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An Evolving Data Wise Culture (DWC): A Case Study

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Abstract

Data-informed instructional decision-making has evolved into an essential process in schools. This feature has not been fully reflected in the school culture constructs developed to date. To reflect this feature, this study examines the extent to which a data-wise culture (DWC) exists in schools and test if the construct that reflects such a culture can be measured. The study finds that there was such a culture existing in the schools in one district. The reliability of the construct DWC was high, indicating that the construct could be a unique variable that deserves further exploration. The DWC survey can be used to evaluate how well school leaders influence school conditions that foster data analysis in schools. This paper calls for the revisit of those cultural variables that have been developed to date in the field of educational leadership to reflect the new feature of data use in schools.

Key Words: Leadership**,** Culture, Data Use, Data-Driven Decision-Making

School culture is an important factor to student learning outcomes (e.g., Blasé & Blasé, 1999; 2003; Hallinger & Heck, 1997; Leithwood et al., 2004; Marzano et al., 2005; Waters et al., 2003). Accountability policy contexts (e.g., Common Core Standards; Race to the Top) motivate school administrators and teachers to look at standards, assess student progress against standards, and use students' performance data to inform their decisions related to instruction and curriculum. Data-informed instructional decision-making has evolved into an essential process in schools. It has been argued to move schools forward on a large scale is to provide precise, personalized instruction to each student emphasizing data (e.g., Fullan, Hill, & Crévola, 2006). This feature has not been fully reflected in the school culture constructs developed to date. Data-informed instructional decision is one of the best means to operationalize "inclusion" theories, helping each student succeed and promoting social justice. The purpose of this study is to explore if there is such a distinctive cultural element existing in schools. And if so, what is its status? Can it be measured?

The concept of school culture

Over the past 30 years, a number of similar constructs that reflect a variety of school culture elements were developed such as school culture, school climate and organizational learning. Elements involved in the conceptualizations of school culture include: Shared belief and value system (e.g., Fullan, 2005; Hoy, 1990; Peterson & Deal, 1998), norms (e.g., Deal, Kennedy, & Spiegel, 1983; Hoy, 1990 ; Owens, 2001), relationships (Bondi & Wiles, 2004), the common language that staff and students use, and the expectations for change and learning that saturate the school's world (e.g., Peterson & Deal, 2002). The uniqueness in these elements determine the characteristics of the people in schools, hence the culture of the school. Some scholars consider school climate an all-encompassing term, inclusive of the characteristics of the total school environment (Lunenburg & Ornstein, 2004; Owens, 2001). Whereas others consider school culture a more general term (e.g., Hoy, 1990), observing climate as perceived behaviors (easier to measure) and culture as comprising the values and norms of the school (harder to measure).

During the 1970s, scholars endeavoured to measure school climate or culture to identify effective cultures in schools. Fox (1973) developed the CFK Ltd. School Climate Profile measuring teachers' perceptions of the climate of their schools. It included eight general factors: respect, trust, high morale, opportunities for input, continuous academic and social growth, cohesiveness, school renewal and caring. Since then, at least eight measures were developed, including probably the most used instrument, the Organizational Climate Description Questionnaire (OCDQ). The OCDQ was developed by Hoy and his associates (e.g., Hoy & Clover, 1986 or Hoy, Tarter, & Kottkamp, 1991 for elementary schools; Hoy & Sabo, 1998 for middle schools; Hoy, Kottkamp, & Mulhern, 1991 for secondary schools) and measures both principals' behaviors (e.g., supportive, directive, or restrictive) and teachers' behaviors (e.g., collegial, committed or disengaged). Overall, the various constructs, overlapping to some extent, measured the following aspects of school culture: school change and improvement processes, teacher psychological factors such as commitment, morale, efficacy and satisfaction, teacher practices such as teacher collaboration, working environments (e.g., supportive or open, disciplinary climate), and goal achievement.

According to Bulris' (2009) meta-analysis, school culture in various forms is significantly correlated with student learning (r= .30). The contributions of the elements involved in the general terms of school culture or climate vary considerably: Some are effective and the others are not. Research in the late 90's focused on identifying specific aspects of school culture that significantly contributed to student learning. Previous studies have identified eight variables at the school level that significantly contribute to student learning:

- academic press (e.g., Goddard et al, 2000; Lee and Smith, 1999; Shouse, 1996)
- teacher collective efficacy (e.g., Barr, 2002; Goddard et al., 2000; Hoy et al, 2002; Hylemon, 2006; Tschannen-Moran and Barr, 2004)
- teacher trust in others (e.g., Goddard et al., 2001;1996; Tschannen-Moran, 2001)
- academic optimism (the combination of the above three variables) (Hoy and Miskel, 2013; McGuigan, 2005)

- teacher organizational citizenship behavior (e.g., DiPaola and Hoy, 2005; Podsakoff et al., 2000; Tschannen-Moran, 2001),
- professional learning community (e.g., Bolam, McMahon, Stoll, Thomas, Wallace, Greenwood, Hawkey, Ingram, Atkinson, and Smith, 2005)
- school disciplinary climate (e.g., Ma and Crocker, 2007; Ma and Klinger, 2000; Willms and Ma, 2004), and
- teacher commitment (Author, 2015)

More recently, teachers' analyzing student data collaboratively, assessing student progress, and determining instructional strategies have become an essential process in most schools. More and more scholars argue for the importance of data use in schools (e.g., Gallagher, Means, Padilla & SRI, 2008; Leithwood, Aitken & Jantzi, 2006; Sharratt & Fullan, 2012).

School leaders and teachers' use of data to make decisions and to inform instruction has penetrated almost each aspect of school culture. This new norm has not been conceptualized in the above cultural constructs developed so far by scholars. The conceptualization and vision of educators' data use are not clear. This study tries to explore the following two questions:

1) To what extent a data wise culture exists in schools?
2) Can such a data culture be measured?

Conceptual Framework

In order to define the data wise culture, we first thoroughly reviewed empirical studies on educators' data use. These studies were located within the Scholar's Portal, the repository of the annual meetings of the American Educational Research Association, and six major peer-reviewed journals in educational administration that were searched for relevant studies conducted in the last 20 years. Selected studies had to:

1) be an empirical study using quantitative, mixed research methods or meta-analytical review methods; and
2) report principals or teachers' practices of using student data that were effective in improving student learning.

The majority of the 80 studies (57) were published while 14 studies were unpublished dissertations. Five of the studies are currently in press and four studies are conference papers. These studies were mainly conducted in elementary, with a few in middle, and some in high schools, or in a mixed samples of schools.

Our review of this body of literature revealed that most teachers were in the process of learning how to use data to inform their instruction, with their use of data being limited and inconsistent (Barry, 2006; Schildkample & Kuiper, 2009; Wang, Waterman, Perie & Marion, 2010). In some places, teachers' use of data already existed, while in other places teachers' practices using data did not occur extensively or systematically (Cho, 2011; Cho & Wayman, 2012; 2014). In spite of these reported facts, a data-wise culture characterized by effective practices in teachers' use of data is emerging in schools. Our review resulted in the identification of five cultural elements, or aspects of the DWC, that are effective in improving student learning. These elements are associated with the five out of eight existing cultural variables, including teacher collective efficacy, academic press, professional learning communities, disciplinary climate, and focused instruction.

Based on this we conceptualized the DWC as denoting a friendly culture where school staff work collaboratively and systematically towards a shared vision constructed on evidence, and where the emphasis is on: (1) *Precise Instruction Using Data (PIUD), (2) Data-Informed Instruction Sharing (DIIS);* (3) *Shared, Aligned Learning and Teaching Goals developed based on data (SALTG);* (4) *using data to inform the development of a Safe and Orderly Environment (SOE), and (5) Collective Teachers' Efficacy in Using Data (CETUD).* The following sections briefly explain how we developed each of these five aspects. By "data", we mean the student data typically used by teachers: short, formative assessment (e.g., exit slips, students assignments and work, end of unit tests), state-wide standardized test scores (e.g, California State Test) or local benchmark assessments, and attendance records. These are the three out of seven types of data we identified through review that teachers often used to improve student learning.

Precise Instruction Using Data (PIUD)

Our review of 75 studies on educators' use of data shows that teachers' use of student data to make instructional decisions is the central strategy they can employ to move school forward. Building upon this, we constructed a new factor, *Precise Instruction Using Data (PIUD)*. We also added to the concept a few important elements involved in other instruction improvement related constructs. Thus, we use the notion of ***PIUD*** to capture the major elements of change in and improvement on data-informed instruction in several constructs including Focused Instruction (Leithwood & Louis, 2011)[1], teacher Utilization of Knowledge (see Stasny1996 for an example)[2], Improved Instruction (see Johnson, 2007; Nader, 1997 for examples)[3], and providing prompt, scaffolding and remedial feedback (Hattie, 2009).

Teachers revealed that their analysis of student data improved student performance specifically related to content standards (e.g., Dalton, 2009; Ferguson, 2009; Filbin, 2008; Gates, 2008; Hoover, 2009; Palucci, 2010; Soslau, 2009; Williamson, 2012; Yao, 2009). Department chairs also emphasized improving student achievement by identifying and closing the "content knowledge" gaps through looking at student data (Rayor, 2010). Based on that, corresponding courses were arranged to fill in all the gaps. Similarly, special education teachers also reported using assessment data to help improve student achievement. Based on the analysis of state standardized test scores, they created lessons that were more remedial, aligned with students' Individualized Education Plans (IEPs), and supplementary lessons to support and assist them in the classes of the general education teachers. All these efforts contributed to the improvement of student learning.

Though a few studies reported no significant link between teachers' data use

[1] Focused Instruction in the Leithwood & Louis study means instruction that combines elements of teacher-directed and constructivist approaches.

[2] Issues addressed in the notion of knowledge use were change in practice, new understandings to make change occur, commitment to school, and sources of knowledge (Leithwood, 1994 in Stasny 1996).

[3] Improved instruction measures the compatibility of teachers' instructional practices with school improvement plans, their classroom instructional practices, teaching strategies, instruction planning, students' assessment, and improved curriculum (Johnson, 2007; Nader, 1997).

and improved student learning (e.g., Prichett, 2008; Gates, 2008; Hoover, 2009), increased use of formative and/or summative assessment data has led to increased student achievement in various subjects (e.g., Dalton, 2009; Ferguson, 2009; Filbin, 2008; Gates, 2008; Hoover, 2009; Palucci, 2010; Soslau, 2009; Williamson, 2012; Yao, 2009). In addition, about half of the studies reported positive impacts of teachers' use of data as shown in the following areas.

Data-Informed Instruction Sharing (DIIS)

A common, yet powerful, use of assessment data by teachers is working collaboratively in various teams or groups or using a PLC model or monthly meetings (e.g., Farley-Ripple & Buttram, 2013; Jimerson, 2013; Raynolds, 2008; Timperley, 2009; Wayman, 2005). A very typical process that teachers reported valuable included looking at both summative state-standardized test scores or benchmark tests and formative and summative classroom assessments collectively. Teachers also found value in reviewing student work, evaluating present levels of performance in the course, setting aside time for reflection and discussion, developing common assessment tools, identifying students who did not get concepts, developing interventions, writing goals to support the overall goals of the school, and developing strategies collaboratively (Brunner et al., 2009; Cosner, 2011; Datnow et al., 2013; Datnow, Park & Wohlstetter, 2007). Discussions in these various forums also provided opportunities for teachers to share strategies and ideas they were finding successful within their classrooms, best practices supported by formative assessment data, and what worked for others (e.g., Fischer, 2011; Henry, 2011). They felt the opportunity to work with their colleagues in this manner and discuss specific teaching strategies was an integral part of the process leading to increased academic scores (e.g., Fischer, 2011).

Based on these highlights obtained from our review of 48 studies, we found the collaborative process in which teachers shared knowledge and concerns associated with data, developed collaboratively common assessments and solutions, and shared effective instructional strategies was valuable. We used ***Data-Informed Instruction Sharing (DIIS)*** to capture the above-mentioned key elements related to instructional knowledge sharing, creation and experimentation based on student data as well as the key components conceptualized in such constructs as effective working environment, school conditions, organizational learning, effective schools, shared decision-making and professional learning communities (PLCs). We peeled off ineffective elements conceptualized in these constructs, such as the items that denote PLCs as a "container" of a group of teachers, and kept the "meat," such as experimentation to create new knowledge, social construction of new knowledge through dialogue and collaboration, which in turn results in positive changes in instruction and enhances student learning directly. We conceptualize DIIS as including the following components: changes in instructional practices, instructional knowledge and experience sharing, collaboration, reflection, being open, using student data to inform the discussion in PLCs, and shared decision-making.

Collective Teacher Efficacy in Data Use (CTEDU)

In the majority of the studies we reviewed, teachers expressed a concern about or lack of confidence in using data in their instruction (e.g., Barry, 2006). In effective schools, teachers' efficacy in using data to help students was reported being high. For example, teachers were reported to examine individual student's reports to see where each student was, which students were having problems, and then addressed those particular problems in their work (e.g., Rayor, 2010). Once the data was gathered teachers sat down and broke it down with their students. Thus teachers tended to see how they were able to improve their own practice, and relayed the information to students. Teachers believed that they really could move every student forward if they planned carefully in this way (e.g., Rayor, 2010; Fischer, 2011).Collective Teacher Efficacy (CTE) represents the level of confidence a group exudes in its capacity to organize and execute the tasks required to reach desired goals (Bandura, 1993; Goddard et al., 2004). Correlations between measures of CTE and student learning range from .38 to .99, with an average r being .69 were found (e.g., Barr, 2002; Garcia, 2004; Hoy et al, 2002; Tschannen-Moran & Barr, 2004). Thus, we convert the construct of ***CTE*** into ***Collective Teacher Efficacy in Data Use (CTEDU)*** with the inclusion of data use in the concept.

Shared, Aligned Learning and Teaching Goals developed based on data (SALTG)

Our review of literature suggested that teachers used data to set specific goals for students and sub-goals that led towards school goals. Once these goals were set, the teachers and principal worked collaboratively to devise a system whereby students' academic achievement levels would be assessed in an organized, structured manner (e.g., Fischer, 2011). Teachers looked at data to help them internalize departmental goals. For example, teachers expressed a desire to work collaboratively in their departments to systematically design and scaffold support for departmental goals in math and science (Rayor, 2010).

The goal setting, sharing, alignment, and reinforcement achieved through multiple, on-going data-informed decision making processes helped improve student achievements. For example, the common goals related to college, college preparedness, and completion of a college degree that the principals, teachers, and students set based on data led towards the success of a charter school. They raised the school's API score by 36 points over the previous 3 years (Rayor, 2011). It started with the student participants' goal of being accepted at a 4-year college, followed by the teacher participants' enhancement of the goal of being prepared for the rigors of college, and then it culminated with the administrator participants' fruition of the goal that would result in a student earning a degree from college (Rayor, 2011). Teachers made preparing students to become active problem solvers that could adapt to college level math and college level challenges their biggest goal, thus dividing it into a lot of little goals that could be achieved progressively and coordinately.

The importance of using goals to drive school improvement and enhance student learning is not new. Academic press has been found to be positively related to achievement for all types of students including poor and minority students (Goddard et al, 2000; Hoy, Tarter, & Hoy, 2006), with its effect

stronger in low-SES high schools (Shouse, 1996). However, our review of recent research on data-informed decision-making by school administrators and teachers reveals that a focus on a shared vision of academic excellence is not enough, this "focus" needs to be operationalized into tiered and aligned teaching, learning, professional goals, school, and district goals. It is goal-setting, sharing, alignment, and reinforcement achieved through multiple, on-going data-informed decision making processes that really helped improve student achievements. Further, one distinctive feature that has not been captured by such notions as academic press is data use. Thus, capturing the feature of goal alignment based on teachers' collaborative and individual efforts on analyzing student data, we define *SALTG* as the degree of consensus among school staff on school mission, vision, and goals developed based on data, to which school administrators and teachers refer for academic guidance or direction. In turn, these inform school instructional activities and teacher practices, and both administrators and teachers are committed to that direction, therefore principals align resource support. At the service of the superordinate school goal (vision), specific students' performance goals, teachers' teaching goals, and student learning goals should be aligned with each other.

Using data to inform the development of a safe and orderly environment (SOE)

Less frequently reported in the studies, but a notable theme, is that one type of data teachers look at are student attendance and behavioral records. Sometimes, teachers combined such data with student academic data to identify students' behavioral or social problems,_pinpoint the academic needs of students, and identify the association between their learning needs as well as their behavioral and social issues. By analyzing academic data, school personnel were able to identify the academic needs of the child and focus on learning, easing behavioral and social issues. Further investigation of data, possibly from home visits and parent interviews, other social and behavioral problems could be determined and mitigated. It is important to note that many times behavioral problems went hand in hand with a student's academic struggle (Simpson, 2011).

The emphasis of orderly and safe aspect of school culture is not new. The construct of school disciplinary climate, the typical construct developed in this regard, includes students' discipline concerns, class disruptions, student absenteeism and tardiness, students' counseling about discipline, students' discipline experience, the rules for behavior, race or cultural conflicts at the school, students' behaviors, the punishments for misbehaviors at the school, teachers' behavior, and teacher-student relations (Willms & Ma, 2004). Although this conceptualization was a move away from traditional views of discipline rooted in the classroom alone, recent Capitol Hill Briefing by a group of experts (e.g., Astor, Guerra, & Acker, 2010; Borum, Cornell, Modzeleski, & Jimerson, 2010; Cornell & Mayer, 2010; Mayer & Furlong, 2010; Swearer, Espelage, Vaillancourt, & Hymel, 2010) developed a more holistic understanding and new strategies based on research evidence for promoting school safety and preventing youth violence in schools. New elements include a three-tiered approach, the need to coordinate school and community services, efficiently providing mental health services for those students who need it, threat assessment rather than violence survey, emphasis on prevention vs. suspension prevention and on

safe schools vs. school violence, and increasing the use of restorative justice practices in progressive discipline vs. retributive practices. Thus we use *Using data to inform the development of a safe and orderly environment (SOE)* to capture both orderly features of disciplinary climate and using data to informed the development of such disciplinary climate.

The community-based, more holistic ecological approach to safe and orderly schools is relatively new. Empirical research on this is scarce. However, limited evidence shows a "strong correlation" between school climate with safety as one key feature and academic achievement, even after controlling for school demographic factors like ethnicity, parental income, and parents' level of education (e.g., Hanson, Austin & Zheng, 2011). Disciplinary Climate was found to have a significant correlational relationship with student learning, r = .33 (Leithwood et al., 2010). Its effects were over and above the effects of student variables including student SES, as reported in a few large scale studies both in US and Canada (Ma & Crocker; Ma & Klinger, 2000; Willms & Ma, 2004).

Method

In order to measure the status of a DWC, we first developed instruments to measure the each of the five aspects of a DWC and then administered the survey instruments to measure the extent to which a DWC existed in 8 middle schools in a district. The measures of all five elements of the DWC were developed based on the constructs we conceptualized and described in the previous sections. In instances where there are existing instruments that we can adapt, we first selected the ones that have good reported reliabilities and then adapted and converted the items with data use as the focus. All existing instruments from which we adapted some items are the ones we selected through the review of the scales for their high reliabilities, construct validities and predictive validities as reported in previous empirical studies. The following texts brief how we developed the instruments.

Measures

Precise Instruction Using Data (PIUD) were measured by the teacher survey items developed from the items included in the construct we conceptualized. The survey items are developed based on the following effective practices in teachers' use data we identified through our review:

- analyzing data in groups periodically and providing differentiated instruction;
- looking at individual students' reports to see where each student is and addressing those problems in teaching;
- talking to the teachers from the previous year and the next year about students' needs;
- looking at a lot of data and changes over a period of time; and
- analyzing academic data to pinpoint the academic needs of each child and ease students' behavioral and social issues.

Data-Informed Instruction Sharing (DIIS) were measured by survey items we created and adapted from PLC instruments. In order to develop survey items to measure we searched research for relevant instruments. We found Bolam et al.'s (2005) effective professional learning community (PLC) instrument is the closest one from which we can borrow insights. The survey items measured nine dimensions of the construct: changes in instructional practices,

instructional knowledge and experience sharing and knowledge creation, collaboration, reflection, being open, using student data to inform the discussion in PLCs, common assessment and monitoring of student academic progress, shared decision-making on instructional strategies and intervention, and collective professional learning. Thus, based on our conceptualization of DIIC and Bolam's PLC instrument, we developed 16 survey items to measure DIIC. For example, a typical item for mentoring collaboration is "Teachers collaborate with their colleagues for their teaching, working as a team in developing common assessment to evaluate their teaching and to promote students' learning".

Collective Teacher Efficacy in Data Use (CTEDU) were measured by the survey items developed based on Goddard et al.'s (2002) 12 item Short Collective Efficacy Scale with a focus on data use and survey items to be further developed based on our interview data. The model acknowledges that expectations for attainment depend both on perceived competence to perform a given task and the context in which the task will take place. We chose this scale because of its high reliability (Cronbach α=.94) and high predictive validity, compared with other CTE instruments. We chose the short form of the scale because the scale is more theoretically pure, parsimonious, more balanced across 12 items rather than unbalanced across 21; the salient factor structure coefficients were higher compared with their earlier 21-item version. We converted the items with data use as the focus. For example, the original item "Teachers here are confident they will be able to motivate their students" was converted to "Teachers here are confident they will be able to motivate their students by sharing with them their academic progress data".

Shared, Aligned Learning and Teaching Goals developed based on data (SALTG) were measured by the survey items developed based on the synthesis of three Academic Press instruments (i.e.., Goddard et al2000, Cronbach α=.92; Shouse, 1996, Cronbach α=.73; Phillips 1997, Cronbach α=.83-.95) with a focus on data use and our conceptualization of this construct. We chose these instruments because of their high reliabilities (Cronbach α=.94) and high predictive validities. For example, a typical item is "Students respect others who get good grades".

Using data to inform the development of a safe and orderly environment (SOE) were measured by the survey items developed based on our conceptualization of this construct and the synthesis of the four major school disciplinary climate instruments (Lee & Bryk, 1989; Ma & Crocker, 2007; Ma & Klinger, 2000, Cronbach α= .77; Raudenbush et al 1998; and Willms & Ma, 2004, Cronbach α= .455-.713). We used *SOE* to capture both orderly features of disciplinary climate and those new elements uncovered in our review and developed 14 survey items to measure this construct. A typical item is "This school emphasizes preventing youth violence in schools vs. suspension".

Evidence

We developed the DCW Survey (DCWS) including the abovementioned survey items to examine this phenomenon based on our conceptualization of this construct. The survey was administrated on-line to all teachers for voluntary response in a central Alabama district from 8 middle schools (200 teachers) in June 2014. The response rate was 87 %. Teachers were asked to rate their opinions on a six-point Likert Scale, ranging from "Strongly Disagree", "Agree",

"Somewhat Agree" to "Somewhat Agree", "Agree" and "Strongly Agree". Among these 8 middle schools, five of them were underserved schools (majority of the students are on reduced or free lunch) with the remaining three having about 40 % of students on reduced or free lunch. 173 teachers responded to the survey, with a response rate of 80.0% (173/216). Among the 173 responses, 157 were complete data. The valid response rate was 78.5% (157/200). Reliability analysis and principal component analysis were conducted using SPSS 20 based on these 157 cases. All survey items can be found in Tables 2-4 reporting factor loadings. Reliability analysis and principal component analysis were conducted using SPSS 20 to test the reliability and construct validity of the constructs involved in the DWC model.

Results

Q1: To what extent a data wise culture exists in the schools in this district?

As Table 1 indicated, a DWC did exist in all the eight schools. The means for all five aspects of the DWC are above 3, with teachers doing better in using data to inform instruction and develop aligned teaching and learning goals than in using data to develop a SOE in schools. Teachers' collective efficacy in using data to improve student learning overall was not high (Mean = 3.62). This empirical evidence is consistent with what is reflected from literature. As reported in 48 studies, a school culture in which both school leaders and teachers analyzed student data to inform leading and teaching was initiated in many schools over the last ten years. This is an emerging feature of culture existing in most schools.

Strengths in the DWC in schools include:

- Teachers were doing very well in identifying weaknesses in relation of instruction to standards and curriculum, adjust and monitor effectiveness of their instructional strategies by looking at formative assessment results (PIUD).
- Teachers focus on students' needs, provide specific feedback and tailored assistance to each of their students, and identify and close the "content knowledge" gaps through looking at student data (PIUD)
- Teachers analyze academic data to pinpoint the academic needs of each student and ease students' behavioral and social issues (SOE) (See Table 2).
- The schools emphasize preventing youth violence in schools vs. suspension (SOE)
- Teachers send parents progress reports periodically throughout the year informing them of the continuous progress of their children (SOE)
- Teachers periodically look at internal grade-level, class-level and even student-level data (SALTG)
- The schools set high standards for performance (SALTG)
- Academic achievement is recognized and acknowledged by the school (SALTG)

Areas that can be further improved in the aspect of SOE included:

- Talking to the teachers from the previous year and the next year about students' needs and prepare students for their skills accordingly
- Looking at a lot of data and changes over a period of time, which informs teaching
- Increasing the use of restorative justice practices in progressive

discipline vs. retributive practices to reduce violence
- Increasing the use of threat assessment rather than violence survey to assess school safe conditions
- Efficiently providing mental health services for those students who need it
- Providing support, time and structure for teachers to collaboratively develop common assessment tools for measuring students' progress and evaluate students' work and identify strategies to help them accordingly

In particular the following aspects of SOE need to be substantially improved:

- Students at this school are absent deliberately or/and habitually and don't start working for a long time after lessons begin
- There are physical conflicts among students at this school
- Safety issues in the community make learning difficult for students here
- Students in this school cannot be counted on to do their work

As well, TCEUD in the schools is low (M = 3.6) (See Table 3). The following elements of teachers' collective efficacy in using data needs to be substantially improved:

1. Teachers in this school do not have the skills to deal with student disciplinary problems
2. Learning is more difficult at this school because students are worried about their safety
3. If a child doesn't want to learn, teachers here give up
4. The opportunities in this community help ensure that these students will learn.

Q2: Can DWC be measured?

The reliabilities of these measures are very good with Cronbach alphas ranging from .70-.94 (see Table 1). The Cronbach's Alpha of the measure for DIIS was .96indicating a highly reliable measure. Principal component analysis resulted in the items loading towards two factors: teachers' collaborative efforts on data-informed instruction and teachers' own instructional efforts based on student data (see Table 4). The Cronbach's alpha of our measure for SALTG was .88. Principal component analysis resulted in nine survey items loading towards one factor: Teachers' goal development based on data and goal internalization (See Table 5 for details).

The Cronbach's Alpha of our measure for SOE was .80, indicating a fairly reliable measure (Table 1). Principal component analysis resulted in nine SOE items largely loading towards two factors: school data-based preventions and teacher data-based efforts (Table 6).

The Cronbach's alpha of our measure for TCEDU was a bit low compared with the other elements (.68). Principal component analysis resulted in 12 survey items loading towards three factors: Teachers' collective efficacy in using data to inform their teaching, reversed items, and their belief about students' parents (See Table 7 for details). Eigen values for these two factors are larger than 1. This result indicates that teachers' belief about themselves and parents may be two different things, hence the deletion of the two items about their beliefs in parents. Also, reversed items should be revised to reduce variances.

The Cronbach's alpha of our measure for PIDU was high (.95). Principal component analysis resulted in 12 survey items loading

towards one fact (see Table 8 for details). This result indicates that teachers' using data to inform their instruction and provide precise instruction could be a unique variable, which could be a new variable closely related to student learning and which could be measured.

Conclusion

Our review of literature and empirical investigation revealed that most teachers were in the process of using data to inform their instruction and assist in developing a safe and orderly school environment. School leaders need to make efforts to enhance teachers' collective efficacy. Establishing safe and inclusive schools should continue being the focus for improvement of the district efforts. This study developed five factors to capture and reflect this data-culture. This DWC has begun to take shape in these eight schools and can be measured. Results indicated that the major existing cultural variables that are significantly related to student learning should be revised to capture the new feature of data use in schools. The DWC framework this study developed can be used to inform the development of such cultural variables. These cultural variables that incorporate the elements of data use in schools should be distinct new cultural aspects, which can be measured. Such variables can be used to evaluate how effective school staff are in terms of using data to improve school leaders influence school conditions that foster data use in schools.

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Table 1

The descriptive statistics for the five aspects of the DWC

	Minimum	Maximum	Mean	Std. Deviation	**No. of Items**	**Cronbach's Alpha**
PIUD	.00	6.00	4.4643	.91834	16	.95
SALTG	2.86	5.36	4.3921	.66231	14	.88
DIIS	.47	6.00	4.3156	.90342	16	.96
SOE	1.00	6.00	3.7407	.70808	14	.80
TCEUD	.00	5.00	3.6182	.87542	12	.68

Table 2

The descriptive statistics for SOIE

	N	Minimum	Maximum	Mean	Std.Deviation
SOIE_4	3	5	6	5.33	.577
SOIE_8	4	5	5	5.00	.000
SOIE_7	4	5	5	5.00	.000
SOIE_3	4	3	5	4.50	1.000
SOIE_11	1	4	4	4.00	.868
SOIE_13	4	2	4	2.75	.957
SOIE_10	3	2	4	2.67	1.155
SOIE_14	4	1	5	2.50	1.732
SOIE_6	4	1	4	2.00	1.414
SOIE_12	4	1	2	1.50	.577
SOIE_5	4	1	2	1.50	.577

Table 3

The descriptive statistics for Teachers' Collective Efficacy in Using Data

	N	Minimum	Maximum	Mean	Std.Deviation
TCEUD2	44	1	6	4.66	1.055
TCEUD12	44	1	6	4.61	1.061
TCEUD1	44	2	6	4.55	1.170
TCEUD3	44	1	6	4.30	1.268
TECUD8	44	1	6	3.64	1.331
TCEUD7	44	1	5	3.55	1.170
TCEUD6	43	1	6	3.47	1.737
TCEUD4	44	1	6	3.45	1.771
TCEUD11	44	1	6	3.32	1.325
TCEUD5	44	1	6	3.27	1.633
TCEUD10	45	0	6	2.87	1.938
TCEUD9	45	0	5	2.58	1.559

Table 4

Factor loadings and communalities of the DIIS Items Based on a Principal Components Analysis

	DIIS Items	Communality	Factor 1	Factor 2
DIIS_16	Teachers in this school collaboratively evaluate students' work and identify strategies to help them accordingly	.802	.971	
DIIS_10	Special education teachers in my school create lessons that are aligned with standards	.807	.855	
DIIS_9	Special education teachers in my school create lessons that are more remedial, aligned with students' Individualized Education Plans (IEPs).	.782	.838	
DIIS_11	Special education teachers in my school provide supplementary lessons or supports or whatever worked to help students in need in the classes of the general teachers.	.741	.834	
DIIS_15	Teachers in this school collaboratively develop common assessment tools for measuring students' progress	.735	.834	
DIIS_14	In this school we often challenge one another's beliefs about education	.591	.780	
DIIS_13	Teachers in this school frequently share instructional practices that work	.684	.753	
DIIS_7	I focus on each student's needs in my teaching	.774	.543	
DIIS_1	I know what students already know and what they don't know and instruct accordingly	.538	-.246	.855
DIIS_2	I look at all the data about each student and use that to guide my teaching of the student for a whole academic year	.730	.129	.770
DIIS_6	I know exactly what my students need to move forward	.735	.234	.696
DIIS_3	I identify and close the "content knowledge" gaps through looking at student data	.829	.310	.689
DIIS_5	I know the learning style of each student and teach them accordingly	.686	.276	.632
DIIS_8	I provide tailored assistance to each of my students	.825	.431	.581
DIIS_4	I know how each student is doing in various subjects	.666	.378	.530
DIIS_12	I provide specific feedback to each student	.685	.401	.522

Table 5

Factor loadings and communalities of the SALTG Items Based on a Principal Component Analysis

	SALTG Items	Communality	Factor 1
SALTG_4	Teachers in this school collaboratively identify short-term goals or sub-goals that are consistent with or work towards the long-term goals	.802	.882
SALTG_5	Our school goals and priorities are clear	.827	.868
SALTG_8	Teachers in this school collaboratively devise a system whereby students' academic achievement levels are assessed in an organized, structured manner towards the school goals	.764	.865
SALTG_2	In this school priorities are set based on looking at students' mastery of basic skills against standards	.789	.857
SALTG_6	Teachers in this school develop teaching and learning goals in alignment with the overall school goals	.723	.834
SALTG_1	In this school, long-term goals for the school are set based on the analysis of the external accountability measures of student achievement	.734	.816
SALTG_3	Teachers in this school periodically looked at internal grade-level, class-level and even student-level data	.666	.801
SALTG_10	The school sets high standards for performance based on student performance data.	.702	.554
SALTG_7	I plan lessons and determine pacing calendar based on my analysis of student data	.440	.507

Table 6

Factor loadings and communalities of the SOE Items Based on a Principal Component Analysis

	SOE Items	Communality	Factor 1	Factor 2
SOE_8	This school emphasizes preventing youth violence in schools vs. suspension based on	.738	.843	
SOE_11	Our school increases the use of restorative justice practices in progressive discipline vs. retributive practices to reduce violence	.768	.804	
SOE_1	The learning environment in this school is orderly	.717	.779	
SOE_2	The learning environment in this school is safe	.750	.687	
SOE_10	Our school efficiently provides mental health services for those students who need it	.634	.680	
SOE_9	Our school uses threat assessment rather than violence survey to assess school safe conditions	.489	.638	
SOE_7	School leaders, teachers, parents and communities work collaboratively to promote school safety	.694		.747
SOE_4	I analyze academic data to pinpoint the academic needs of each student and ease students' behavioral and social issues.	.799		.722
SOE_3	Teachers in this school look at student demographic data and make efforts to promote an inclusive school	.651		.718

Table 7

Factor loadings and communalities of the TECUD Items Based on a Principal Component Analysis

	TECUD Items	Communality	Factor 1	Factor 2	Factor 3
TCEDU1	Teachers in this school are confident that they will be able to motivate their students by sharing with students their progress data	.742	.628		
TCEDU2	Teachers in this school really believe every child can learn	.903	.758		
TCEDU3	Teachers in this school are able to get through to difficult students by identifying the strengths and weaknesses of each student and responding accordingly	.804	.668		
TCEDU7	Teachers believe students come to school ready to learn	.507	.520		
TCEDU12	Teachers communicate with parents about students' progress periodically	.858	.726		
TCEDU4	Teachers here don't have the skills needed to produce meaningful student learning.	.741		.576	
TCEDU5	If a child doesn't want to learn teachers here give up (reverse)	.819		.720	
TCEDU6	Teachers in this school do not have the skills to using student data to deal with student disciplinary problems	.806		.626	
TCEDU10	Learning is more difficult at this school because students are worried about their safety (reverse)	.587		.549	
TCEDU11	Students here just aren't motivated to learn (revere)	.378		.400	
TEC8	The opportunities in this community help ensure that these students will learn	.763			.686
TCEDU9	Home life provides so many advantages the students here are bound to learn.	.700			.694

Table 8

Factor loadings and communalities of the TECUD Items Based on a Principal Component Analysis

	SOE Items	Communality	Factor 1
PIDU_1	I analyze data with my colleagues periodically	.579	.761
PIDU_2	I analyze my students' achievement results and provide differentiated instruction	.739	.859
PIDU_3	I conduct formative assessment on my students on a daily basis and use the assessment results to inform my own teaching	.557	.746
PIDU_4	I identify weaknesses in my students' academic skills based on their progress data and develop interventions to remediate or reteach	.759	.871
PIDU_5	I identify weaknesses in relation of instruction to standards and curriculum	.784	.885
PIDU_6	I identify data-supported/best teaching practices	.776	.881
PIDU_7	I adjust and monitor effectiveness of my instructional strategies by looking at formative assessment results	.771	.878
PIDU_8	I help colleagues determine what professional areas are needed based on the analysis of student data	.652	.808
PIDU_9	I look at individual students' reports to see where each student is and address those problems in teaching	.749	.865
PIDU_10	I talk to the teachers from the previous year and the next year about students' needs and prepare students for their skills accordingly	.467	.683
PIDU_11	I look at a lot of data and changes over a period of time, which inform my teaching	.698	.836
PIDU_12	I pinpoint the academic needs of students and identify the association between their learning needs and behavioural and social issues	.700	.837