

Monitoring School Improvement with Non-Academic Indicators

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## **Abstract**

In 2017, the Kentucky Department of Education (KDE) set out to develop a new monitoring instrument for low-performing schools. This report, called the Student Performance Monitoring Report (SPMR), standardizes the incremental school improvement monitoring system, allowing for greater scalability and analysis by users at the school, system and agency levels. Instead of traditional academic measures, which vary from school to school and district to district, the SPMR uses indicators that are known to be influenced by multiple system-level factors; including attendance, behavior and early warning indicators. This study uses exploratory data analysis procedures to examine the relationships between these variables and established indicators of school quality such as identification for Comprehensive Support and Improvement (CSI) and other federally required classifications. In sum, this analysis provides early evidence that these indicators can be utilized as standardized measures of overall institutional health by demonstrating clear alignment and relationships between the variables and school outcomes. This report establishes a theoretical framework upon which future work can be built.

## **Keywords**

school improvement, continuous improvement, periodic monitoring, data-driven decision making

## **Introduction**

School improvement practices at the Kentucky Department of Education (KDE) began forming into their current shape in 2010 when the Obama Administration refined the school improvement statues within the No Child Left Behind Act of 2001 (NCLB), setting new expectations for school improvement. Among these changes was creation of the School Improvement Grant (SIG) program as a way to fund and set parameters for school improvement efforts (U.S. Department of Education, 2010). As part of its responsibility to administer federal programs, KDE saw a need to establish systems for the periodic monitoring of school improvement. The solution became known as the Quarterly Report (QR).

The QR was designed to align with the federal reporting requirements of the SIG program, which included the intervention model deployed in each school, the number of minutes within the school year, the average scale scores on state assessments for reading/language arts and mathematics, the number of students completing advanced course work, and the teacher attendance rate (U.S. Department of Education, 2010). Through the QR, required reporting information was collected, analyzed and reviewed by schools every quarter during the school year before being archived and reported to the U.S. Department of Education during the annual reporting period. Over time, other pieces of information, such as student performance on benchmark assessments and student behavior metrics, were added to the QR in an effort to better track progress towards the school improvement goals established by individual schools.

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In 2015, the Every Student Succeeds Act (ESSA) reauthorized the Elementary and Secondary Education Act (ESEA) with new and dramatic changes to federal school improvement policy. Notably, ESSA created new school improvement designations and new methods for identifying which schools need improvement. ESSA also ended the SIG program and removed the reporting requirements that had shaped the QR process (U.S. Department of Education, 2015 and 2016). KDE utilized this new flexibility to take a renewed look at the periodic monitoring process which remained enshrined in state regulations. A new process needed to be created that included standardized measures, was more readily accessible to school and district leaders, had the ability to provide insight at the student, school, system and state levels, and allow for disaggregation of data among multiple student groups. This new process became the Student Performance Monitoring Report (SPMR).

Unlike the QR, which was a manual data collection and review process, the SPMR lives inside the state's data management system provided by Infinite Campus. The SPMR presents information about the current demographics within a school, summary statistics for 11 standardized indicators, and the ability to disaggregate and analyze data by grade level, gender, age, race/ethnicity, economic status, special education status and English learner status.

Like the QR, the SPMR continues to be reviewed by schools at regular intervals, although the standardization of the process allows schools to have more agency in determining the interval period that works best for them. Staff from the KDE also review and analyze the SPMR and provide technical support to schools and districts in their analysis process. This study seeks to explore the ability of the SPMR to provide a snapshot into the overall organizational health of a school by comparing the reports of low-performing schools to high-performing schools.

### *School Improvement in Kentucky*

While available to all schools in the state, the SPMR exists primarily to support the improvement process of schools designated as Comprehensive Support and Improvement (CSI) under Kentucky's accountability system. In accordance with the ESSA, the KDE developed an accountability system that defines federally required classification labels and assigns them to schools. These labels include Comprehensive Support and Improvement (CSI) status, which is assigned to the lowest-performing schools in the state, and Targeted Support and Improvement and Additional Targeted Support and Improvement (TSI/ATSI), which is assigned to schools with persistently low-achieving groups of students (Kentucky Department of Education, 2019).

In addition to the federal classifications, Kentucky's accountability system also assigns schools an "Overall Score" and uses the Overall Score to assign Star Ratings to schools. The Overall Score is calculated using a weighted formula that considers student proficiency in reading and math, student achievement in science, social studies and writing, student growth (at the elementary and middle school levels) and graduation rate (at the high school level). Star Ratings are assigned to schools to help provide context to the Overall Score. They exist on a range of One Star to Five Star, with Five Star schools representing the highest-performing schools in the state. To determine these cut scores for each of the five levels, KDE assembled a standard setting committee that reviewed anonymized school data to determine where the threshold for each level

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should be (Kentucky Department of Education, 2019). At the time of this writing, these cut scores resulted in 105 One Star schools, 364 Two Star schools, 965 Three Star schools, 317 Four Star Schools, and 65 Five Star schools (Kentucky Department of Education, 2019a). The cut scores are designed to remain stagnant for multiple years to facilitate the goal-setting process and monitor school improvement efforts.

Schools identified as CSI receive intensive support from KDE as they work to drive their improvement efforts. This support includes a Diagnostic Review audit that helps to identify gaps in instructional integrity, on-site support from trained improvement specialists, additional professional learning opportunities, and access to school improvement fund grants to battle resource inequities (Kentucky Department of Education, 2020). In addition to these supports, the SPMR provides an additional layer of monitoring and data collection that schools use to provide regular “pulse checks” on their progress towards higher student achievement.

### *Periodic Monitoring of Low-Performing Schools*

The periodic monitoring of low-performing schools is a regulatory requirement in Kentucky (703 KAR 5:280), but it also is a well-established best practice. The use data for decision-making has become an inherent part of the educational system at both the leadership and classroom level (Cohen-Vogel, & Harrison, 2013; Wang, 2019; Dufour, et al., 2006). Within a school improvement context, the regular collection and use of data for decision-making is a vital part of the establishment of well-honed continuous improvement systems (Gates Foundation, 2015; Park, et al., 2013).

Schools identified for improvement in Kentucky are required to write and submit turnaround plans that outline their improvement goals and processes (703 KAR 5:280). While the authoring of plans is an important step, it is the periodic monitoring of these plans that allow for incremental changes that lead to sustainable, long-term change in an organization (Park, et al., 2013). Small systemic changes are monitored through plan-do-study-act (PDSA) cycles, which have been proven to facilitate changes to entrenched systems and lead to school improvement (Tinchor-Wagner, et al., 2017; Vaszauskas, 2011; Deming, 2000). While these PDSA cycles serve to monitor the implementation of individual turnaround efforts, the SPMR is a supplemental tool that helps a school organization see how their efforts are impacting the system as whole.

### *The SPMR Indicators*

To ensure the periodic monitoring process is meaningful, KDE carefully selected 11 indicators to include in the SPMR. The indicators can be divided into three captions: attendance, behavior and early warning. All 11 indicators are able to be standardized through the state’s data collection system and have been proven to provide insight into student achievement and organizational health.

Absenteeism is intrinsically linked to the health of a school organization. If students are not participating in learning activities, logic suggests they are not learning. The SPMR allows leaders to review the number of days tardy and absent for each student as well as descriptive

statistics of the distributions for a school, district or state. While personal and family factors certainly contribute to absenteeism (Robinson, et al., 2018; Sahin, Arseven, & Kilie, 2016; Demir & Akman Karabeyoglu, 2015), studies that seek to examine the underlying causes of absenteeism or test interventions designed to lower the rate of absenteeism also focus on organizational factors. Some of these factors include a lack of clear communication between the school and families, past academic performance, and elements of school culture and climate (Cook, et al., 2017; Termos, 2013; Sahin, Arseven, & Kilie, 2016; Demir & Akman Karabeyoglu, 2015; Baliks, Arslan, & Duru, 2016; Black, Seder, & Kekahio, 2014; Ansari & Gottfried, 2018). When seeking to evaluate the health of a school or system, absenteeism appears to be a valuable metric that reflects a wide variety of community and organizational factors.

Student behavior records also prove to be a valuable measure of the culture and climate of a school. The SPMR allows leaders to review information related to student behavior referrals, in-school removals from class, out-of-school suspensions and expulsions. While it is commonly accepted that removal-based consequences for behavior incidents negatively impact the achievement of the students directly involved (Lacoe & Steinberg, 2019; Rausch & Skiba, 2005; Balfanz, Byrnes, Fox, 2014; Noltemeyer, Ward, & Mcloughlin, 2015), negative peer effects on achievement also have been documented (Demming, 2011; Kinsler, 2013; Perry & Morris, 2014). Students in schools with high levels of behavior incidents have reported feeling less safe and more distracted during the school day (Lacoe, 2015; Steinberg, Allensworth, & Johnson, 2011; Burdick-Will, 2018). Similarly, teachers in such schools report higher levels of turnover, burnout and stress (Ramos & Hughes, 2020; Ingersoll, 2016; Tsouloupas, et al., 2010). School-wide efforts to improve culture and climate, frequently called Positive Behavior Interventions and Supports (PBIS), have been shown to improve academic outcomes by improving school climate (Darling-Hammond & Cook-Harvey, 2018; Christofferson, & Callahan, 2015; Özgenel, 2020). When viewed through a lens of the descriptive statistics provided by the SPMR, these behavior indicators can provide insight into the health of the school climate.

State regulations prohibits the KDE from standardizing traditional measures of student achievement, such as grade scales or benchmark tests. To provide a snapshot into the academic health of the school, the SPMR relies on a series of five early warning indicators: On-Track to Graduate, Attendance, Behavior, Academics and Stability. These indicators use machine-learning algorithms to analyze student data and create a standardized metric that predicts their likelihood of success in school. Early warning systems have proven to be highly effective at identifying students at risk of failure, dropout or non-completion. Effective early warning systems provide school leaders with the information they need to improve student outcomes (Fox & Byrnes, 2015; Faria, et al., 2017; Corrin, et al., 2016).

The particular early warning indicators included in the SPMR were developed by Infinite Campus in collaboration with KDE. These indicators combine the known information about a student into scores ranging from 50 to 150, with a higher score indicating a more positive predicted outcome. The algorithms consider a variety of information about each student, including their enrollment history, demographic variables, behavior outcomes, household demographics, student engagement, guardian involvement, attendance rates, classroom grades

and standardized test scores (Infinite Campus, 2020). These indicators have been thoroughly validated and have been proven to be highly accurate in their predictive ability (Christie, et al., 2019). While they are designed as early warning tools to identify individual students for intervention, the SPMR allows schools to view summary statistics of the distribution of the scores to make informed improvement decisions.

### Methodology

In order to understand how the SPMR functions as a progress monitoring tool for low-performing schools, this study deployed exploratory data analysis (EDA) procedures to understand the relationship between each of the SPMR indicators and outcomes in the state’s accountability system.

The analytic sample for this study includes data from all Kentucky students in ninth through 12th grade who attend schools that receive accountability ratings. Students without complete data sets were removed from the calculations due to the impact of missing values on the calculations listed below. The complete sample included student data from 225 Kentucky high schools. Table One shows the distribution of the schools across accountability categories.

**Table One: Number of Schools by Accountability Category**

	<i>One Star</i>	<i>Two Star</i>	<i>Three Star</i>	<i>Four Star</i>	<i>Five Star</i>	<i>Total</i>
Count	19	52	119	28	7	225
Percent	8.44%	23.11%	52.89%	12.44%	3.11%	100.00%

Data was collected from KDE. The SPMR, as well as school accountability ratings, were retrieved for all Kentucky high schools. The SPMR represents a snapshot of the school at the time it is pulled. To examine the relationship between the SPMR indicators and school accountability ratings, this study utilized the end of the year SPMR for the 2018-2019 school year and the accountability ratings assigned to schools in the fall of 2019. This data set represents the most recent complete school year.

This study deployed exploratory data analysis (EDA) techniques to better understand the relationship between the 11 SPMR indicators and school accountability designations. First, the student-level data collected from the SPMR was summarized up to the school level by calculating the mean score for each of the 11 indicators for each of the 225 schools. From these scores, the mean and standard deviation for each indicator was calculated for each accountability category. To further illustrate the difference between high- and low-performing schools, the Cohen’s  $d_s$  also was calculated for each indicator for CSI schools (the lowest-performing group) and Five Star schools (the highest-performing group). Cohen’s  $d$  is a measure of effect size that shows the magnitude of a difference between two means. Cohen’s  $d_s$  is a variant of Cohen’s  $d$  that allows for a more accurate comparison of the magnitude of difference between small sample groups of different sizes (Cohen, 1988; Lakens, 2013).

For deeper analysis, the Pearson product moment correlation was calculated to measure the strength of the relationship between each indicator and both accountability measure outcomes

(Star Rating and Overall Score). Additionally, a multiple linear regression model was fitted to examine the predictability of the SPMR indicators for the school accountability ratings. This series of calculations was completed using the “realimpo” package in the R software package (R Core Team, 2020; Gromping, 2006).

### **Findings**

Table Two presents the mean of each indicator by accountability performance category. Taken at face value, the mean performance for each indicator is clearly aligned to accountability performance categories. As the accountability rating increases, the average performance on each behavior-related variable decreases. Similarly, as accountability ratings increase, so does the average of each early warning indicator. In both instances, this movement represents a favorable change in the indicators score and suggests that higher-performing schools have lower rates of behavior-related incidents, better school attendance and higher early warning scores.

When the highest-performing high schools (Five Star) and lowest-performing high schools (CSI) are pulled out for closer examination, it is clear that a stark difference exists between the two groups. Table Three illustrates the difference in performance between these two groups. Five Star schools have dramatically lower incidents of behavior-related events and absenteeism, and far greater early warning indicators. The Cohens  $d_s$  illustrates this gap. It also is notable that Five Star high schools have a lower standard deviation among their average performance than CSI high schools. This suggests there is more spread at the bottom end of the accountability spectrum.

**Table Two: Mean by Performance Category**

	<i>One Star</i>	<i>Two Star</i>	<i>Three Star</i>	<i>Four Star</i>	<i>Five Star</i>
Number of Behavior Referrals	2.76	1.06	1.08	1.00	0.55
Number of In-School Removals	1.69	0.39	0.35	0.23	0.10
Number of Out of School Suspensions	0.40	0.13	0.09	0.07	0.05
Number of Expulsions	0.00	0.00	0.00	0.00	0.00
Days Absent	16.63	11.87	11.16	9.74	7.33
Days Tardy	11.73	6.50	6.02	5.87	5.44
On Track to Graduate	115.69	130.53	131.62	136.99	143.83
Early Warning Attendance Score	114.36	121.94	125.39	130.35	136.32
Early Warning Behavior Score	122.15	130.65	131.87	132.70	135.22
Early Warning Academic Score	118.99	129.47	132.46	135.48	139.13
Early Warning Stability Score	113.75	118.79	119.16	122.63	133.67

**Table Three: Difference Between CSI and Five Star High Schools**

	CSI		Five Star		<i>d<sub>s</sub></i>
	<i>M</i>	<i>(SD)</i>	<i>M</i>	<i>(SD)</i>	
Behavior Referrals	3.86	(2.89)	0.58	(0.61)	1.66
In School Removals	2.52	(2.70)	0.12	(0.26)	1.32
Out of School Suspensions	0.64	(0.27)	0.06	(0.05)	3.14
Expulsions	0.00	(0.00)	0.00	(0.00)	-0.81
Tardies	16.63	(3.87)	5.13	(0.78)	4.35
Absences	21.11	(1.52)	7.02	(0.86)	11.75
On Track to Graduate	99.38	(3.65)	135.24	(2.49)	-11.71
Early Warning - Attendance	98.34	(7.21)	127.93	(4.30)	-5.12
Early Warning - Behavior	108.52	(1.91)	126.84	(3.06)	-7.01
Early Warning - Academics	106.58	(4.41)	129.52	(4.56)	-5.10
Early Warning - Stability	102.47	(2.88)	125.88	(7.14)	-4.14

Table Four presents the correlations between each of the SPMR indicators and both Star Rating and Overall Score. All indicators are moderately correlated with both outcome measures. The directionality of the correlation is notable, and reflects the findings discussed above. Behavior-related indicators have an overall negative effect on the accountability outcomes, and early warning indicators have an overall positive effect on the same outcomes.



**Table Four: Correlation between Indicator and Performance Category**

	<i>Star Rating</i>	<i>Overall Score</i>
Number of Behavior Referrals	-0.31	-0.38
Number of In-School Removals	-0.41	-0.50
Number of Out of School Suspensions	-0.51	-0.62
Number of Expulsions	-0.04	-0.01
Days Absent	-0.50	-0.62
Days Tardy	-0.40	-0.51
On track to Graduate	0.47	0.52
Early Warning Attendance Score	0.56	0.67
Early Warning Behavior Score	0.55	0.64
Early Warning Academic Score	0.62	0.69
Early Warning Stability Score	0.29	0.29

Finally, a multiple linear regression was calculated to predict Star Rating based on the 11 SPMR indicators. A significant regression equation was found ( $F(11, 214) = 14.51, p < 0.000$ ), with an  $R^2$  of 0.427 and an adjusted  $R^2$  of 0.398. The coefficients of the independent variables are listed in Table Five. Out-of-school suspensions, average days tardy, early warning behavior, and early warning academic scores all were statistically significant predictors of Star Rating.

**Table Five: Independent Variable Coefficients**

	<i>Beta</i>	<i>Std. Error</i>	<i>t</i>	<i>p</i>
Number of Behavior Referrals	0.07	0.08	0.91	0.97
Number of In-School Removals	-0.18	0.12	-1.51	0.13
Number of Out of School Suspensions	-1.90	0.60	-3.15	0.00**
Number of Expulsions	-30.04	15.00	-2.00	0.05
Days Absent	0.04	0.03	1.56	0.12
Days Tardy	-0.07	0.03	-2.04	0.05*
On track to Graduate	-0.00	0.01	-0.13	0.90
Early Warning Attendance Score	0.01	0.01	0.80	0.42
Early Warning Behavior Score	-0.03	0.02	-2.01	0.04*
Early Warning Academic Score	0.05	0.01	3.58	0.00***
Early Warning Stability Score	0.01	0.01	1.26	0.21

$p < 0.05^*$ ,  $p < 0.01^{**}$ ,  $p < 0.001^{***}$

## Discussion

As education agencies seek to support low-performing schools, the development of a new, standardized monitoring mechanism is essential. This descriptive analysis suggests the SPMR can be used as an effective measure of the health of an organization. This section will discuss the potential uses and scalability of the SPMR for driving school improvement.

The primary goal of the SPMR is to provide low-performing schools with insight into the overall health of their organization. The standardization of metrics helps support organizations

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streamline monitoring and support processes. By regularly reviewing this report for new insights, users are able to quickly identify trends in student attendance, behavior, academics and stability and prioritize system-level interventions. The SPMR is a snapshot into the current state of a school. Changes to the SPMR can be noted over time and the individual metrics within the SPMR can be used to set and monitor goals.

One benefit of the SPMR is that it can provide insight into the metrics at the student, school, system and state level. This allows for greater flexibility and usability of the report. In schools, student-level detail can be used to tailor interventions to necessary groups of students. At central offices, school-level detail can be used to prioritize supports or direct necessary funding to battle inequities. At the agency level, data from multiple schools can be compared or combined to provide insight into the overall success of the school improvement program as a whole.

Since the data is standardized across all schools, the SPMR is more easily analyzed and understood by stakeholders at every level. When leaders, such as principals or turnaround specialist, move from school to school or district to district, the SPMR stays the same – allowing for newly developed data analysis skills to travel with them and be applied in a new context. This allows for greater scalability and a more efficient rollout of the SPMR into newly identified low-performing schools in the future.

While the SPMR appears to be a useful tool for monitoring changes in overall organizational health, it is not a sufficient replacement for data collection systems designed to measure the impact of a specific intervention. Rather, it can serve as a supplemental piece of information that may be used to triangulate data and verify intervention effectiveness. For example, if a school implements a system-level behavior intervention, they should develop a monitoring protocol for the intervention. This protocol may include some information within the SPMR, such as the number of behavior referrals or in-school removals received by each student, but it also may include other variables, such as the number of social-emotional lessons taught, the frequency of inappropriate language as observed by staff in the hallway, or the duration of verbal disputes with teachers during class. When this data is reviewed, the SPMR can be reviewed alongside the targeted intervention data. If the intervention is working as desired, the leadership team should be able to see changes in both their monitoring data and the overall organizational health data in the SPMR.

Another possible use of the SPMR is as a measure of data quality. It is possible that low-performing schools have lower outcomes on the SPMR due to inadequate procedures for the collection and reporting of data. Low school performance often is associated with a dissolution of effective systems (Park, et al., 2013). By placing a renewed emphasis on the systemic review of standardized metrics, school- and system-level leaders may uncover insufficiencies in their data collection process. With that said, a word of caution is necessary. A renewed focus also may drive less ethical leaders to suppress information or create data collection protocols that limit the availability of data or delay its input into the database. This should not dissuade leaders from using the SPMR to monitor school improvement, but it should encourage leaders to view the SPMR within the context of a whole school. The SPMR should not replace the “footwork” of school improvement or system monitoring; it should supplement and enhance existing systems.

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While this early descriptive analysis is promising, future work is necessary to ensure the SPMR is functioning as intended. First, the SPMR needs to be accessed and analyzed monthly to determine if, and how, the figures within the SPMR change throughout the school year. This information will help leaders set realistic and attainable goals and monitor progress toward those goals more accurately. Second, work needs to be done to apply existing knowledge of data analysis for school improvement to the SPMR to help determine if working with this particular set of data, at regular intervals, can help decision-makers drive school improvement efforts in the same manner as other data sets, such as those collected by benchmark testing systems. Finally, machine-learning algorithms can be used to further understand the predictive ability of the variables included within the SPMR. This will help leaders learn how to better focus their attention toward the issues that will have the greatest long-term impact on overall school performance.

### Conclusion

The Student Performance Monitoring Report (SPMR) developed by the Kentucky Department of Education (KDE) is a useful tool for measuring the current health of an organization. While the instrument is new and requires further study, leaders at the school, system and agency level can benefit from analyzing the standardized metrics housed within the report. The SPMR is not a replacement for existing monitoring structures but can be used to supplement those structures as schools seek to drive improvement, battle inequity and advance data quality.

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