Academic Leadership: The Online Journal

Volume 7
Issue 1 *Winter 2009*

Article 11

1-1-2009

Data-Driven Decision Making: The Development and Validation of an Instrument to Measure Principals' Practices

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Academic Leadership Journal

Introduction

“In God we trust; all others must bring data” (Deming, 1986) captures the essence of the No Child Left Behind (NCLB) Act (2001), which opened a new era of educational accountability and school improvement in the USA. Schools are held accountable to meet the Adequate Yearly Progress (AYP), which requires educators to closely monitor student performance on the high-stakes assessments. NCLB significantly increases the pressure on states, districts, and schools to collect, analyze, and report data. School leaders need to make evidence-based decisions and promote scientifically based research for school improvement. Accountability demands are now forcing school leaders to explore much more the granular data and to do more sophisticated analyses. Nationwide standards-based control and outcome-based funding have brought data-driven decision making (DDDM) to the top of every principal’s agenda (Leithwood, Aitken, & Jantzi, 2001; Thornton & Perreault, 2002).

From the perspective of preparing school administrators, principals need to learn to use and believe in factual data when they make their administrative decisions. In alignment with the NCLB, the revised Standards for Advanced Programs in Educational Leadership have more emphases placed on school administrators’ ability and knowledge in using data (Educational Leadership Constituent Council (ELCC), 2002; National Council for the Accreditation of Teacher Education (NCATE), 2002). The ELCC/NCATE (2002) standards serve as school leadership preparation program standards and can be used as a cornerstone for the professional development of existing school administrators (Murphy & Shipman, 1998; Murphy, Yff, & Shipman, 2000). DDDM is integral to the key school administrators’ skills in the six leadership standards of school vision, school instruction, school organization, collaborative partnerships, moral perspective, and larger-context politics.

As DDDM is increasingly embraced by various groups of school administrators and teachers, there is a strong need for empirical studies and measurement of the emerging leadership phenomena of DDDM. Several instruments were purported to measure principals’ decision making. For example, Davis and Davis (2003) conducted a study using the AIM (Agor Intuitive Management) survey to examine how school principals in California use and experience intuitive decision making processes when solving administrative problems. Leithwood and Aiken (1995) developed an instrument for the various types of school information collected for decision making. Reeves (2002) presented a list of data review questions for school leaders. Yet there is a lack of empirical studies on the issue DDDM, especially the quantitative research from the principal’s perspective. No single instrument reported in the literature has provided measure of the important leadership practices.

The primary goal of this research was to develop and validate an instrument that would provide information to foster a better understanding of principals’ use of data in their leadership practices. In addition, this study examined the extent of principals DDDM practices and investigated the frequency differences in data use among leadership dimensions. The ELCC (2002) standards were used as the framework for this study, through which high school principals’ DDDM practices were examined in

different leadership dimensions.

DDDM and its Theoretical Frameworks

Decision making is the process of identifying problems, generating potential alternative solutions, assessing the probabilities that a given alternative will result in a given outcome and developing a preference ordering among outcomes (O'Reilly, 1983; Simon, 1960). DDDM in this study is defined as the purposeful process of selecting, gathering and analyzing relevant data to define school problems, develop alternatives, estimate outcomes of the alternatives, and choose the preferred alternative (O'Reilly, 1983; Streifer, 2002). Data are "a set of discrete, objective facts about events", which is the essential raw material for the creation of information (Davenport & Prusak, 1998, p. 2). Data in this study were confined to (1) student test scores; (2) demographics including attendance and graduation rates; (3) teachers', students', administrators', and parents' perceptions of the learning environment; and (4) data of school programs and instructional strategies.

DDDM has been practiced for literally decades in most business and industry. DDDM originated from business management models contributes to the foundational activity that underlies NCLB (2001). The business management approaches embracing data use for organizational decision making include total quality management (TQM) (Deming, 1986) and knowledge management (KM) (Davenport & Prusak, 1998). These two approaches have been influencing the school leadership and stimulating changes in the practices of school leaders' decision makings.

The fundamental values of TQM (Deming, 1986) are to improve quality, serve the customer, satisfy customer requirements, encourage employee innovation, provide for the free flow of information, instill pride and teamwork, and create an atmosphere of innovation and continuous improvement. TQM's management philosophy has been applied to educational leadership such as commitment to aims and purpose, a shared common vision, accountability and testing designed to improve education quality, and continuous improvement of schools.

Using data in decision making is one of the important strategies in TQM. Deming (1986; 1991) provided a number of statistical models or tools related to the notion of DDDM for quality improvement. Examples are cause and effect analysis, customer needs analysis, customer data gathering, force field analysis, interviewing, benchmarking, and target and goals. Sagor and Barnett (1994) suggested that the TQM leadership in schools develops the cultural norms such as specifically focusing on students, holding high expectations, using data for decision making, and valuing collaborative work.

KM is a concept used to describe the management of information-based knowledge assets within an organisation (Davenport & Prusak, 1998). It is considered key to achieving breakthrough competitive advantage and is currently receiving a lot of attention from business. Definitions of knowledge management are various. One of the widely used is that KM is a discipline that encourages a mutually supported method to create, capture, organize, and use information (Blair, 1999, as cited in Petrides & Guiney, 2002). KM is a process of people's transformation of data, information and intellectual assets into enduring value (Duffy, 2000). Data become information when its creator adds meaning and values by contextualizing, categorizing, calculating, correcting, and condensing the data. Information transforms into knowledge with humans' comparison, consequences, connections, and conversation. In these ecological processes, primary importance is placed on the humans' strategic use of data and information (Davenport & Prusak, 1998). In the field of education, the knowledge ecological framework

can enable schools to examine the plethora of data collected and transform these data into information and knowledge (Petrides & Guiney, 2002).

Literature on Principals' DDDM Practices

The need for school administrators to engage in DDDM has recently received much focus (Leithwood et al., 2001). Case studies and interviews demonstrated that DDDM is well practiced by principals. Wallace (1985) presented three examples of data analyses successfully used by school leaders for educational improvement by focusing on data-driven educational planning and implementation. Armstrong's and Anthes' (2001) studies reported positive results of secondary principals' practices of DDDM. Principals lead and support the use of data within the school. Principals in some districts spend time reviewing data with teachers, observing lessons and making decisions on intervention strategies. They are beginning to use classroom student achievement data to mentor teachers and create individual professional development plans.

Mathews' dissertation study (2002) addressed the issues of the principals' response to data of high-stakes tests and their assessment of data-based decisions by interviewing six Virginian middle school principals. Findings indicated that principals responded to the call to use data as a guide for decision making by devising systematic processes and implementing changes based on data. They used data as a basis for decision making and do not rely on their own expertise alone in making decisions. They also incorporated collaboration with other professionals for data use in the decision making process. A majority of the principals interviewed believe that data have a stronger influence on the way they make decisions for their schools. LaFee (2002) insisted that DDDM is rapidly spread, but is progressing slowly in schools. There is increased interest and efforts by schools in DDDM. The benefits and values of DDDM are commonly recognized by school leaders. DDDM is the buzz phrase of choice for educators including principals for the new decade (Salpeter, 2004).

Compared to the limited number of studies indicating the good practices of DDDM, more research informs us that DDDM practices are not satisfactory and even missing from many schools. School decisions often depart substantially from the rational ideal. Data are not frequently used systematically or are not used well at the school level (Bernhardt, 1998). Many school leaders struggle to incorporate DDDM into their schools (McLeod & Creighton, 2001). Although DDDM has many vocal proponents, it is equally clear that the message has not yet gotten to the front lines of principals (Doyle, 2003).

Davis and Davis (2003) indicated that the majority of principals frequently use intuition to guide them through their most important decisions. Intuition or gut feelings play a primary role in principals' decision making. Many school leaders make decisions "by using intuition and shooting from the hip, rather than considering data collection and data analysis" (Creighton, 2001, p. 52). Traditionally, data have not been the important factors in the ways schools make decisions. The intuition of principals' advocacy by parents and political interests often has guided decision making (American Association of School Administration, 2002).

Based on the four years of experiences of supporting the implementation of standards-based accountability in a set of districts and schools, Jamentz (2001) concluded that principals seldom uncovered silver bullets in their data reports. The schools are characterized with ongoing, messy, and ambiguous processes of framing questions, examining and weighing evidence, taking actions and discovering new questions. Similar results are shown in Reeves' (2002) analysis of school examples.

He concluded that an astonishing number of principals make critical decisions about curriculum, instruction, assessment, and placement on the basis of information that is inadequate, misunderstood, misrepresented, or simply absent. A limited number of principals use data to influence their decisions although school systems have devoted enormous resources to developing data. School principals commonly underutilize available data (Noyce, Perda, & Traver, 2000).

Method

It was the focus of this study that an instrument was developed for validly and effectively measuring critical aspects related to the use of data in principals' leadership practices. The instrument development process involved the organization of relevant leadership, item constructions of practitioners, experts' validation, pilot testing, field testing, and the validation of instrument data using factor analysis and internal consistency reliability methods. Differences of data use among leadership dimensions were also examined.

Initial Item Development

A group of 15 secondary school administrators with an average of 14 years of experience in education who were taking the courses of a doctoral program in educational administration at a Midwest University were asked to help in developing items for the P3DMI. The following steps were adopted in instructing the school administrators for the development of P3DMI items. First, the topic of principal DDDM was introduced to the school administrators. They were also presented the research proposal and the contexts of the P3DMI including identifying the instrument's specific purposes and clarifying the relevant terms (Fink, 2003). Second, O'Reilly's (1983) "simplified model of decision making process" that guided item development for P3DMI was made known to the school administrators. According to O'Reilly, decision making is the process of identifying problems, generating potential alternative solutions to these problems, assessing the probabilities that a given alternative will result in a given outcome and developing a preference among the outcomes. The school administrators were instructed to understand that items to be developed should reflect the process of decision making.

Third, the ELCC (2002) leadership program standards were presented to the school administrators, who were made clear that the items of P3DMI to be developed should be derived from standards. These standards were used as the content criteria for developing items of principals' DDDM practices in school vision, school instruction, school organization, collaborative partnerships, moral perspective, and larger-context politics so that the items provided a representative sampling of the DDDM skills deemed necessary for principals as argued by the ELCC. Finally, the school administrators were provided with sample DDDM items for each of the ELCC leadership program standards.

The group of school administrators was divided into six panels. Each panel was assigned to develop items for P3DMI related to one of the following six leadership standards: school vision, school instruction, school organization, collaborative partnerships, moral perspective, and larger-context politics. Each panel was provided with the sample items and the relevant ELCC (2002) standard. A total of 42 items were generated that covered the ELCC standards. The items initially developed were revised by the researcher based on ELCC (2002) standards and the literature of DDDM (e.g., Bernhardt, 1998; Glasman, 1994; O'Reilly, 1983; Streifer, 2002; Thornton & Perreault, 2002). Among the 42 survey questions that had been developed, 32 were adopted. The other items were eliminated because of their lack of importance or use of unconventional language (Fink, 2003; Fowler, Jr., 1995).

The wording of the adopted 32 questions was refined. Referring to the following two instruments: School Information Collection and Decision making (Leithwood & Aitken, 1995) and Data Review Questions (Reeves, 2002), 20 more items were developed by the researcher in accordance with the indicators of each of the six ELCC standards. Therefore, a total of 52 items of the P3DMI were initially developed.

Validation of the P3DMI

Content validity. Measurement of content validity of this study is important because research conclusions based on the structural analysis assume that the measurement is accurately measuring principal's DDDM practices. The 52 items were then validated with the content validity assessment. Four professors teaching data analysis for school leadership, two field experts on school data analysis, and five high school principals were asked to review each of the total 52 items that intended to measure data use in the six leadership standards (school vision, school instruction, school organization, collaborative partnerships, moral perspective, and larger-context politics). Prior to doing this, all these individuals were informed of the survey contexts and reviewed the definitions of "data" and "DDDM", and the detailed DDDM indicators in all the six ELCC (2002) leadership standards.

The responses drawn from each item were used to target how appropriate, relevant and representative each of the panel members believe the items are by coding each of the items with the following choices: 1 = not appropriate, 2 = marginally appropriate, and 3 = appropriate. The reviewers were also asked to provide ways to improve the items that they rated "1" or "2", if possible. Expert review can make the instrument accurate and easily administered while potential respondents can help to guarantee that the items are meaningful and inclusive of all important ideas (Litwin, 2003). Based on the mean scores of each survey questions, the comments and suggestions, 16 items were eliminated, and 8 items were reworded, resulting in a 36-item P3DMI.

Subjects. To further validate the P3DMI and provide an estimation of its reliability, the 36-item P3DMI was distributed to 289 senior high schools in a Midwest state. One hundred and eighty three (63.3%) principals participated in this study. The majority of the respondents were male (80.6%) and Caucasians (97.8%) high school principals. Respondents with master's degrees occupied the majority (58.2%) while respondents with doctoral degrees were only 12.1%. A majority (64.3%) of the high schools where they worked were small-sized ones with less than 500 students.

Data Collection. Data collection for this study combined on-line and mail surveys. A cover letter was emailed with an embedded link to the web-based survey to 189 high school principals. In order to increase the return rate, an appreciation and reminder email message was sent to all the survey participants two weeks following the initial email communication, thanking those who may have already participated and encouraging those that had not done so. Two weeks after the reminder email, a letter of support from a professor who had worked as a school administrator as the third follow-up email, was sent to all the survey participants in order to encourage more respondents. Ninety-three high principals successfully completed the online survey.

The mail survey was administered to 163 high school principals who did not participate in or failed to complete the online survey. Of the 163 mail surveys, a total of 90 principals returned their completed survey responses. The combination of online and mail survey generated a total of 183 usable surveys, which provided an overall return rate of 63.3% of the total population of 289 high school principals.

The high school principals were asked to respond to the items that were defined as “how frequently do you practice this?” with a corresponding 5-choice scale as follows: 1 = rarely or never, 2 = seldom, 3 = sometimes, 4 = often, and 5 = usually or always. The items in actual survey were presented in random order rather than by categories of leadership standards to insure objectivity.

Data Analysis Techniques

Principal components analysis was conducted utilizing a varimax rotation to evaluate the construct validity and dimensionality of the P3DMI. The reliability of the P3DMI subscales was estimated using Cronbach’s alphas (Crocker & Algina, 1986). Mean scores and standard deviations of the P3DMI subscales were calculated to assess the extent high school principals practice DDDM in addressing administrative problems. The one-way within-subject analysis of variance (ANOVA) was conducted to evaluate the systematic differences among the mean scores on P3DMI subscales. Follow-up paired t-tests were used to examine the specific group differences.

Results

Factor Analysis

Factor analysis was conducted to determine the underlying constructs for measures on both the 36-item P3DMI. In the principal components analysis utilizing a varimax rotation, four criteria were used to determine the appropriate number of components to retain: eigenvalue, variance, scree plot, and residuals. These criteria indicated that the retaining four components should be investigated. Thus, principal components analysis was conducted to retain four components and to apply the varimax rotation. After rotation, Component Number 1 accounted for 9.85% of the variance, Component Number 2 for 13.45%, Component Number 3 for 13.86%, and Component Number 4 for 22.82%, with a total of 59.98%.

Table 1

Rotated Loadings for P3DMI Items

	Loading
Component Number 1: Data-Driven Decision-Making in School Vision	
I use data to develop a school vision of learning that promotes the success of all students.	.773
I use data to make decisions in aligning resources with the school vision.	.658
I use data to generate potential elements of a vision statement.	.627
I use data to define possible problems in vision implementation.	.580

I use data to develop alternatives for implementing the vision. .489

I use data to determine what strategies to use in achieving the goals of .451

advocating for all students.

Component Number 2: Data-Driven Decision-Making in School Instruction

I use data to generate approaches to curriculum improvement. .740

I use data to make recommendations regarding learning programs. .732

I use data to determine whether specific programs lead to improved .657

achievement.

I use data to plan professional development programs. .613

I use data to identify problems in student learning. .526

I use data to predict the outcome of new instructional programs. .523

I use data to evaluate the instructional efficiency of the school. .444

I use data to assess learning equity for different populations. .420

I use data to guide my decision-making in budget formulation focus on .411

student learning.

(Table 1 continued)

Rotated Loadings for P3DMI Items

_____ Loading

Component Number 3: Data-Driven Decision-Making in School Organizational Operation

I use data to evaluate my ethical behaviors. .719

I use data to advocate for policies that promote success for all students. .665

I use data to promote an environment for improved student achievement. .642

I use data to insure that staff members are treated fairly. .628

I use data to monitor instructional practices of the school organization. .600

I use data to identify safety issues. .564

I use data to assign human resources in ways that promote student .563
achievement.

I use data to judge my performance in effective management. .518

Component Number 4: Data-Driven Decision-Making in Collaborative Partnerships

I use data to develop effective approaches for school-family partnership. .788

I use data to measure the effectiveness of outreach to the community. .773

I use data to suggest appropriate tactics when dialoguing with .761
representatives of diverse community groups.

I use data to determine which community advisory committees should .747
be formed.

I use data to generate approaches with school stakeholders that reflect .744
their concern.

I use data to identify the complex causes of school community concerns. .738

I use data to gauge the effectiveness of collaborative relationships .715
with the community.

I use data to determine what type of community input should be gained. .667

I use data to generate alternatives for improving school-community .624
relations.

I use data to mobilize community resources for the benefit of student .583
learning.

I use data to negotiate with political decision makers for the .554
improvement of students' educational opportunities.

I use data to develop effective communication plans. .534

I use data to understand the larger context of the community, .445

which affects opportunities for students.

Component Number 1 included six items with positive loadings measuring DDDM practices in the leadership dimension of school vision (ELCC (2002) Standard 1). It was labeled school vision DDDM (see Table 1). Component Number 2 included nine items with positive loadings on practicing DDDM in the leadership dimension of school instruction (ELCC Standard 2), which constitutes the construct of school instruction DDDM. Component Number 3 included eight items in positive loadings, which were the items of practicing DDDM in the leadership dimensions of school organizational operation and moral perspective (ELCC Standard 3 and 4). It was labeled School Organizational Operation DDDM. Component Number 4 included 13 items with positive loadings regarding practicing DDDM in the leadership dimensions of both collaborative partnerships and larger-context politics (ELCC Standard 5 and 6). It was named Collaborative Partnerships DDDM (DDDM). In summary, the factor analysis indicated four leadership constructs of DDDM practices including (a) school vision, (b) school instruction, (c) school organizational operation, and (d) collaborative partnerships.

Internal Consistency Reliability

Analyses of construct internal consistency reliability were conducted by using Cronbach's alphas on each of the four constructs of the P3DMI, which was revealed by the results of the factor analysis. For reliability analyses, the P3DMI items were divided into four subscales that matched the four constructs based upon the factor analysis. Crohbach's alpha for each of the four subscales was calculated. The reliability estimate for the 13-item subscales of (a) school vision, (b) school instruction, (c) school organizational operation, and (d) collaborative partnerships were respectively .88, .84, .88, and .95. These statistics indicates all the four constructs' internal consistency reliability was sufficient.

The Extent of High School Principals' DDDM Practices

The extent of high school principals' DDDM practices was measured by the P3DMI. Table 2 presents the descriptive statistics of overall mean scores and standard deviations for each of the four constructs of DDDM practices in (a) school vision, (b) school instruction, (c) school organizational operation, and (d) collaborative partnerships. Mean and standard deviations of the 36 individual items in the P3DMI are also provided in Table 2. The items of each construct were ranked in an order from the highest to the lowest mean for the purpose of understanding the extent differences of principals' DDDM practices among the individual items. The survey was answered in a 5-point Likert scale from 1 representing "rarely or never" to 5 representing "usually or always".

The overall mean scores revealed that high school principals sometimes and/or often practiced DDDM in addressing administrative problems in all the four leadership constructs. The highest overall mean score among these four constructs was in the leadership dimension of school instruction (M = 3.99, SD = 0.54). This indicated that the principals used data more frequently in addressing problems or making decisions in school instructional leadership rather than the other leadership dimensions. Over half of the principals (51.4%) reported that they often or always used data for their decision making in instructional leadership.

Table 2

Means and Standard Deviations of the P3DMI Constructs and Individual Items

Item No.	Item	M	SD
	Leadership in School Vision	3.71	0.71
1.	I use data to develop a school vision of learning that promotes the success of all students.	4.01	0.92
2.	I use data to make decisions in aligning resources with the school vision.	3.98	0.87
23.	I use data to determine what strategies to use in achieving the goals of advocating for all students.	3.76	0.90
5.	I use data to generate potential elements of a vision statement.	3.56	1.01
21.	I use data to develop alternatives for implementing the vision.	3.49	0.87
25.	I use data to define possible problems in vision implementation.	3.36	0.96
	Leadership in School Instruction	3.99	0.54
26.	I use data to identify problems in student learning.	4.24	0.69
7.	I use data to generate approaches to curriculum improvement.	4.23	0.71
6.	I use data to make recommendations regarding learning programs.	4.20	0.73
32.	I use data to determine whether specific programs lead to improved achievement.	4.16	0.70
9.	I use data to plan professional development programs.	4.04	0.78
19.	I use data to evaluate the instructional efficiency of the school.	3.84	0.86
17.	I use data to assess learning equity for different populations.	3.77	0.96
31.	I use data to guide my decision-making in budget formulation focus	3.68	0.98

on student learning.

20. I use data to predict the outcome of new instructional programs. 3.66 0.90

Leadership in School Organizational Operation 3.88 0.67

14. I use data to promote an environment for improved student 4.28 0.72

achievement.

30. I use data to monitor instructional practices of the school organization. 4.18 0.75

12. I use data to advocate for policies that promote success for all students. 4.10 0.87

8. I use data to assign human resources in ways that promote student 3.93 0.82

achievement.

3. I use data to insure that staff members are treated fairly. 3.90 1.02

13. I use data to identify safety issues. 3.83 0.92

15. I use data to judge my performance in effective management. 3.68 0.86

11. I use data to evaluate my ethical behaviors. 3.28 1.28

(Table 2 continued)

Means and Standard Deviations of the P3DMI Constructs and Individual Items

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Item No. Item M SD

Leadership in Collaborative Partnerships 3.29 0.77

33. I use data to measure the effectiveness of outreach to the community. 4.16 0.70

27. I use data to develop effective communication plans. 3.70 0.90

4. I use data to understand the larger context of the community, 3.66 0.93

which affects opportunities for students.

10. I use data to generate alternatives for improving school-community 3.44 0.92
relations.
24. I use data to identify the complex causes of school community 3.38 0.95
concerns.
28. I use data to determine what type of community input should be 3.32 0.94
gained.
18. I use data to mobilize community resources for the benefit of 3.28 1.01
student learning.
16. I use data to gauge the effectiveness of collaborative relationships 3.21 0.96
with the community.
22. I use data to develop effective approaches for school-family 3.20 0.94
partnership.
36. I use data to generate approaches with school stakeholders that 3.20 1.02
reflect their concern.
29. I use data to negotiate with political decision makers for the 3.18 1.11
improvement of students' educational opportunities.
34. I use data to suggest appropriate tactics when dialoguing with 3.00 1.06
representatives of diverse community groups.
35. I use data to determine which community advisory committees 3.00 1.06
should be formed.

The frequency of principals' DDDM practices in the leadership areas of school organizational operation was also relatively high (M = 3.88, SD = 0.67). Almost half of the principals (47.8%) responded that they used often or always used data in the leadership dimension of organization operation. The overall mean scores of the frequency of principals' DDDM practices in the leadership dimension of school vision were third in ranking (M = 3.71, SD = 0.71), but close to the overall means of the above two constructs. Forty one percent of the principals reported their responses of data use at the levels of "always" and "often". With comparison to the above three constructs, the principals' DDDM practices were frequently low in the leadership dimensions of collaborative partnerships (M = 3.29, SD

= 0.77). Only a small percentage of principals (15.2%) reported that they often or always use data in decision making for administrative problems.

The one-way within-subject analysis of variance (ANOVA) yielded results of significant difference among the mean scores on the four leadership constructs, Wilks' $\lambda = 0.367$, $F(3, 167) = 95.85$, $p < .001$, Partial 2 = .633. Follow-up paired t-tests for the six pairs of differences in the four leadership constructs evaluated at 0.01/6 or 0.002 level using Bonferroni procedure indicate that only one pair, School organizational operation versus School instruction, was non-significant, $t(177) = 2.509$, $p = .013$. The data use frequency of the leadership construct of Collaborative Partnerships was significantly lower than that of all the other three constructs: (a) school organizational operation, $t(174) = -14.471$, $p < .001$, (b) school instruction, $t(175) = -16.112$, $p < .001$, and (c) school vision, $t(174) = -10.321$, $p < .001$. The data use frequency of the leadership construct of school vision was significantly lower than that of school organizational operation, $t(176) = -4.328$, $p < .001$, and school instruction, $t(177) = -7.189$, $p < .001$.

Discussion

The results of the factor analysis indicate that the P3DMI measures the following four DDDM dimensions which provide evidence of construct validity: (a) school vision, (b) school instruction, (c) school organizational operation, and (d) collaborative partnerships. The extent or realities of principal DDDM practices can be assessed with the instrument of P3DMI in an acceptable degree of reliability and validity. The statistics demonstrate that the degree of intercorrelation among items in each subscale is reasonably high (Yukl, Lepsinger, & Lucia, 1992) and serve as evidence that the different items combined together to measure the same dimension (Litwin, 2003) in principals' DDDM practices.

The self-reported responses reveal a general picture of the high school principals' use of data in their decision making. The findings of this study indicate that the overall high school principals' frequency level of using data for decision making ranges from "sometimes" to "often" with the mean scores of 3.71, 3.99, 3.88, and 3.29, respectively, for the four constructs of school leadership in (a) school vision, (b) school instruction, (c) school organizational operation, and (d) collaborative partnerships. These descriptive statistics provide the evidence that the high school principals frequently practiced DDDM, particularly in the areas of school instruction and organizational operation. These findings are also supported by looking at the percentage of principals who responded that their use of data for decision making between the high frequency from "sometimes" to "often" was close to and over 50% in the three leadership constructs of (a) school vision, (b) school instruction, and (c) school organizational operation.

The majority of the principals self-reported that they frequently used data to guide their administrative decisions. This seems to suggest that principals have learned to believe in factual data. Data are part of making factual decisions. The results of this study are consistent with the literature that DDDM is well practiced by principals in school leadership (Armstrong & Anthes, 2001; LaFee, 2002; Leithwood et al., 2001; Mathew, 2002; Salpeter, 2004). NCLB (2001), acting as a driving force of DDDM, has added new responsibilities for states, districts, and schools to exercise more and more efforts in collecting, analyzing and reporting data to prove their bottom line of the educational accountability. DDDM holds students, teachers, administrators and school systems accountable. Data need to be collected and used to plot progress, to plan and execute instructional interventions, and to report

results. School leaders will all meet the demands of DDDM (Doyle, 2003).

After years of educational policy enforcement in DDDM, principals' interests and practices in DDDM are increasing. DDDM as part of school instructional leadership is an effective strategy in their school administration. Principals seem to commonly recognize the benefits and values of DDDM, and respond to the call in using data as a guide for decision making during the course of a decade in framing how school would react to the accountability environment. Principals will continue focus their efforts with regard to student achievement and quality teaching and learning, and to seriously evaluate and analyze the existing data in their schools (Creighton, 2001).

Only a small percentage of principals reported that they often or usually use data in decision making in the leadership dimension of collaborative partnerships. The majority of principals did not use the data-based rationality, but probably utilized intuition or experiences for administrative decision making in the leadership dimension of collaborative partnerships. Almost 40% of the principals reported that their frequency level of data use for decision making in school vision leadership was lower than "sometimes". The findings demonstrate that principals' decision making is frequently guided by intuition and experience, but not by data-based rationality (American Association of School Administration, 2002; Davis & Davis, 2003).

Conclusions and Implications

The primary purpose of this study was to develop an effective instrument that would collect and provide information to foster a better understanding of the emerging and important practice of DDDM of principals by conducting initial evaluations on the validity and reliability of data obtained from the instrument. A series of instrument development techniques and multiple sources of evidence were involved and examined in the instrument development process of item constructions and validation of content validity and construct reliability. Factor analysis shows that the instrument, the P3DMI, measures four unique leadership constructs of DDDM practices: (a) school vision, (b) school instruction, (c) school organizational operation, and (d) collaborative partnerships. Internal consistency reliability tests indicate that the degree of intercorrelation among items in each construct is reasonably high. One-way within-subject ANOVA and the follow-up t-tests show that the P3DMI can differentiate in the extent of DDDM practices among the four leadership constructs. These results of the statistical tests provide further evidence of construct validity.

The descriptive statistics provide the evidence that the high school principals practiced DDDM in a high level of frequency particularly in the leadership dimensions of school instruction and organizational operation. The investigation of differences in data use between leadership dimensions suggest that DDDM was practiced significantly more in the leadership dimensions of school instruction and school organization than in the dimensions of school vision and collaborative partnerships. The results support that notion that the nature of principals' administrative problems to be addressed defines the shape of principals' information seeking and using (Taylor, 1991).

This study shows that the P3DMI is a reliable and valid instrument for measuring principals' DDDM practices as demanded by the NCLB Act and the ELCC/NCATE (2002) leadership program standards. The P3DMI can be applied in the emerging field of DDDM practices, serving as a practical tool in assessing school principals' DDDM practices so that a better understanding of principals' DDDM practices can be fostered. Information provided by the instrument may help district/board and

state-level administrators understand, assist and support their principals to achieve more effective school leadership. The P3DMI can also be useful in helping policy makers gain a rather complete picture of principals' practices of DDDM and provides evidence for crafting principals' DDDM professional development programs. Finally, the instrument can be used to gather information of DDDM from the standpoints of teachers and school district administrators who work closely with the principals.

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