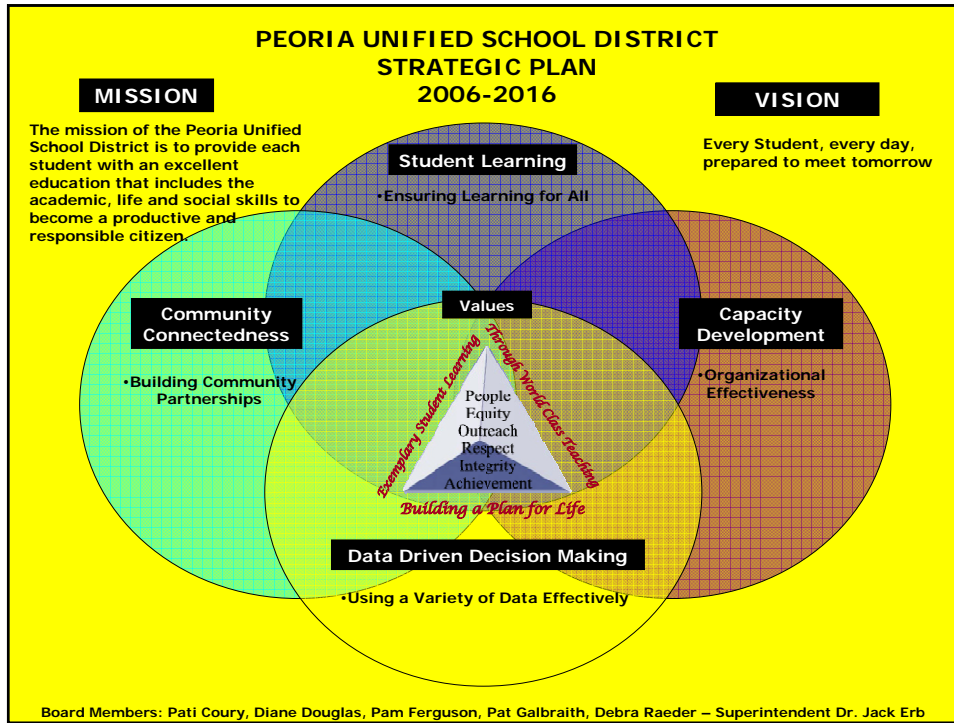



# Performance Management with KPIs



**PUSD Decision Support System:  
The 'Level 1' Challenge**



- **Push large amounts of assessment data direct to teacher's desktop**
  - ✓ 38,000 students x multiple assessments x multiple years x item & sub-content level
- **Allow teachers to 'mine' pertinent data based on dynamic queries**
- **Support on-going PUSD professional development**
- **Function in an easy to learn/use system**
- **Construct at very low cost**

**1<sup>st</sup> Priority: Supporting the Teacher-Student Dialog**

# Performance Management with KPIs

## Foundation of PUSD Professional Development Training



- Use data to focus & drive instructional decision making & instructional improvement planning
- Disaggregate testing information to sub-test & item (Perf. Obj.) level ⇒ *content-specific intervention*
- Be 'Student-Specific' not 'Classroom-General'
- Evaluate both '*Instructional Needs*' and '*Instructional Effectiveness*'

### Resulting Implementation Sequence/Priority:

**1<sup>st</sup> Evolution Priority:** *Priority given to pushing individual student information at the test & sub-test level to a teacher*

**2<sup>nd</sup> Evolution Sequence:** *Augment DSS with summative/descriptive information and support of business intelligence at the organizational level*

## PUSD Assessment DataMart

(SY2001-02 Through Present)



- ✓ **AIMS & AIMS-A** (State Mandated Assessments)
- ✓ **SAT 9 & Terra Nova** (State Mandated Assessments)
- ✓ **PUSD End-of-Course Assessments**
  - ⇒ Elementary – Math Grades 5 through 8 (3<sup>rd</sup> & 4<sup>th</sup> in SY2006-07)
  - ⇒ High School – Math, Language Arts, Social Studies (selected)  
-- Science in SY2007-08
- ✓ **PUSD Benchmark Assessments**
  - ⇒ Elementary
    - Math in Grades 5 through 8 (3<sup>rd</sup> & 4<sup>th</sup> SY2006-07)
    - AzAC Reading (Mid-Year AIMS Reading, Grades 3 through 8)
    - DIBELS in Grades K through 2<sup>nd</sup> with 3<sup>rd</sup> in SY2007-08)
    - Literacy/Reading in SY2007-08
  - ⇒ High School – Beginning Algebra in SY2006-07

# Performance Management with KPIs

2006 Desert Harbor Elementary

CLASS: 118607-1 - Math 7  
 TEST YEAR: 2006 Spring  
 TEST: AIMS ES Math

Guide to AIMS Subcontent Areas (Spring 2005)  
[Math](#) [Reading](#) [Writing](#)

Fields Available for Selection:

- \*\*\*SIS\*\*\*
- student.LastNAME
- student.FirstNAME
- student.BIRTHDATE
- student.SEX
- student.ETHNIC
- student.GRADE
- student.Migrant
- student.TitleOne
- student.ESLStatus
- \*\*\*AIMS ES 2006 Math\*\*\*
- AIMSEL2006M.studid
- AIMSEL2006M.saisid
- AIMSEL2006M.iname

Select Test:

- All
- AIMS HS Read Write
- DIBELS K Spring 2006
- DIBELS 1st Spring 2006
- DIBELS 2nd Spring 2006
- DIBELS 3rd Spring 2006
- AIMS ES Read
- AIMS ES Write
- AIMS ES Math
- Terra Nova Grade 9
- Terra Nova Grade 2
- AIMS HS Math
- AIMS A

Fields Selected for Viewing:

Start Over Screen Excel Filters

State Tests Start Over

Guide to AIMS Subcontent Areas  
[Math](#) [Reading](#) [Writing](#)

sid	math_perfv1	math_ss_2006
13711434		
13713412		
12712828		
12839057	Approaching	488
12815404	Approaching	491
12870943	Approaching	491
12814438	Approaching	494
12839552	Meets	497
12814040	Meets	501
12885612	Meets	507
12894272	Meets	511
26706263	Meets	526
12855447	Meets	530
12814422	Meets	538
26711747	Meets	538
12814371	Meets	553
12886836	Meets	553
12822801	Meets	558
12855439	Meets	558
12817662	Exceeds	578
12815141	Exceeds	587
12835591	Exceeds	587
12895267	Exceeds	587
12822007	Exceeds	593
12822094	Exceeds	593
12839895	Exceeds	593
12816088	Exceeds	622

Approaching Standard

Meets Standard

Exceeds Standard

# Performance Management with KPIs

## Example: PUSD Math Assessment Classroom View

2006 Desert Harbor Elementary

CLASS: 118607-1 - Math 7  
 TEST YEAR: 2006  
 TEST: Math Grade 6 - May 2006 End of Year T

Column Descriptions  
 (click on the column description to see a list of students not mastering items in that unit)  
 C1 - U1 Problem Solving & Estimation (4 Items)  
 C2 - U2 Add and Subtract Fractions (7 Items)  
 C3 - U3 Multiply and Divide Fractions (5 Items)  
 C4 - U4 Measurement (3 Items)  
 C5 - U5 Data Analysis (4 Items)  
 C6 - U6 Geometric Properties and Definitions (4 Items)  
 C7 - U7 Geometric Properties, Measurement and Construction (7 Items)  
 C8 - U8 Discrete Mathematics and Transformations (5 Items)  
 C9 - U9 Functions and Relationships (4 Items)  
 C10 - U10 Algebraic Representations in Expressions and Equations (5 Items)  
 C11 - U11 Probability (4 Items)

Content Based on Scope & Sequence

Std	LName	FNName	SchoolNum	TestYear	PctCorrect	Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8	Column9	Column10	Column11	Detail
1281	ABBEY	123	MAY 2006	56	NM	NM	NM	NM	NM	NM	NM	A	NM	NM	A	NM	View
1281	ALAN	123	MAY 2006	85	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	View
1281	VICKEY	123	MAY 2006	79	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	View
1281	COLE	123	MAY 2006	65	NM	NM	A	A	NM	NM	A	NM	NM	NM	NM	NM	View
1281	TERRENCE	123	MAY 2006	54	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	NM	View
1281	NOEL	123	MAY 2006	87	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	View
1281	MEGAN	123	MAY 2006	71	NM	NM	A	NM	NM	NM	NM	NM	NM	NM	NM	NM	View
1281	MOLLY	123	MAY 2006	81	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	View
1281	ERIC	123	MAY 2006	77	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	View
1282	SARAH	123	MAY 2006	81	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	View
1282	MEGAN	123	MAY 2006	85	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	View
1283	ZACHARY	117	MAY 2006	100	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	View
1283	RYAN	123	MAY 2006	87	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	View
1283	MARIAH	123	MAY 2006	56	NM	NM	NM	NM	NM	NM	NM	A	NM	NM	A	NM	View
1283	JOSEPH	123	MAY 2006	60	NM	NM	NM	NM	NM	NM	NM	A	NM	NM	NM	NM	View
1283	HAYLEY	123	MAY 2006	92	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	View
1283	SUSAN	123	MAY 2006	69	NM	NM	NM	A	NM	NM	NM	NM	NM	NM	NM	NM	View
1287	JAMES	123	MAY 2006	60	NM	NM	NM	NM	NM	NM	NM	A	NM	NM	NM	NM	View
1284	HANNAH	123	MAY 2006	54	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	NM	View

**Drill Down Capability: Content-by-item & student-by-item**  
 Note: All PUSD assessments scored using IRT (Rasch) methods with standards based on item probability thresholds

## Example: PUSD Math Assessment Student-Item View


BRITTANY

Test Date: %Correct: #Correct:

Item	Result	UnitNumber	UnitName	PerfObj	PerfObjDesc
Item 1	1	2	Add & Subtract Fractions	2.1	Identify the greatest common factor for two whole numbers
Item 2	2	2	Add & Subtract Fractions	2.4	Determine the least common multiple for two whole numbers
Item 3	0	3	Multiply & Divide Fractions	3.1	Express a whole number as a product of its prime factors using exponents when appropriate
Item 4	0	7	Geometric Properties, Measurement, & Construction	7.3	Triangles: Properties, measurement, & construction.
Item 5	1	9	Patterns, Functions, & Relationships	9.1	Communicate a grade level appropriate recursive pattern using symbols & numbers
Item 6	0	9	Patterns, Functions, & Relationships	9.3	Describe the rule used in a simple grade level appropriate function (see above). Use T-charts, input/out models
Item 7	1	1	Problem Solving & Estimation	1.3	Select the grade level appropriate operation to solve word problems
Item 8	0	2	Add & Subtract Fractions	2.7	Add proper fractions and mixed numbers with unlike denominators with regrouping
Item 9	0	2	Add & Subtract Fractions	2.8	Subtract proper fractions and mixed numbers with unlike denominators and regrouping
Item 10	0	2	Add & Subtract Fractions	2.9	Subtract proper fractions and mixed numbers with unlike denominators with regrouping
Item 11	1	1	Problem Solving & Estimation	1.4	Solve word problems using grade level appropriate operations & numbers including rounding to estimate.
Item 12	0	3	Multiply & Divide Fractions	3.5	Multiply mixed numbers
Item 13	0	3	Multiply & Divide Fractions	3.6	Demonstrate that division is the inverse of multiplication of proper fractions.
Item 14	0	3	Multiply & Divide Fractions	3.8	Divide mixed numbers
Item 15	1	1	Problem Solving & Estimation	1.3	Select the grade level appropriate operation to solve word problems
Item 16	0	8	Discrete Mathematics & Transformations	8.4	Determine all possible arrangements given a set with 4 or fewer objects using a systematic list, table, or tree diagram when order is not important.
Item 17	0	10	Algebraic Representations in Expressions & Equations	10.2	Simplify numerical expressions using the order of operations with grade appropriate operations on number sets.
Item 18	0	1	Problem Solving & Estimation	1.4	Solve word problems using grade level appropriate operations & numbers including rounding to estimate.
Item 19	0	7	Geometric Properties, Measurement, & Construction	7.6c	Application of perimeter and area: Estimate and measure for the area and perimeter of polygons using a grid.
Item 20	0	9	Patterns, Functions, & Relationships	9.3	Describe the rule used in a simple grade level appropriate function (see above). Use T-charts, input/out models


Note: All PUSD assessments scored using IRT (Rasch) methods with standards based on item probability thresholds

# Performance Management with KPIs




## Business Intelligence Systems --- PUSD Research Report Server ---

- Currently being implemented
- Real-time web-based reports & analytics
- Integration of distributed data warehouses across organization
- User Interaction with information (Parameterized interface)
- Low cost implementation (SQL Server 2005)
- Extremely flexible
- Rapid report development & deployment time
- Drastic reduction in 'data access' gap between data location and Business Analyst



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6330 West Thunderbird Road - Glendale, Arizona 85306  
Telephone: (623) 486-6000



## PUSD Report Server

Example: Highly parameterized analysis interface (2006 AIMS Results by School & Subject)

**New Subscription**

Grade: <input type="text" value="3"/>	School: <input type="text" value="ALTA LOMA SCH, APACHE ELEM"/>	<a href="#">View Report</a>
Race: <input type="text" value="Am. Indian, Asian, Black, Hispa"/>	Gender: <input type="text" value="Female, Male"/>	
Primary Home Language: <input type="text" value="English, Navajo, No Data/Unkn"/>	ELL Program: <input type="text" value="No, Yes"/>	
Start This School This Year?: <input type="text" value="No, Yes"/>	SPED Program: <input type="text" value="No, Yes"/>	
Gifted: <input type="text" value="No, Yes"/>	Accommodation Area: <input type="text" value="Home Schooled, Math, Math/Wr"/>	
Read Pass: <input type="text" value="Fail, Pass"/>	Math Pass: <input type="text" value="Fail, Pass"/>	
Write Pass: <input type="text" value="Fail, Pass"/>	Free/Reduced Lunch Prg: <input type="text" value="YES, NO"/>	
Title1: <input type="text" value="No, Yes"/>		

1 of 1 | 100% | Find | Next | Select a format | Export

	Reading 2006			Math 2006			Writing 2006		
	Count	Pass	Fail	Count	Pass	Fail	Count	Pass	Fail
ALTA LOMA SCH	64	63 %	38	67	66 %	35	42	41 %	60
	102	37 %	100 %	102	34 %	100 %	102	59 %	100 %
APACHE ELEMEN	93	85 %	16	97	89 %	11	58	53 %	47
	109	15 %	100 %	109	11 %	100 %	109	47 %	100 %
CANYON ELEMEN	38	68 %	18	42	75 %	25	15	27 %	41
	56	32 %	100 %	56	25 %	100 %	56	73 %	100 %

# Performance Management with KPIs



## Predictive Analytics

--- Prototype Example ---

- Predicting Student Performance (Pass/Fail Status) on Spring AIMS Mathematics using analytic models
- Incorporating 'At-Risk' information into teacher-based knowledge systems (DSS)

*Data Example: Grade 5 Math Benchmarks for SY2005-06*



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## Basis for Prototype Grade 5 Mathematics Model

Model Type: Binary Logistic\*

$$P(\text{Passing AIMS}) = \frac{1}{1 + e^{-Z}} \quad \text{where} \quad Z = \alpha + \beta(\text{BM}) + \beta(\text{AIMS})$$


Statistical Estimates

**Dependent Variable:** P: Probability Spring 2006 AIMS (Pass/Fail)

**Independent Variables:** AIMS: Spring 2005 Math (Scale Score)  
BM<sub>1</sub>: October PUSD Math Benchmark (% Correct)  
BM<sub>2</sub>: December 2005 PUSD Math Benchmark (% Correct)  
BM<sub>3</sub>: March 2006 PUSD Math Benchmark (% Correct)

(\*) HLM prototype models are also being developed

# Performance Management with KPIs




		<i>Predicted Outcome</i>	
		Fail	Pass
<i>Actual Outcome</i>	Fail	✓	<i>False Positive</i>
	Pass	<i>False Negative</i>	✓

---

**Model Classification Rates (Correct Prediction of 2006 Pass/Fail Status)**

<u>Variables in Model</u>	<u>Correct Classification Rate</u>
AIMS '05, Oct BM	89%
AIMS '05, Oct BM, Dec BM	89%
AIMS '05, Oct BM, Dec BM, Mar BM	90%



## Possible Implementation – Teacher’s Desktop (DSS)

2006      Desert Harbor Elementary

CLASS: 118607-1 - Math 7

TEST YEAR: 2006

TEST: Math Grade 6 - May 2006 End of Year T

NM - Not Mastering  
A - Approaching  
M - Mastering

[Start Over](#)

Column Descriptions  
(click on the column description to see a list of students not mastering items in that unit)

[C1 - U1 Problem Solving & Estimation \(4 Items\)](#)  
[C2 - U2 Add and Subtract Fractions \(2 Items\)](#)  
[C3 - U3 Multiply and Divide Fractions \(5 Items\)](#)  
[C4 - U4 Measurement \(3 Items\)](#)  
[C5 - U5 Data Analysis \(4 Items\)](#)  
[C6 - U6 Geometric Properties and Definitions \(4 Items\)](#)  
[C7 - U7 Geometric Properties, Measurement and Construction \(7 Items\)](#)  
[C8 - U8 Discrete Mathematics and Transformations \(5 Items\)](#)  
[C9 - U9 Functions and Relationships \(4 Items\)](#)  
[C10 - U10 Algebraic Representations in Expressions and Equations \(5 Items\)](#)  
[C11 - U11 Probability \(4 Items\)](#)

id	LName	FName	SchoolNm	TestDay	PctCorrect	Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8	Column9	Column10	Column11	Detail
267		BRITTANY	123	MAY 2006	52	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	View
128		TERRENCE	123	MAY 2006	54	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	View
128		Hannah	123	MAY 2006	54	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	View
128		Abby	123	MAY 2006	56	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	View
128		MARIAH	123	MAY 2006	56	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	View
267		Brandi	123	MAY 2006	56	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	View
128		JOSEPH	123	MAY 2006	56	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	View
128		JAMES	123	MAY 2006	60	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	View
128		Brittany	123	MAY 2006	63	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	View
128		COLE	123	MAY 2006	65	NM	NM	A	A	NM	NM	NM	NM	NM	NM	A	View
128		SUSAN	123	MAY 2006	69	NM	NM	NM	A	NM	NM	NM	NM	NM	NM	A	View
128		MALIA	123	MAY 2006	69	NM	NM	NM	A	NM	NM	NM	NM	NM	NM	A	View
128		MEGAN	123	MAY 2006	71	NM	NM	NM	A	NM	NM	NM	NM	NM	NM	A	View
128		ERIC	123	MAY 2006	77	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	View
128		VICKEY	123	MAY 2006	79	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	View
128		COREY	123	MAY 2006	79	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	View
128		MOLLY	123	MAY 2006	81	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	View
128		SARAH	123	MAY 2006	81	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	A	View

**Model identifies 'At-Risk' based on available information**

i.e. All content representations identify individual student's degree of 'At-Risk'

# Performance Management with KPIs

