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Measuring the Process and Outcomes of Team Problem Solving

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Abstract

Although there is a strong legislative base and perceived efficacy for multidisciplinary team decision making, limited evidence supports its effectiveness or consistency of implementation in practice. In recent research, we used the Decision Observation, Recording, and Analysis (DORA) tool to document activities and adult behaviors during positive behavior support team meetings. In this study, we revised the DORA to provide evidence of the extent to which the solutions that teams developed were implemented with fidelity and associated with improvements in student behavior. Using trained observers, we documented decision making at 18 meetings in 10 schools where team members discussed a total of 44 problems. We found that scores on the Decision Observation, Recording, and Analysis–II (DORA-II) were acceptable indicators for documenting problem solving during team meetings and that they provided technically adequate information on the extent to which teams were assessing whether they had implemented a solution and whether the solution made a difference for students. We believe the revised assessment tool has value in studying team-based problem solving, and we discuss our findings as a base for a well-reasoned research agenda for moving the process forward as evidence-based practice.

Keywords

problem solving, data-based decision making, team decision making

The use of school teams to identify and solve educational problems is a widely recommended and accepted practice in America's schools (Blankenship, Houston, & Cole, 2010; Boudett, City, & Murnane, 2006a, 2006b; Boudett & Steele, 2007; Chenoweth, 2010; Coburn & Turner, 2012; Leithwood, 2010; Murnane, Boudett, & City, 2009; National Association of School Psychologists, 2010; Steele & Boudett, 2008a, 2008b). Driven in large measure by a conceptual framework for data-informed decision making embodied in *No Child Left Behind* (NCLB, 2002) and by reauthorizations of Public Law 94-142 now codified as the Individuals With Disabilities Education

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Improvement Act of 2004, this practice is a core feature of both general and special education (Boudett et al., 2006a, 2006b; Brown-Chidsey & Steege, 2005; Henley, Ramsey, & Algozzine, 2009; McLeskey, Waldron, Spooner, & Algozzine, 2014; Ruby, Crosby-Cooper, & Vanderwood, 2011; U.S. Department of Education, 2009). The assumption is that problem solving by a group of individuals (including family members and students) acting as a team will provide better outcomes than these same individuals acting alone, and an impressive literature exists with guidance and recommendations about the need for and the process of team problem solving (Bransford & Stein, 1993; Carroll & Johnson, 1990; Gilbert, 1978; Jorgensen, Scheier, & Fautsko, 1981; Marsh, McCombs, & Martorell, 2010; McNamara, Rasheed, & Delamatre, 2008; Ysseldyke et al., 2006). In our continuing and renewing familiarity with what has been written about this practice, we have identified the following important takeaways: (a) the cycle of steps or stages for effective problem solving remain impressively consistent across time, context, and authors; (b) simply giving teams steps for the process does not guarantee they will effectively use them; (c) current problem-solving practices in schools leave much room for improvement; (d) barriers to effective problem solving are the same as those often cited as challenges to other promising practices (i.e., attitudes and a lack of time, resources, and training); (e) teams often lack both relevant data and a rubric for using the data for problem solving; and (f) there is an impressive lack of evidence-based research on the extent to which school teams engage in recommended problem-solving practices and whether those practices are related to positive outcomes for students.

An analysis and review of extant writing revealed that in a variety of formats, team problem solving has been a recommended practice for many years (Bergan & Kratochwill, 1990; Berger et al., 2014; Boudett et al., 2006b; Deno, 2005; Hamilton et al., 2007; Ruby et al., 2011; Spillane, 2012; Tilly, 2008; U.S. Department of Education, 2009). Yet, as Little (2012) pointed out,

> little of this writing affords a window into the actual practices [professionals] employ as they collectively examine and interpret . . . data or the ways in which the contexts of data use come to occupy a central or peripheral part of . . . ongoing work life. (p. 144)

Put another way, what teams of professionals actually do under the broad banner of "problem solving" and how well any of it works remain relatively underdeveloped, understudied, and unknown.

Principles Guiding our Work

Our interest in the process of using data to articulate the nature of problems and produce desired change related to them (i.e., problem solving) was grounded in six guiding principles that we derived from the extant knowledge base.

1. The problem-solving process is similar whether engaged by individuals or teams of professionals. At the simplest level, people engaged in problem solving collect and analyze information, identify strengths and problems, and make changes based on what the information tells them; and, doing it well often involves the systematic focus and perspective, precision, and persistence of an engineer (Anderson, 1994; Bergan & Kratochwill, 1990; Bradford, 1976; Deno, 2005; Lencioni, 2004; Mackin, 2007; Perkins, 2009; Newton, Horner, Todd, Algozzine, & Algozzine, 2012; Newton, Todd, Horner, Algozzine, & Algozzine, 2009; Todd, Newton, Horner, Algozzine, & Algozzine, 2009; Tobia & Becker, 1990).
2. The problem-solving process is universally applicable and unbounded by conventions or traditions of general and special education. The need to reform practice and improve

outcomes is not unique to either general or special education (Bergan & Kratochwill, 1990; Berger et al., 2014; Boudett et al., 2006a, 2006b; Brown-Chidsey & Steege, 2005; Deno, 2005; Newton, Horner, Todd, Algozzine, & Algozzine, 2012; Newton, Todd, Horner, Algozzine, & Algozzine, 2009; Todd, Newton, Horner, Algozzine, & Algozzine, 2009; Ysseldyke et al., 2006).

3. The problem-solving process is iterative, involving cycles of activities that are observable. The process typically involves iterative steps (e.g., collecting information from a variety of sources; transforming the information into testable hypotheses; selecting, implementing, and evaluating interventions that test the hypotheses; and adapting or revising the interventions based on fidelity and impact data; Bergan & Kratochwill, 1990; Hamilton et al., 2009; Hamilton et al., 2007; Newton, Horner, Todd, Algozzine, & Algozzine, 2012; Newton, Todd, Horner, Algozzine, & Algozzine, 2009; Todd, Newton, Horner, Algozzine, & Algozzine, 2009; Algozzine, Newton, Horner, Todd., & Algozzine, 2012; Newton, Todd et al., 2009; Ysseldyke et al., 2006).
4. The problem-solving process is a practice of coordinated activities informed by the context in which it occurs and the actions represented there. The process is about change and we can only change what we can see (Bergan & Kratochwill, 1990; Boudett et al., 2006a, 2006b; Deno, 2005; Hamilton et al., 2009; Hamilton et al., 2007; Little, 2012; Newell, 2010; Ruby et al., 2011; Newton, Horner, Todd, Algozzine, & Algozzine, 2012; Newton, Todd, Horner, Algozzine, & Algozzine, 2009; Todd, Newton, Horner, Algozzine, & Algozzine, 2009).
5. The problem-solving process is inherently goal-oriented and incomplete until an action taken has resulted in a change in behavior. Almost anybody can identify a problem and many policy makers and professionals are remarkably good at doing it; but the work is incomplete until the goal identified as evidence of improvement is achieved (Doll et al., 2005; Newton, Horner, Todd, Algozzine, & Algozzine, 2012; Newton, Todd, Horner, Algozzine, & Algozzine, 2009; Todd, Newton, Horner, Algozzine, & Algozzine, 2009).
6. All data are not equal. Effective problem solving requires access to the right data, in the right form, at the right time. Too often educators are asked to engage in problem solving with inadequate information (Berger et al., 2014; Boudett et al., 2006a, 2006b; Hamilton et al., 2009; Hamilton et al., 2007; Steele & Boudett, 2008b; Tilly, 2008; U.S. Department of Education, 2009).
7. The problem-solving process is defined by actions that are teachable. Giving people data does not ensure that they will actively use them to solve problems; the actions of problem solving can be and have to be carefully taught (Doll et al., 2005; Newton, Horner, Todd, Algozzine, & Algozzine, 2012; Newton, Todd, Horner, Algozzine, & Algozzine, 2009; Todd, Newton, Horner, Algozzine, & Algozzine, 2009; Algozzine, Newton, Horner, Todd., & Algozzine, 2012; Newton, Todd et al., 2009).

We were interested in documenting the quality of problem-solving processes and outcomes evidenced in the decision making of teams providing school-wide positive behavioral interventions and supports (SWPBIS) in elementary schools. We refer to the process as Team-Initiated Problem Solving (TIPS) and operationalize it with a set of actions taken during meetings of school-based teams engaged in identifying and resolving students' social and academic behavior problems (see Figure 1). Specifically, team members use TIPS to

- identify and define students' social and academic problems with *precision* (the what, when, where, who, and why of a problem);

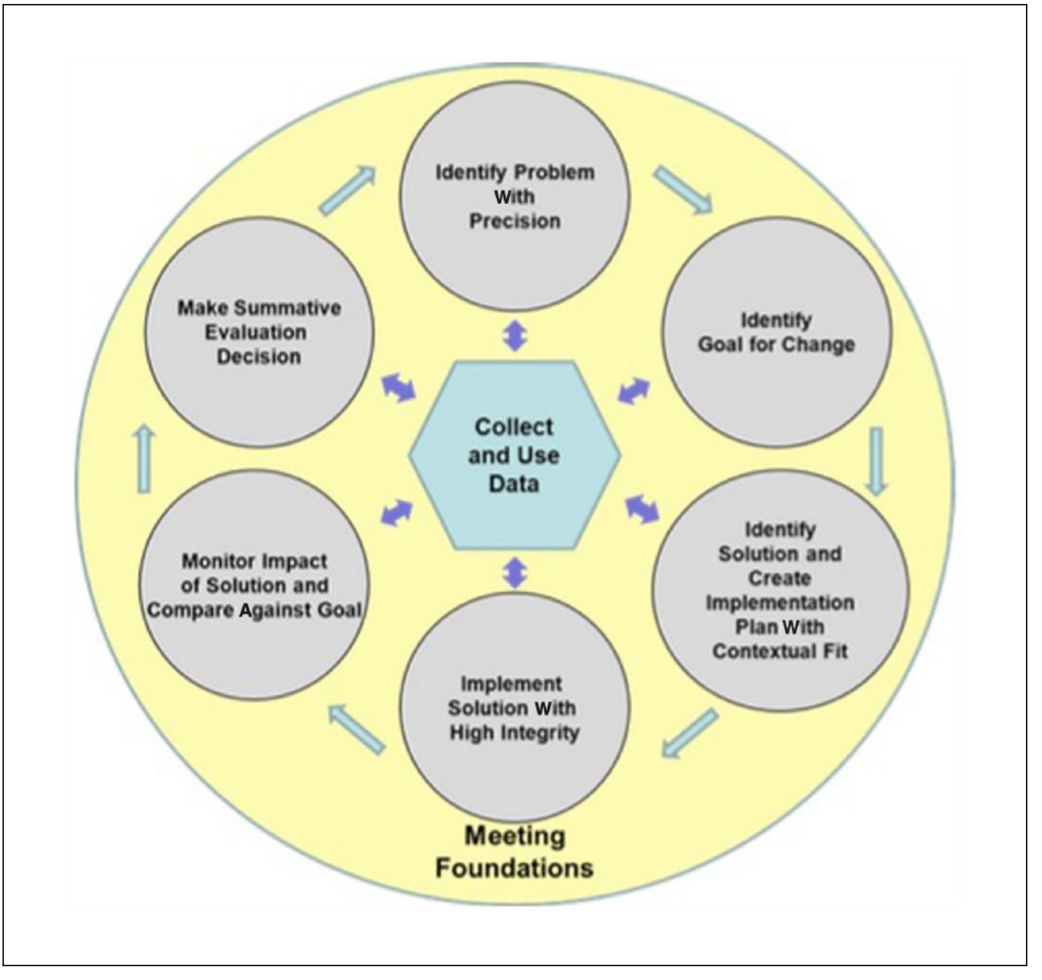

Figure 1. TIPS model.
Note. TIPS = Team-Initiated Problem Solving.

- establish an objectively defined goal that, once achieved and maintained, signals resolution of the problem to the team's satisfaction;
- discuss solutions and create a contextually appropriate implementation plan to resolve the problem;
- implement solutions with a plan for describing, monitoring, and achieving "treatment fidelity" of the actions taken;
- monitor the intervention across successive meetings to determine the extent to which implementation of solution actions with integrity resolves the identified problem; and
- revise solution actions as necessary to achieve resolution of the problem.

A key feature of TIPS is its emphasis on team members' ongoing cyclical use of data to inform decision making about each stage of the problem-solving process. TIPS also consists of a set of "foundational" or "structural" elements that give team members a template for holding team meetings that are efficient and effective (e.g., job descriptions for important team roles, a standardized meeting minutes form).

In previous research, we developed the Decision Observation, Recording, and Analysis (DORA) tool to document activities and adult behaviors during team meetings and to provide a basis for documenting the relationship between teaching teams how to systematically solve problems and achieve improvements in the quality of their school-based meetings (Newton, Horner, Todd, Algozzine, & Algozzine, 2012; Newton, Todd, Horner, Algozzine, & Algozzine, 2009; Todd, Newton, Horner, Algozzine, & Algozzine, 2009). We reasoned that a team identified a problem when three or more meeting participants spent at least 10 s talking about (or "paying attention" to talk about) changing student social or academic behavior, without agreeing not to change the behavior. An observer using DORA documented information about the identified problem (e.g., who, what, when, where) as well as reasons or hypotheses for why it was occurring, the type of data, if any, the team reviewed, the type of solution(s), if any, the team proposed, and any details to the solution that the team proposed (e.g., person assigned to carry it out, timeline). Although technical adequacy information for DORA suggests that it "focuses on processes that professionals believe define effective and efficient team decision making, it can be used with interobserver agreement that makes the scores trustworthy, and it appears to be much more sensitive to change than measures that focus primarily on perceptions of decision makers," it was not designed for and did not include items for documenting the extent to which the decision-making process that was observed was implemented with fidelity or the extent to which it resulted in improvements in the problems that were identified (Algozzine, Newton, Horner, Todd., & Algozzine, 2012; Newton, Todd et al., 2009, p. 245).

We developed the Decision Observation, Recording, and Analysis–II (DORA-II) to refine our understanding of the problem-solving process and to expand our analyses to the outcomes (i.e., changes in identified problem behaviors) of these meetings. We addressed the following questions related to validity, reliability, fidelity, and utility of DORA-II scores:

1. To what extent are scores on DORA-II reflective of characteristics and practices of effective team meetings and problem-solving processes?
2. To what extent are scores on DORA-II consistent across trained observers?
3. To what extent are scores on DORA-II reflective of the extent to which teams assessed the fidelity of implementation and impact an approved solution?
4. To what extent are scores on DORA-II reflective of changes in student outcomes?

Method

Our research took place in two states. We followed widely used procedures for documenting the technical adequacy of measurement data (i.e., scores) obtained using assessment instruments in counseling, education, psychology, and other social science areas (cf. American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 1999; Cohen, 1960; Dimitrov, 2012; Messick, 1989, 1995; Soukakou, 2012; Watkins & Pachecco, 2000). We delimited our study to teams charged with addressing problem behaviors; however, the areas we documented were relevant to other decision-making teams (e.g., intervention teams, teacher support teams, and classroom consultation teams).

Participants and Setting

Over a 6-month period, we observed 18 meetings in which team members discussed a total of 44 problems in 10 schools that met the following criteria: (a) enrolled elementary-aged students, (b) implemented SWPBIS (Horner, Sugai, & Anderson, 2010) for at least 1 year, (c) used the

Table 1. Demographic Characteristics of Participating Schools and Teams.

Characteristic	North Carolina		Oregon		Obtained *t*
	M	*SD*	*M*	*SD*	
School enrollment (number)[a]	400.20	70.93	354.75	154.41	0.59
Classroom teachers (FTE)[a]	27.08	4.73	16.99	6.27	2.76
Student–teacher ratio[a]	14.84	1.69	21.02	4.09	−3.11
School enrollment[a] (%)					
Kindergarten	15.61	1.51	15.63	3.87	−0.01
First	14.41	2.41	17.29	3.91	−1.32
Second	14.83	2.68	15.57	0.54	−0.45
Third	16.71	2.51	15.29	1.41	0.88
Fourth	16.26	2.28	21.31	9.31	−1.19
Fifth	16.41	1.06	18.76	9.29	−0.57
School free lunch eligible[a]	253.40	65.63	160.75	87.54	1.82
School reduced-price lunch eligible[a]	31.40	6.12	21.00	7.02	2.38
Student ethnicity[a] (%)					
African American	45.29	27.12	1.34	0.71	3.20
American Indian	0.84	0.31	1.11	0.80	−0.64
Asian	4.88	4.66	2.10	1.53	1.13
Hispanic	16.13	6.99	24.63	12.92	−1.27
Caucasian	28.28	24.53	64.94	16.48	−2.55
Two or more races	5.01	2.94	5.14	2.39	−0.07
Student gender[a] (%)					
Male	49.91	2.41	50.68	3.08	−0.43
Number of team members	11.80	1.30	8.25	3.86	1.95

Note. No statistically significant differences ($p < .01$) were found between states. FTE = full-time equivalent.
[a]Retrieved from http://nces.ed.gov/ccd/schoolsearch/

school-wide information system (SWIS; May et al., 2010) during the previous 6-month period, (d) monitored SWPBIS implementation fidelity using procedures (e.g., *Self-Assessment Survey* [SAS]: Horner, Sugai, & Todd, 2003; *School-Wide Evaluation Tool*: Todd et al., 2012) recommended by Algozzine et al. (2010), and (e) had SWPBIS team that met at least monthly. In addition, based on previous experience and information provided by external coaches, we selected schools with teams with a wide range of experience with the problem-solving process. The teams discussed 1 or 2 problems at most (66%) of the meetings. More specifically, 1 problem was discussed at 8 (44%) meetings, 2 problems were discussed at 4 (22%) meetings, 4 problems were discussed at 3 (17%) meetings, and 3, 4, and 8 problems at 1 (6%) of the other meetings.

Demographic data for participating schools and teams are in Table 1. No statistically significant differences ($p > .01$) were found between the two states with regard to school enrollment, classroom teachers (full-time equivalent [FTE]), student–teacher ratio, percent student enrollment for kindergarten through fifth grade, free or reduced-price lunch, student ethnicity, or student gender. Likewise, there was no statistically significant difference ($t = 1.95$, $df = 7$, $p > .05$) between the two states regarding the number of team members, and teams in both states had been implementing SWPBIS for at least 3 years.

Procedure

We collected data using trained observers who attended team meetings at each of the participating schools. Prior to attending these meetings, the observers obtained a copy of the minutes from the

Table 2. Cross-Tabulation of DORA-II Foundations and Recommended Core Features of Effective Meetings.

	Recommended core features				
DORA-II foundations	Anderson (1994)	Perkins (2009)	Haynes (1988)	Timm (1997)	Tobia and Becker (1990)
Start meeting on time	✓	✓	✓	✓	✓
Share previous minutes	✓	✓	✓	✓	✓
Have agenda available	✓	✓	✓	✓	✓
Have clearly defined roles	NA	✓	✓	✓	✓
Share data to support discussion	✓	✓	✓	✓	✓
Schedule follow-up meeting	✓	✓	✓	✓	✓
End meeting on time	✓	✓	✓	✓	✓
Percent of recommended core features	86	100	100	100	100

Note. DORA-II = Decision Observation, Recording, and Analysis–II.

Table 3. Cross-Tabulation of DORA-II Problem-Solving Processes and Recommended Principles From Practice.

	Recommended principles from practice				
DORA-II problem-solving process	Boudett, City, and Murnane (2006a, 2006b)	Bransford and Stein (1993)	Deno (2005)	Gilbert (1978)	Hamilton et al. (2009)
1. Identify problem with precision	✓	✓	✓	✓	✓
2. Identify goal for change	✓	✓	✓	✓	✓
3. Identify solution and create implementation plan with contextual fit	✓	✓	✓	✓	✓
4. Implement solution with high fidelity	✓	✓	✓	✓	✓
5. Monitor impact of solution and compare against goal	✓	✓	✓	✓	✓
6. Make summative evaluation decision	✓	✓	✓	✓	✓
Percent of principles from practice	100	100	100	100	100

Note. DORA-II = Decision Observation, Recording, and Analysis–II.

previous team meeting. The observers' review of the contents of these minutes informed them of (a) any student problems identified by the team and targeted for resolution, and (b) any specific solution actions selected by the team to resolve each problem. The observers recorded this information on the DORA-II instrument before attending the meeting. During the course of the meeting, the observers monitored team members' discussion of the problems and the selected solution actions, and independently recorded data on the DORA-II regarding each problem's solution actions (e.g., whether anyone inquired about implementation of a specific solution action, whether anyone reported on implementation of the solution action, team members' description of the implementation status of the solution action). For cases in which no team member reported on a selected solution action, the DORA-II data-collection protocol directed the observer to record "NA/Don't know" as the implementation status of the solution action and no points were awarded.

Instrumentation. Based on a review of documents addressing the conceptual and practical guidance for effective team meetings (see Table 2) and team-based problem solving (see Table 3), we included two sections in the DORA-II. Critical features of the *meeting foundations* for effective problem solving that should be in place at the start, during, and at the end of meetings comprise the first part; and the six processes of *effective problem solving* are represented in the second part of the instrument (see the appendix). While the first part of the measure contained items similar to those on the DORA, the second part was revised to provide important additional information on the problem-solving process of the teams being observed.

The "structure" of meetings (e.g., how a team prepares, conducts, and manages the follow-up activities) is important to their effectiveness. Critical "foundations" to be observed at the start of a meeting include whether an agenda was distributed, team roles were established, team members were present, relevant data were reviewed, and the meeting started "on time." During the meeting, quantitative data should be distributed or projected, the status of one or more previous decisions/tasks regarding student social or academic behavior should be reviewed, and the fidelity and impact of one or more implemented decisions/tasks regarding student social or academic behavior should be discussed. At the close of the meeting, the minutes should be distributed, the date and time of the next meeting should be confirmed, and attendance at the beginning and end of the meeting as well as whether it ended "on time" should be recorded.

Because the *process of effective problem solving* is iterative, we reasoned that observers using DORA-II would also record the cycles of problem-solving and decision-making processes used by team members as they address social or academic problems. Each "problem" was recorded in a single row that included information about the problem being addressed by the team (e.g., who, what, where, when, why), the data used to illustrate the level of the problem, the solution identified and the implementation plan created to address it, the extent to which the solution was implemented with fidelity, and the impact of the solution.

DORA-II data were collected in real time by an observer who was present for a full team meeting (or at least 70 min). The intent in using and scoring the instrument was to document existing and naturally occurring levels of critical features of effective problem solving rather than to record achievement of predetermined standardized or benchmarked scores in response to a planned intervention.

Design and Data Analysis

We focused DORA-II on the observable behaviors of team members as they managed meetings and identified problems, identified solutions to those problems, and implemented and evaluated those solutions. We used multiple methods to evaluate the extent to which DORA-II scores documented problem-solving processes, the extent to which repeated use of DORA-II produced similar results, and the extent to which DORA-II scores reflected core features and outcomes of effective team meetings.

As we were interested in measuring observable behavior representative of team decision making, we evaluated the content-related validity of DORA-II to provide evidence that information collected was consistent with the underlying knowledge base (i.e., the scale contains items that accurately and adequately represent the content of interest). We also documented the extent to which scores were similar when collected during the same observation by different observers. These aspects of the study replicated core technical adequacy features of DORA and addressed our first two research questions. We extended our previous analyses by documenting the extent to which teams assessed the fidelity of solutions that were implemented and by confirming the accuracy of their reported and actual problem status indicators (third and fourth research questions).

We trained observers using an "observe, review, and revise" cycle. We used sets of scores recorded by these trained observers to document overall agreement scores as well as item-by-item occurrence agreement indices. Following widely recognized standards (cf. Cohen, 1960; Krippendorff, 2013; Watkins & Pachecco, 2000), we reasoned that reliability was established when occurrence-only interobserver agreement between the two observers on implementation of solution actions for associated problems was 85% or better on the foundations and each of the process features of TIPS (e.g., problem identification, goal identification, status of problem reported).

Results

We evaluated the extent to which scores on DORA-II represented characteristics and practices of effective team meetings and problem-solving processes using a variation of the "Content Validity Ratio" (CVR) approach recommended by Lawshe (1975). In this context, content validity is reflected in the overlap or agreement between expert panel members' perceptions of core features of what is being measured and the items on the measure. Our goal was to determine the extent of agreement between expected and actual content in our instrument (e.g., Are included items addressing areas that are recommended by experts as critical and essential to the effective problem solving?). We cross-tabulated foundation and process data collected with DORA-II with expert-recommended characteristics and practices of effective team meetings and problem-solving processes. We established a criterion for adequate content validity as 80% or more agreement between foundations and problem-solving processes in DORA-II and expert-recommended core features and principles from practice. As illustrated in Table 2, DORA-II Foundations reflected 87% to 100% of the core features recommended by experts for effective meetings. We also documented complete (100%) agreement between areas of problem solving included on DORA-II and the critical features of five widely accepted problem-solving models (see Table 3).

We used DORA-II to document critical problem-solving features of meetings where team members discussed 12 (27%) new and 32 (73%) old behavior problems. We documented the following discrete aspects of the problems discussed at the meetings: Who (84.09%), where (93.18%), what (90.91%), when (84.09%), and why (77.27%). The teams focused on group (72.73%) more than individual problems; and, the discussion resulted in a "goal for change" (11.90%) or an indication of when the problem was expected to change (11.36%). The teams followed the TIPS process, and DORA-II was effective at documenting each of its core features.

We documented the extent to which scores on DORA-II were consistent across trained observers with a series of analyses. We calculated the percentage of agreement between pairs of observers by comparing meeting foundation element scores and decision-making thoroughness scores at 20 randomly selected meetings. Agreement for meeting foundation scores averaged 97% (range = 80%-100%). We also documented agreement for data associated with problem identification, problem precision, quantitative data use, goal identification, solution implementation, problem status, and decision after status of problem was reported (see Table 4). The average agreement across observers for these categories ranged from 74% for solution implementation status to 100% for quantitative data use, including agreement of 86% and 83% for problem identification and problem precision, 97% for goal identification, 88% for solution implementation integrity plan, 89% for status of problem reported, 98% for status of problem compared against goal, and 89% for decision after status of problem was reported. If there was a lack of agreement on the presence or absence of associated items for 1 of the 44 problems discussed at these meetings, a value of 0.0% resulted. The average overall interobserver agreement across the categories was 90%.

Table 4. Interobserver Agreement Across TIPS/DORA-II Categories.

Category	Average (%)	Minimum (%)	Maximum (%)
Foundations	97.00	80.00	100.00
Problem identification	86.39	50.00	100.00
Problem precision	82.95	20.00	100.00
Quantitative data use	100.00	100.00	100.00
Goal identification	96.71	50.00	100.00
Solution implementation integrity plan	88.00	60.00	100.00
Solution implementation status	74.44	0.00	100.00
Status of problem reported	89.44	0.00	100.00
Status of problem compared against goal	97.78	66.67	100.00
Decision after status of problem reported	88.89	0.00	100.00
Average	90.16		

Note. TIPS = Team-Initiated Problem Solving; DORA-II = Decision Observation, Recording, and Analysis–II.

DORA-II includes codes for documenting discussions of team members related to *implementation* (i.e., not started, partial implementation, implementation with integrity) and *impact* (i.e., NA, new problem, worse, no change, improved but not to goal, improved and met goal, unclear, or not reported) of solutions implemented to address team-identified problems. Participating schools provided evidence of using SWIS for at least 6 months. This created an opportunity for additional analysis of problems that met the following criteria:

1. Was an old problem (i.e., a problem with a solution selected by the team at a meeting previous to the meeting at which the DORA observation was conducted), *and*
2. Was an old problem for which the primary observer's DORA noted that the status of the problem was reported by the team (necessary for validity analysis of the impact score), *or*
3. Was an old problem for which the primary observer's DORA included a solution score of either "partial implementation" or "implementation with integrity" (necessary for validity analysis of the solution score).

Sixteen (50%) of the 32 old problems discussed by teams met the criteria for this part of our study, and we documented information about partial implementation for 7 (44%) and implementation with integrity for 9 (56%) of them.

We were also interested in the extent to which the impact of solutions was confirmed by objective data. The additional analyses extended our focus from whether DORA-II accurately measured what teams decided (e.g., level of solution implementation and impact of solution implementation on student outcomes) to whether team assessments could be validated by external documents. In a post hoc analysis, we identified old problems with fidelity and outcome evidence that could be verified with information other than that which included in the original observation record. For example, the team members at one school proposed to teach behavioral expectations on the bus, and their fidelity confirmation was a hard copy of the teaching plan and a documented schedule of the training. Another school team proposed to deliver tokens for appropriate behavior in the classroom. In both cases, an external review of permanent products allowed the researcher to confirm the decision of the team that they had "implemented," "partially implemented," or "not implemented" the proposed solution. Of the 16 problems that could be externally validated with classroom- or school-based evidence, the results from 13 (81%) of team assessments of implementation confirmed the accuracy of the team assessment.

Similarly, we identified 20 (63%) of the 32 old problems where the team was able to make an assessment about the impact of the solution on student behavior and there were external data (SWIS or permanent products) where the observer could confirm whether the team assessment of impact was accurate (e.g., goal met, progress in desired direction, noneffect). For example, we used office discipline referrals to confirm reported reductions in problems on the playground following implementation of additional supervision at one of our schools. On 18 of the 20 (90%) instances the assessment of the team was consistent with the permanent product information. One nonagreement was due to the team accurately assessing student progress, but not being satisfied that the progress was sufficient, even though it met the initially defined goal.

Discussion

Our goal was to document the utility of DORA-II as a measure that may be helpful to researchers focused on improving data-based decision making in schools. The stages of problem solving are well documented and consistently presented in the extant knowledge base; however, evidence of the effective implementation of the processes and their outcomes is less well articulated. For example, there is plenty of advice on what team members should do as problem-solving practices, but little empirical documentation of the extent to which they do them or of their effects on academic or social problems that are the reasons for doing them in the first place. We trained school-based teams to use a systematic problem-solving model and we documented both the extent to which they used it and the effects it had. We focused our work on SWPBIS teams in elementary schools, but we believe our findings are generalizable to other school-based problem-solving groups.

In previous research, we documented the technical adequacy of a tool for recording and analyzing activities and adult behaviors during positive behavior support team meetings (Algozzine, Newton, Horner, Todd., & Algozzine, 2012; Newton, Todd et al., 2009) and used it to demonstrate changes that resulted from teaching team members to systematically solve problems during their school-based meetings (Newton, Algozzine, Algozzine, Horner, & Todd, 2011; Newton, Todd et al., 2009; Todd et al., 2012; Todd, Horner, Newton, Algozzine, Algozzine, & Frank, 2011; Todd, Newton et al., 2009). We did not document the extent to which the efforts of the teams resulted in improvements in student outcomes. In this research, we developed the DORA-II to confirm our understanding of the problem-solving process and to place more emphasis on evaluation of implementation fidelity, "solutions," and "impact." The findings from our preliminary technical analyses reflect that the content of DORA-II is consistent with key components of problem solving recommended in the field and provides a basis for measuring each of these features; and our confirmation of team-scored solutions and impact with permanent product extends the value of the measure for documenting the ultimate goal of team-based problem solving (i.e., improving academic and social behavior).

Conclusion

Problem solving is cyclical and goal-oriented. Any protocol for documenting it must provide evidence of the extent to which participants engage critical components and stages of the process as well as the extent to which doing so improves problems and benefits students. Using DORA-II, we verified both the level of engagement of teams in expected activities and the outcomes of those activities. We also confirmed selected core features and processes using permanent products obtained and reviewed after the meetings.

Underlying our work was an interest in determining the extent to which teams engaged in core features of effective problem solving. We believe using DORA-II will create strong potential for better understanding problem solving as an evidence-based practice. To date, models for problem solving are plentiful but data documenting either use of these models or the impact of model use are scarce. Moving problem solving from promise to preferred practice requires proof of implementation integrity and impact; that is, most of what we know about problem solving is grounded in an opinion-base and stakeholders, policy makers, and other professionals need an evidence-base to make informed decisions about education interventions. Our findings provide a base for establishing problem solving as an evidence-based practice.

An important limitation to our present analysis is that of the 40 problems assessed across the 10 teams, only 16 could be externally confirmed for implementation fidelity and only 20 could be externally confirmed for implementation impact. Although the results from these problems are encouraging (e.g., team-based assessment was confirmed by the external assessment), it is possible that teams are more likely to be accurate about implementation and impact in situations where clear, external information is available. Further research examining team accuracy in their assessment of solution implementation and impact is needed.

We believe that scores on DORA-II provide useful indices of team problem-solving processes. By directly observing team behavior with DORA-II, researchers are now able to examine questions such as (a) Which steps in the problem-solving process are essential? (b) What data are most helpful to teams in their problem solving? (c) What features of "solutions" improve the likelihood of implementation? and (d) What problem-solving practices improve the efficiency of team problem solving? The importance of understanding how to guide, teach, and improve team problem solving is reflected in the large amount of time and resources currently spent on the process by educators across the United States. Given the emerging reach and sophistication of data access, now more than ever, we need research that will help the field better understand how to do problem solving with efficiency and impact. DORA-II is one measure that may assist researchers to achieve this goal.

We believe DORA-II provides a measure that may enhance functional research and analysis of team problem solving. Research questions and conclusions are often affected by the ability of researchers to obtain relevant information. We look to DORA-II as one tool for providing scholars and clinicians with information to improve our understanding about how school teams identify and solve educational problems.

Appendix

Decision Observation, Recording, and Analysis–II (DORA-II)

Section 1. Demographic Information

School ID No.:	# PBIS Team Members:	Observer Name:	☐ Primary Observer	☐ Reliability Observer
Date:	Scheduled Start Time:	Scheduled End Time:		

If these are research data complete the following:

Group:	State:	Condition:	Data Wave No.:

Section 2. Foundations of Effective Team Problem Solving.

START OF MEETING	DURING MEETING (ROLES)	END OF MEETING
01. Meeting started within 10 minutes of scheduled start time	05. Facilitator	08. Next meeting scheduled
02. At least 75% of team members present at the start of the meeting	06. Minute Taker	09. Meeting ended within 10 minutes of scheduled end time (includes a revised end time that team members agreed to)
03. Previous meeting minutes available	07. Data Analyst	10. At least 75% of team members present at the end of the meeting
04. Agenda available		

Section 3. Team Problem-Solving Processes.

Operational definition of a "problem"—At least one team member or meeting participant ☐ identifies a student social or academic behavior to change, AND ☐ the team selects/selected a solution to bring about the desired change.

PRECISE PROBLEM & GOAL FOR CHANGE IDENTIFIED

Problem No. ☐ **PR**

Description of identified problem

1.1 Problem Precision

What ☐ Who ☐ Where ☐ When ☐ Why ☐

Problem Category

Social Behavior ☐ Academic Behavior ☐

Problem Features

New ☐ Old ☐ Individual ☐ Group ☐

1.2 Quantitative Data Use

Social Behavior ☐ Academic Behavior ☐

Description of data presented

2. Identified Goal

What Change ☐ By When ☐

Description of change to be achieved

☐ Postponed/out of time
☐ Old problem not discussed

SOLUTION IDENTIFIED AND IMPLEMENTATION PLAN CREATED & SOLUTION IMPLEMENTED WITH INTEGRITY

Description of selected solution

Write description of Solution below, including its individual components or "solution actions."

3. Solution Implementation Plan

NA Old Prob. ☐ Person ☐ Imp. Timeline ☐ Integrity What ☐ Integrity When G/R ☐ Integrity Who ☐

Description of implementation integrity plan

4. Solution Implementation-Integrity

NA New Prob. ☐ Not Started ☐ Part. Imp. ☐ Imp. w/ Integrity ☐ Stopped. ☐ Not reported/ DK ☐

☐ Postponed/out of time

IMPACT OF SOLUTION MONITORED AND COMPARED AGAINST GOAL & SUMMATIVE EVALUATION DECISION MADE

5. Status of Problem Reported—Direction of Change & Relation of Change to Goal

NA (See Protocol*) ☐ Worse ☐ No Change ☐ Imprv. but not to Goal ☐ Imprv. & Met Goal ☐ Unclear ☐ Not Reported ☐

Description of status of problem (i.e., summary of findings from qualitative and/or quantitative data) or NA if New Problem

Data source for report on status of problem (NA if New Problem)

6. Summative Evaluation Decision (Note: Check "No" if team did not report status of problem)

(Note: Examples of summative evaluation decisions include (a) retaining, revising, or terminating (a) the solution, (b) the goal, (c) the precisely defined problem, or (d) some combination of the preceding)

NA New Problem ☐ Yes ☐ No ☐

Description of decision or NA if New Problem

☐ Postponed/out of time

Note. G/R = gathering" or "reporting" information on the Solution Implementation Plan. *Please see Newton et al. 2014.

Authors' Note

The opinions expressed herein are those of the authors, and no official endorsement should be inferred.

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