USE OF BUSINESS INTELLIGENCE FOR COMPETITIVE ADVANTAGES BY THE BEAUMONT INDEPENDENT SCHOOL DISTRICT IN TEXAS

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ABSTRACT

In this paper, we discuss the use of Business Intelligence (BI) for competitive advantages by Beaumont Independent School District (BISD) in Texas. First, we define Business Intelligence and its development in school districts in Texas. Second, we discuss how BISD gathers business intelligence and what the drivers of BI are. Third, we report what kind of tools and technologies and data analyses are being used. Finally, we discuss the competitive advantages achieved by BISD from the use of BI and the possible future options, that they may expand on and how other school districts may benefit from following BISD's example.

BUSINESS INTELLIGENCE IN BEAUMONT INDEPENDENT SCHOOL DISTRICT

Business Intelligence (BI) refers to architectures, tools, databases, applications and methodologies to help an organization acquire better understanding of its operations. Business Intelligence often aims to improve performance and support better decision making. BI can also help an organization create efficiencies with operations.

In an effort to bring greater public accountability to the educational community, the 68th Texas legislature, through House Bill 72, established the Public Education Information Management System (PEIMS). Bill 72 passed in 1984 and the legislature created the Texas Education Agency PEIMS division in September of 1986. PEIMS recorded its first student data during the 1989-1990 school year. Reporting PEIMS data is not optional for BISD and Texas law enforces its reporting across the state (Region 4 Education Service Center, 2010). The Texas Education Agency (TEA) measures student success on many factors including: student graduation rate, SAT/ACT scores, TAKS and STAAR scores, and student college attendance. To accomplish these goals, BISD must track massive amounts of data for students (Saveat, 2012). A list of acronyms is included in Table 1 at the end of the paper.

The TEA and PEIMS provide standard requirements for reporting Texas public school data to the Texas legislature so that the TEA can perform its purpose, which is to monitor Texas public schools (Texas Association of School Board, 2009). PEIMS is a set of rules and standards about Texas public school data; however, it also houses the data, but is not a database. PEIMS data that is available to the public exists on the TEA's website (Texas Education Agency, 2011). There are three main drivers for PEIMS data: Funding, Accountability, and Information Resources (Region 4 Education Service Center, 2010).

The Texas legislature uses PEIMS data to calculate how much funding goes to each school for title programs, school lunches, special education, and grant programs. For example, if a particular district, such as BISD, has a larger special needs group of students than average, then the Texas legislature knows to allocate more funding for those programs to that district (Region 4 Education Service Center, 2010). The Texas legislature uses the accountability data that PEIMS records to rate each school system and report the Federal Adequate Yearly Progress (AYP) (Education Week, 2011). It also does Performance-Based Monitoring (PBM) based on student test scores. The accountability driver also includes attendance audits and monitoring schools for drugs (Region 4 Education Service Center, 2010). See Figure 1 for 2011 data for an accountability summary of BISD's Westbrook High School.

Figure 1 illustrates what the TAKS test scores are for Westbrook High School students in 2011. This data comes from the TEA website, which is what the State of Texas uses to make PEIMS data available to the public. While the table explores some sub-populations such as economically disadvantaged, White, African American, and Hispanic, this site is unable to provide any data that would combine sub populations. For instance, if a school administrator wanted to know what percentage of economically disadvantaged, Hispanic students passed the math portion of TAKS, this table would not readily provide that information.

PEIMS data now, consists of all the data that Texas school districts provide to the TEA. This data is available to the public through the TEA website (Texas Education Agency, 2011). This data gathered is in a standard format that meets PEIMS requirements. BISD uses Pearson to create and grade TAKS tests, but Pearson sends the data first to BISD and BISD inputs the data into TEAMS, which then compiles a report to send to the TEA for PEIMS.

When data from a school district, or even a school within a district, shows a deficiency in a particular area of test scores, the TEA and the district decide how to fix this deficiency. First, administrators slice the data into different sub populations to discover the reasons why this is occurring. It may be that a particular school has a higher percentage of special needs students, or it has a higher Hispanic population whose first language is Spanish. Any data that might provide insight is used. Using this information, administrators make decisions on how to fix the deficiency. When the data comes from PEIMS, then this is a TEA or state mandated decision (Saveat, 2012).

TEXAS ASSESSMENT OF KNOWLEDGE AND SKILLS (TAKS) TABLE

	2011				2010			Required Improvement			Status by Measure			
Performance Results	Number Met Std	Number Taking	Pct Met Std	Stu Grp %	Number Met Std	Number Taking	Pct Met Std	Met Min Size	Act Chg	RI	Met RI?	STD	RI	EXCP	***
Reading/ELA (70%/80%/90%)															
All Students	1,618	1,693	96%	100%	1,687	1,800	94%		2			EX	-	-	EX
African Amer	640	682	94%	40%	720	775	93%		1			EX	-	-	EX
Hispanic	233	246	95%	15%	213	235	91%		4			EX	-	-	EX
White	604	618	98%	37%	637	661	96%		2			EX	-	-	EX
Econ Disadv	576	624	92%	37%	673	747	90%		2			EX	-	-	EX
Writing (70%/80%/90%)															
All Students	*	*	*	*	*	*	*		*			-	-	-	-
African Amer	*	*	*	*	*	*	*		*			-	-	-	-
Hispanic	*	*	*	*	*	*	*		*			-	-	-	-
White	*	*	*	*	*	*	*		*			-	-	-	-
Econ Disadv	*	*	*	*	*	*	*		*			-	-	-	-
Social Studies (70%/80%/90%)															
All Students	1,031	1,059	97%	100%	1,121	1,155	97%		0			EX	-	-	EX
African Amer	391	409	96%	39%	463	484	96%		0			EX	-	-	EX
Hispanic	*	*	99%	*	150	153	98%		1			EX	-	-	EX
White	411	418	98%	39%	422	431	98%		0			EX	-	-	EX
Econ Disadv	341	353	97%	33%	437	457	96%		1			EX	-	-	EX
Mathematics (65%/80%/90%)															
All Students	1,432	1,682	85%	100%	1,456	1,794	81%		4			RE	-	-	RE
African Amer	527	675	78%	40%	561	770	73%	Yes	5	4	Yes	AA	RE	-	RE
Hispanic	202	244	83%	15%	197	236	83%		0			RE	-	-	RE
White	570	617	92%	37%	578	659	88%		4			EX	-	-	EX
Econ Disadv	475	617	77%	37%	545	746	73%	Yes	4	4	Yes	AA	RE	-	RE
Science (60%/80%/90%)															
All Students	952	1,061	90%	100%	1,015	1,155	88%		2			EX	-	-	EX
African Amer	342	411	83%	39%	401	486	83%		0			RE	-	-	RE
Hispanic	128	143	90%	13%	133	152	88%		2			EX	-	-	EX
White	400	418	96%	39%	400	430	93%		3			EX	-	-	EX
Econ Disadv	298	355	84%	33%	374	457	82%		2			RE	-	-	RE

Source: Campus Accountability Data Tables. [Table] (2011) Retrieved April 28, 2012 from ritter.tea.state.tx.us/perfreport/account/2011/districtlist.srch.html

FIGURE 1. TEXAS ASSESSMENT

If a school is scoring poorly in English, but it has a high population of students who are ESL (English as a second language), then the decision may be to increase funding for programs that focus on ESL classes.

INTELLIGENCE GATHERING AND BI DRIVERS AT BISD

When the federal government passed the No Child Left Behind Act, it put enormous pressure on public schools in the U.S. The act made it difficult for public schools to have the option to fail students. This created issues in the classrooms because now teachers were required to re-teach. Districts refer to re-teaching as reviewing material that has already been taught if the students do not master the material the first time through. This also leads to re-testing which is allowing students to retake tests over the subjects in which they scored poorly. Instead of solely retaining grade records, the districts now have to keep records of which students are passing, and which students have been re-taught (Phillips, 2012).

The No Child Left Behind Act created the need for tracking new data. For example, now schools needed to know how many times a student has failed, which teacher taught them the material, which schools fail the most students, and what the potential causes are for these failures (Saveat, 2012).

The 'No Child Left Behind' Act was a primary driver for developing BI in BISD. The need for demographic and socio-economic information grew. For example, an auditor for PEIMS may look at BISD TAKS test results and compare them to another district in the Southeast Texas area, such as Nederland ISD. The auditor may assume that BISD's use of funds is less efficient than Nederland ISD's. However, when considering BISD has one of the highest percentages of economically disadvantaged students in all of the Texas ISDs, then it creates a new paradigm for the auditor, because the auditor knows that economically disadvantaged students tend to score lower on standardized tests (Knight, 2012).

Before 2003, BISD primarily sent data to PEIMS using an AS400 IBM and a flat database in the form of a spreadsheet. The district used the data collected primarily for populating the state PEIMS data, which the TEA uses. The TEA analyzed the PEIMS data since the district itself did not have an effective BI solution. Also, this analysis stated a number of challenges in the existing data collection (IBM Global Business services, 2009):

- Aged PEIMS system and processes - The existing system is still primarily a batch collection system; the process for reviewing and approving data elements is slow and difficult, the efforts to support the system are labor intensive and expensive for the state.
- Untimely reporting of and access to data - The data is collected infrequently (many elements only once a year) and due to the time it takes to analyze and report the data, new

reports often represent data that is at least nine months old. The data is not available to stakeholders in an easy to obtain, easy to manipulate fashion.

- Data reporting redundancies - Due to the inefficiencies of PEIMS, many other data collections have evolved at TEA and some of these overlap with PEIMS.

- Data quality needs improvement - The districts must perform their own aggregation, business rules and analysis to provide the data as defined in the PEIMS data collections. Due to the complexities of creating the required data locally at the districts, these efforts are prone to error.

- Labor-intensive reporting burden to districts - The requirement for districts to create the required data from their source systems creates an expensive and time-consuming effort for both the districts and for the TEA, who must monitor their submissions for quality and completeness.

- Barriers to data sharing - Current stakeholders find it difficult to get data from the TEA. Many data requests require significant programming efforts by the TEA staff and may take weeks to provide. This is true for both internal TEA stakeholders who want to use the data and other, external stakeholders.

Administrators in BISD saw the growing need for analyzing data before getting feedback from the state. Having to wait for PEIMS data and the TEA would make decisions slower. If BISD has the data in real-time, decisions would be more effective because administrators could implement change faster. In 2004, Dr. Kimber Knight and Supervisor Programmer Darren Fredrick developed an in-house program to make it easier for teachers to report and retrieve district data. They developed the Item Analysis system (Knight 2012).

BI TOOLS AND TECHNOLOGIES AND DATA ANALYSES

Item Analysis was BISD's first BI system. Teachers would scan in Scantron data using Apperson scanners into an IBM AS400. The Apperson scanners, developed by Apperson Educational Products, read the information from the scantrons that the teachers scanned including answers keys and student tests. From the AS400, the district could run reports and sort data more efficiently. It also allowed teachers to access reports. Item Analysis is a traditional database system. After a short pilot test in 2004, BISD deployed Item Analysis into more and more schools. The Item Analysis data was a separate database from the PEIMS data. BISD primarily used Item Analysis to improve decisions made at the campus and teacher level. Since BISD made the information in Item Analysis available to teachers, it increased teachers' ability to make decisions about curriculum and re-teaching (Knight, 2012).

The more data teachers scanned into Item Analysis, the more apparent it became that one programmer could not manage such a large system. The district relied on Item Analysis, so downtime caused work stoppage. The programmer would have to drop his current project and focus on bringing the system back up. BISD realized this was not a cost effective solution (Fredrick, 2012). Administrators in BISD saw the need to have a real-time database for decision-making. In 2006, BISD implemented the TEAMS ERP system, developed by Prologic. TEAMS is a real-time database tracking system designed for inputting and tracking data. This database is responsible for all day-to-day transactions involving students at BISD. It is important to note that TEAMS is a BISD system and is not part of the PEIMS system. BISD integrated the TEAMS server into their IT infrastructure.

The TEAMS system tracks student data. When a new student enrolls in BISD, TEAMS creates a record of all of their demographic information, such as name, address, contact information, social security number, sex, ethnicity, economic background, etc. This data is important because it is a primary factor in decision-making. Not all data is available for inputting into TEAMS. For instance, a transfer student may not have records from a previous school. The more data TEAMS has, however, the more information teachers and administrators have to make decisions. The TEAMS system keeps a record of day-to-day information such as attendance, student grades, student test scores, and discipline (Saveat, 2012).

Teachers input the majority of students' day-to-day data. When a class period begins, the teacher takes attendance through the TEAMS system. TEAMS shows teachers which students were absent in a previous period, which students have already called to inform the school of their absence, and whether or not an absence is considered to be excused. This information is real-time and makes decision making easy for the teacher and administration. For example, if an attendance clerk notices that a student is continually marked absent for fifth period, but is present for fourth and sixth period, the clerk has the power to start an investigation into the possibility of truancy. Since, attendance is a primary driver of school funding and schools get state funding based on the number of students that attend class, BISD employees pay close attention to attendance (Saveat, 2012).

Teachers also input and maintain students' grades. Teachers maintain their grade books through TEAMS by creating assignments and giving grades to those assignments. A teacher has the power to maintain categories and assign those categories percentages of value. For example, a teacher can create three categories: Daily Grades, Tests, and Labs, and then assign 25%, 25%, and 50% respectively, to each category. As the teacher creates the assignments, they assign each assignment to a category. TEAMS then, calculates each assignment’s value based on the percentage of value for each category. TEAMS will calculate six weeks averages based on the criteria inputted by the teacher. Each six weeks, TEAMS records the students' averages and places the averages into the students' permanent grade file (Phillips, 2012).

At the end of each semester, which is three, six-week grading periods; students receive a semester average, which TEAMS also calculates. At the end of the school year, TEAMS calculates both semester averages to get the final grade for the course (Phillips, 2012).

TEAMS also tracks standardized test scores such as TAKS tests. Pearson Education Inc. creates the TAKS test and BISD administers the test to the students. BISD ships the completed tests to Pearson where they are graded. Once Pearson grades the tests, they compile the results and send them back to BISD. BISD then inputs the test results into the TEAMS system (Knight, 2012). BISD sends data to the TEA and PEIMS four times per year. PEIMS mandates a Fall Collection or Submission 1, a Midyear Collection or Submission 2, a Summer Collection or Submission 3, and an Extended Year Collection or Submission 4. PEIMS deems the fall, Midyear, and Summer Collections mandatory, but the Extended Year Collection is reported only if there is data to report. BISD uses the TEAMS system to generate a report that the TEA uses for PEIMS data (Region 4 Education Service Center, 2010).

As BISD's reliance on BI data for decision-making grows, so does its need for more information. The TEAMS system provides an excellent way to input data and report data to PEIMS. However, it does not allow the slicing of data the way administrators need to view it without taxing BISD's IT staff. Using the TEAMS system for reporting, a BISD programmer had to write the report or hired Prologic to create a report if teachers or administrators needed new data. This became expensive and a cost prohibitive solution (Knight, 2012).

In the fall semester of 2011, BISD purchased Eduphoria!'s Aware package. Eduphoria! is a company that writes BI products that are designed to integrate into school districts infrastructure and assist with the reporting and tracking of information. Eduphoria! created the Aware package for benchmarking student performance. As stated on Eduphoria!'s website, "Aware redefines student data analysis, by making your data 'browsable' in a rich, interactive format. Drilling from district to school to individual teacher or student data is just a click away." BISD deployed Eduphoria!'s Aware district wide in January of 2012 (Knight, 2012).

Eduphoria! designed Aware to give easy access to school administrators and teachers for tracking student performance. It provides a platform for data that is easy to access and easy to understand. If an administrator is evaluating the performance of a particular school, he or she can drill down all the way to the percentage of African-American males that are economically disadvantaged who took geometry in the 11th grade from a particular teacher. That would allow an administrator the ability to know which teachers produce better test results and why. Then an administrator may be able to identify teachers in need of assistance or TINA (Knight, 2012).

The main advantage Eduphoria provides is the ability to slice all educational data stored in one place (Ector County Independent School District, 2012). This now includes initial testing at the first and second-grade level for reading and math and an IQ test. The results from these tests can

now follow a student throughout their K-12 career. In five years time, BISD expects to see results of improvement based upon these baselines. A TINA identification allows administrators to give aid to teachers in the form of additional training or incentives. BISD designed the concept of TINAs to assist teachers; however, teachers try to avoid receiving them due to their negative connotation (Knight, 2012).

COMPETITIVE ADVANTAGES AND FUTURE OPTIONS

BISD hosts the TEAMS system in house. This adds to the overall cost of running the system. Prologic created TEAMS and charges a yearly maintenance fee of $200,000 per year. The BISD IT dept. hopes to move the system to Prologic's hosting services. This would increase the fee, but decrease the internal overhead created by the in house servers and salaries required to maintain the hardware, Eduphoria!, charges based on the modules used and not on a per user basis. The initial setup fee was $2,000 and the annual maintenance fee is $85,000.

Now that information is so readily available, both teachers and administrators in BISD can tailor programs to fit the needs of students. In the past, BISD would have to use Item Analysis or wait for the TEA to analyze the data TEAMS reported to PEIMS and then report that data back to BISD. Now, 'Eduphoria! Aware' provides real-time access to data as soon as a teacher inputs it (Knight 2012). See Figure 2 for how TEAMS populates Eduphoria!

Figure 2 will illustrate that the day-to-day data from TEAMS syncs to both PEIMS and Eduphoria! While BISD reports PEIMS data four times per year, TEAMS and Eduphoria! are in real-time sync with each other. When a teacher inputs into TEAMS, the data immediately is available in Eduphoria! for analysis. The real-time feature allows decision makers to have information much faster than in the past. It is important to note that Eduphoria! Aware is a different database than TEAMS and PEIMS. BISD employees enter data only through TEAMS. TEAMS is in real-time sync with Eduphoria! Aware, and sends PEIMS report data four times per year (Fredrick, 2012; Region 4 Education Service Center, 2010).

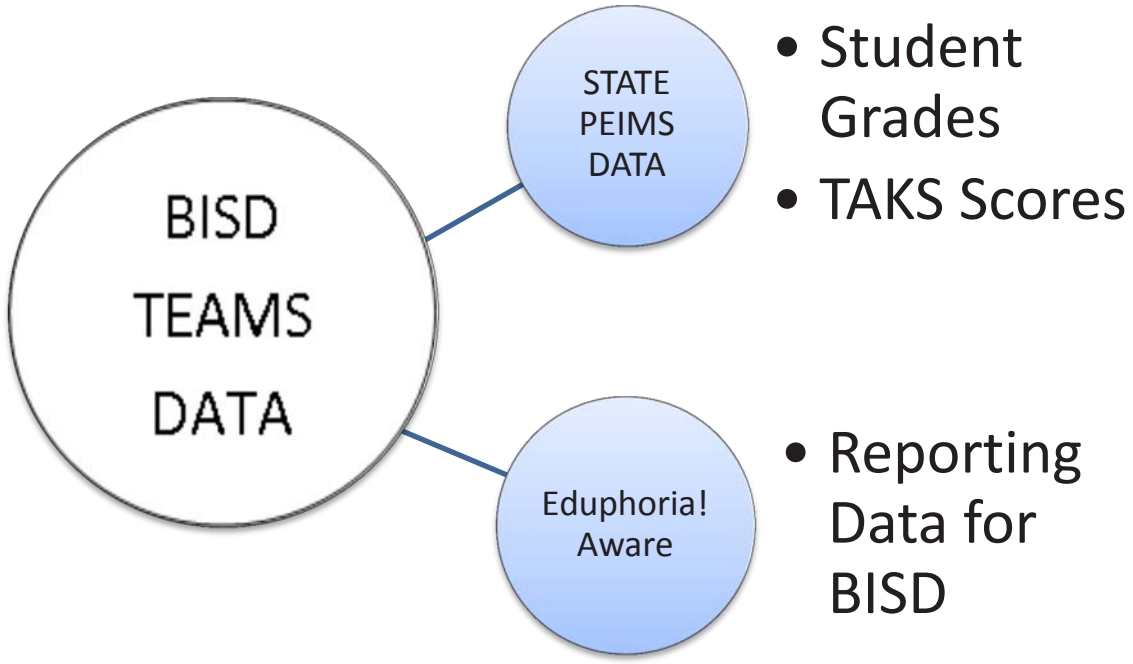

FIGURE 2. MAP OF DATABASE REPORTING AND SYNCHRONIZATION

It is clear that in the past ten years, BISD has made giant strides in BI. The district changed from reporting PEIMS data to the TEA four times per year via a flat database to having a real-time database capable of drilling down to any detail inputted into it. While the district-wide deployment of Eduphoria!'s Aware is four months old, as of April 2012, this gives teachers access to data that, until just a few years ago, administrators had a hard time getting. BISD provides this information through the use of its in-house TEAMS system developed by Prologic and Eduphoria!'s Aware system.

The largest issue that BISD employees face is familiarity with the "Eduphoria! Aware" system. Not all teachers are aware of how effective and useful the "Eduphoria! Aware" system is. Most teachers that do know about it do not know how to use the information to create an environment better suited for students. Part of the problem comes from the fact that in the past administrators made decisions using the detailed information provided by BI systems. Because teachers did not have the information, they received no training for its uses. Training teachers on how to use "Eduphoria! Aware" is the next step for BISD. BISD trained users in the Eduphoria! system in three phases: 1)When Eduphoria! was first introduced, only select administrators learned how to use the system; 2) The next phase was training a test group of teachers from every grade level for them to examine how the new system would benefit re-teaching; and 3) After the success of the test group, BISD gave all teachers the opportunity to train in the use of Eduphoria! by integrating it into the 2011-2012 staff development continuing education classes.

Another recommendation is a dashboard for the Eduphoria! Aware platform, which displays menu driven navigation. BISD does not have access to a dashboard for Eduphoria! Aware, though it would provide even faster access to data. Users would have even more control with a customizable dashboard for each individual login. By making these changes, BISD would have a very effective BI system in place to make decisions.

School districts, more than most other organizations, are required to and benefit from logging incredibly large amounts of data. As a result, the amount of data to enter, track, and analyze can be a cumbersome responsibility. A few of the ways, that other school districts can benefit from following BISD's example, are: 1) Improve attendance by having a clear picture of attendance percentages by individual, grade, school, and district and by sharing that information with students; 2) Create simple communication streams between administrators and teachers and between teachers and teachers district wide; and 3) Give all system users easy access to critical student information. With contact information, test scores, attendance, behavior history, and more within reach, wasted time and misplaced files can be reduced (School District Solutions, 2012). However, a very few Texas ISD's are currently using a BI system this complex due to the cost of implementation in conjunction with the current budget cuts.

We plan to re-examine the progress BISD test scores and re-teaching takes in the next five years. BISD implemented Eduphoria! district-wide in 2012 so there is no measurable progress for reforms yet Eduphoria! is a new implementation. In five years, BISD expects to see improved standardized test scores in comparison to districts with similar demographics and 2011 test scores. Over the next five to ten years, we will know more about the effects of this particular BI system in BISD compared to other districts that still use benchmarking only. Since Eduphoria! is a new implementation, there is no data to compare. One of the ways to measure progress in education is in awarded grants. Through the innovation of the Item Analysis system, BISD was able to secure a grant through the Michael and Susan Dell Foundation (MSDF) whose funding allowed the expansion into their current BI system.

TABLE 1. ACRONYM LIST

PEIMS	- Public Education Information Management System
TEAMS	- Total Education Administrative Management Solution
BISD	- The Beaumont Independent School District in Beaumont, Texas
AYP	- Adequate Yearly Progress reported to the federal government
TEA	- Texas Education Agency
PBM	- Performance-Based Monitoring
TAKS	- Texas Assessment of Knowledge and Skills
STAAR	- State of Texas Assessment of Academic Readiness
OLTP	- Online Transaction Processing
OLAP	- Online Analytical Processing
ERP	- Enterprise Resource Planning
TINA	- Teacher in Need of Assistance

REFERENCES

Campus Accountability Data Tables. [Table] (2011) Retrieved April 28, 2012 from http://ritter.tea.state.tx.us/perfreport/account/2011/districtlist.srch.html

D. Frederick, Supervisor Programmer, Beaumont Independent School District, personal interview, April 19, 2012

Ector County Independent School District (n.d.). *ECISD's new initiatives - what are CSCOPE, Eduphoria, and PLCs?* Retrieved November 22, 2012 from http://www.ectorcounty.k12.tx.us/site/default.aspx?PageType=3&ModuleInstanceID=7613&ViewID=047E6BE3-6D87-4130-8424 8E4E9ED6C2A&RenderLoc=0&FlexDataID=3581&PageID=1

Education Week (July 18, 2011). *Adequate Yearly Progress*. Retrieved November 22, 2012 from http://www.edweek.org/ew/issues/adequate-yearly-progress/

Eduphoria! SchoolObjects (2009) http://www.eduphoria.net/default.aspx Source: Eduphoria!SchoolObjects:Aware (2012) https://beaumont.schoolobjects.com/aware/default.aspx

IBM Global Business Services (January 27, 2009). *TEA Data Collection, Analysis and Reporting Systems Investigation Issues and Recommendations.* Retrieved November 22, 2012 from http://ritter.tea.state.tx.us/tea/IBM_TDCARSI_Recommendation.pdf

Knight, Director of Performance Management and Instructional Technology, Beaumont Independent School District, personal interview, April 23, 2012

M. Phillips, Vocational Counselor, Beaumont Independent School District, personal interview, April 26, 2012

Marianne K. McGee**,** Ohio Schools Use Business Intelligence To Improve Student Performance, *InformationWeek,* http://www.informationweek.com/software/business-intelligence/ohio-schools- use-business-intelligence-t/217701629?pgno=2

Region 4 Education Service Center. (2010) FastTrack to PEIMS: Manual for Business Managers, PEIMS Coordinators, and PEIMS Personnel. p 2-17

S. Saveat, PEIMS Supervisor, Beaumont Independent School District, personal interview, April 19, 2012

School District Solutions, (2012), http://www.dawabi.com/school-district-solutions.aspx

Texas Association of School Boards (February 2009). *Transparency Mandates on School Districts*. Retrieved November 22, 2012 from www.tasb.org/legislative/documents/transparency

Texas Education Agency (n.d.). *PEMIS Data Standards*. Retrieved November 20, 2012 from http://www.tea.state.tx.us/peims/

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