

The Use of Graphs to Communicate Psychoeducational Test Results to Parents

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One of the major roles of a school psychologist is psychoeducational testing and the preparation of psychoeducational reports. Unfortunately, parents often have difficulty understanding psychoeducational reports. This difficulty might be ameliorated by supplementing psychoeducational reports with graphs. This hypothesis was tested with 144 parents who were asked to read a psychoeducational report either with or without supplemental bar graphs and then to complete recall and satisfaction measures. Parents who read a report with graphs recalled significantly more information correctly than did parents who read a report without graphs. Parents who read a report with graphs also expressed greater satisfaction than parents who read a report without graphs. Regardless of the type of report, parents with a college degree performed better on the recall measure than parents without a college degree.

KEYWORDS *psychoeducational report, psychological report, test results, parents, graphs*

School psychologists write psychoeducational reports for a variety of purposes. Perhaps the most important function of a psychoeducational report is to communicate test results to diverse audiences in a clear manner (Brandstatter & Mucke, 2009; Hollander, 1986). Besides communicating results, information in reports can be used to develop Individualized Education

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Programs for students, provide recommendations for school and home, and document eligibility for special education services (Tegasi, 1983). A psychoeducational report can also represent psychologists in their absence and serve as a record of their work for future reference (Ownby & Wallbrown, 1986). In addition, parents may refer to the report to aid in remembering information the psychologist reported orally or to share it with others to obtain needed services (Tallent, 1993). Therefore, it is important for parents to understand results presented in psychoeducational reports, not only while in the meeting or the psychologist's presence but also when reviewing the report on their own or trying to explain the information to others (Hollander, 1986). If parents do not comprehend the information presented about their child, they could make erroneous placement and treatment decisions that could negatively impact their child's growth and development (Geffken, Keeley, Kellison, Rodriguez, & Storch, 2006; Hoff, Fenton, Yoshida, & Kaufman, 1978; Leyser & Cole, 1984; Osborne, 1996).

Unfortunately, parents can be overwhelmed by psychoeducational reports (Academy for Educational Development, 2000; Wright & Wright, 2008) and often misunderstand psychoeducational results (Dirks, Bushkuhl, & Marzano, 1983; Eissenberg & Rudner, 1988; Gargiulo & Warniment, 1976; Hoff et al., 1978; Hollander, 1986; Switzer, 1985). In fact, parents have difficulty recalling or understanding their child's psychoeducational evaluation even after meeting with psychologists to discuss the results (Dirks et al., 1983; Hoff et al., 1978; Leyser & Cole, 1984; Zake & Wendt, 1991).

Fortunately, researchers have found some facets of a written psychological report that can increase the likelihood that a parent will understand the information that the psychologist is trying to convey (Harvey, 1997, 2006; Rafoth & Richmond, 1983; Schwartz, 1987; Tallent, 1993; Weddig, 1984; Wiener, 1985, 1987; Wiener & Kohler, 1986). Specifically, psychoeducational reports written in a clear, concise manner in a traditional format (reason for referral, background information, test results, and recommendations) with few technical terms and a readability level appropriate for the general public will likely improve parental comprehension.

In clinical practice, however, most psychological reports do not adhere to these affirmative guidelines and remain opaque to some readers (Groth-Marnat & Horvath, 2006; Harvey, 1997; Weddig, 1984). Consequently, it is important to identify additional ways to improve the comprehensibility of psychoeducational reports (Cornwall, 1990). One potential tactic is to provide a supplement to the written report. This was investigated by Hopper (1977), who gathered information about how well 88 parents remembered children's test results after attending a parent-teacher conference where they were provided with a visual profile (similar to a line graph) and verbal interpretation of standardized group achievement test results. Approximately 50% of the parents were not accurate in recalling their child's test performance

or information about the normative sample 2 weeks later. However, a comparison of test results presented with a visual profile to test results presented without a visual profile was not conducted. Thus, it cannot be determined whether the graph provided useful information or was a distraction. Also, an example of the visual profiles used in the study was not published, which makes replication and comparison of the findings difficult.

Visual profiles have also been used as a supplement to an oral report of test results to parents in a setting outside of school (Hollander, 1986). Learning disability specialists working in a learning disabilities clinic in New York plotted different subtest scores ranging from very low average to high average in a format resembling a line graph. This graph was intended to provide information on a child's strengths and weaknesses on a standardized group achievement test. It was reported that the graph aided in the interpretation of test findings and helped present concepts simplistically that could not be done with technical language. However, no empirical data were provided to support that claim. In addition, a graph was used to supplement an oral report, so it is difficult to compare to written psychoeducational reports. Last, the number of participants and the questions used to determine parental understanding were not reported, which makes it difficult to generalize or compare the findings to others.

School psychologists have also reported that supplemental graphics can increase parental understanding (Dixon, 2000; Iddings, 2000). Unfortunately, empirical evidence to support these claims was not presented. However, researchers in other fields have investigated the use of supplemental graphics to improve readers' comprehension of text. Results in medicine, education, and journalism consistently favored graphic supplements (Branin & Griemel, 1996; Davis et al., 1996; Griffin & Stevenson, 1992; Houts, Witmer, Egeth, Loscalzo, & Zabora, 2001; Kelly, 1993; Murphy, O'Keefe, & Kaufman, 1999; Peterson, Clancy, Champion, & McLarty, 1992; Shah & Hoeffner, 2002). Participants also consistently reported a preference for information presented with a graph over information presented without a graph.

Relatively few studies have examined the use of graphs for reporting standardized achievement test scores (Dreher & Singer, 1985; Goodman & Hambleton, 2004; Hollander, 1986; Hopper, 1977), and no studies have investigated the use of graphs in a written psychoeducational report. Consequently, the purpose of this study was to appraise the effectiveness of graphs as supplements to a traditional written psychoeducational report. One hypothesis for this study was that parents who read psychoeducational reports containing supplemental graphs would be able to recall more information than parents who received a psychoeducational report without graphs. It was also predicted that parents with less educational attainment would be helped most by the addition of graphs because the information was being presented in two different formats (text and graphics). Finally, it was hypothesized that parents would be more satisfied with reports that contained graphs.

METHOD

Participants

This study was approved by a university institutional review board to ensure that participation in this study was informed and voluntary. Parents (123 mothers and 21 fathers) who attended meetings of 13 parent organizations in central Pennsylvania participated. The mean age of participants was 40 years with a standard deviation of 8 years (range of 22–75 years). Most parents were married (93%) and Caucasian (99%). No participants reported having less than a high school diploma: 21% of the parents had a high school diploma, 19% completed some college, 35% were college graduates, and 24% earned a graduate degree. Approximately 25% of the parents reported that one of their children had been evaluated for or received special education services. No additional identifying information was collected to preserve the anonymity of participants.

Procedure

A between-subjects, posttest-only design was used in which participants were randomly assigned to experimental and control groups. Before beginning the study, participants were told that they were volunteering to help school psychologists learn how to improve communication of test results to parents. They were then asked to read a psychoeducational report as if it described their own child. Participants next answered 12 multiple-choice questions based on their recollections of the report without referring to it. These questions were based on information that was located in both text and graphs. Finally, participants were asked to rate their satisfaction with the report on three Likert-type items.

Materials

Materials used in this study included a recall measure, a satisfaction measure, and experimental and control versions of a psychoeducational report.¹ Identical textual and tabular information was included in the reports provided to the control and experimental groups. However, the experimental group psychoeducational report was supplemented with five graphs.

Control version of the psychoeducational report. Participants were asked to read a psychoeducational report based on information that is similar to reports written by school psychologists for students being evaluated for special education services. Specifically, the report contained information about a boy in second grade who had been referred by his classroom teacher due to academic difficulties. This scenario was used because it has been

reported that the highest number of referrals for psychoeducational testing are from elementary teachers regarding boys with academic deficits (Harris, Gray, Rees-McGee, Carroll, & Zaremba, 1987).

The report format was modeled after the traditional psychoeducational report that includes the following sections: demographic information, reason for referral, background information, behavioral observations, assessment methods, assessment results, summary, and recommendations (Pryzwansky & Hanania, 1986; Sattler, 2008). Demographic information included the student's name, age, date of birth, grade, date of testing, date of report, parents' names, address, and school. The reason for referral section included a brief statement indicating why the student was receiving a psychoeducational evaluation and identified the person making the referral. Background information consisted of items that described the student's current family situation, academic progress, and other information relevant to the reason for referral. Behavioral observations included a narrative of the student's observed behavior in the classroom and during the testing session. The names of the measures used and how information was gathered for the report were provided in the assessment methods section of the report. Results from tests were included in the assessment results section, with the summary section being used to combine and integrate the entire psychoeducational evaluation. Descriptive labels (e.g., average, above average) for test scores were included based on labels frequently used to describe scores from individual norm-referenced tests (Sattler, 2008). The report ended with a recommendations section that included several interventions to improve reading (Joseph, 2004).

Several modifications were made to the traditional psychoeducational report. For example, diagnostic and eligibility statements were excluded because eligibility for special education services is a team process (Osborne, 1996). Because most referrals are for academic concerns (Harris et al., 1987), the focus of the report was on intelligence and academic achievement test results. Therefore, information about social, behavioral, and emotional functioning was limited to parent, student, and teacher interviews. Finally, test results were provided in a psychometric summary at the end of the report. Such tables are regularly used to report test scores (Sattler, 2008).

The reading level of the report was computed with the Flesch-Kincaid Grade-Level Readability Formula on Microsoft® Office Professional 2003. This readability formula was based on the length of words, sentences, and paragraphs. By systematically modifying these characteristics, the report was adjusted to an eighth-grade reading level that has been found to be appropriate for most adults (Scown, 2001; Stephens, 1992).

It is difficult to eliminate all technical language in a document such as a psychoeducational report. Some of the technical language is needed to convey information effectively and to meet legal requirements for program eligibility (Harvey, 1997, 2006). Technical language is considered to be

acceptable if it is used sparingly and to enhance understanding (Hirst, 2003). Therefore, proper nouns and words that were needed to describe essential information (e.g., standard deviation, psychoeducational) remained in the report and were not included in the calculation of readability.

To determine if the report was representative of psychoeducational reports and to assure that technical language was kept to a minimum and explained appropriately, five practicing school psychologists were asked to identify any terms that were inappropriate for parents. Those psychologists did not identify any terms that needed to be replaced. The same five psychologists unanimously agreed that the report was realistic and comparable to reports written by school psychologists.

Experimental version of the psychoeducational report. Five horizontal bar graphs were added to the control version of the psychoeducational report to create the experimental version of the psychoeducational report. The two versions were identical in all other respects. Bar graphs were chosen because they have been reported to be the best way to illustrate comparisons and are considered the easiest graph for readers to understand (Lefferts, 1981; Zacks & Tversky, 1999). The first bar graph presented cognitive test scores in the intellectual functioning section of the report. The next three graphs depicted reading, mathematics, and written expression scores in the academic achievement section of the report. The fifth bar graph was placed in the summary section of the report and summarized academic and cognitive test results (e.g., Figure 1).

The bar graphs were created by Microsoft Excel and included standard scores on the X axis and the names of tests on the Y axis. The title of the graph was included because graph titles serve as a link between the text and the graph (Schmid & Schmid, 1979). The average score range was lightly shaded, and the bars used to represent obtained test scores were a darker shade. Even though there is some evidence that color graphics enhance

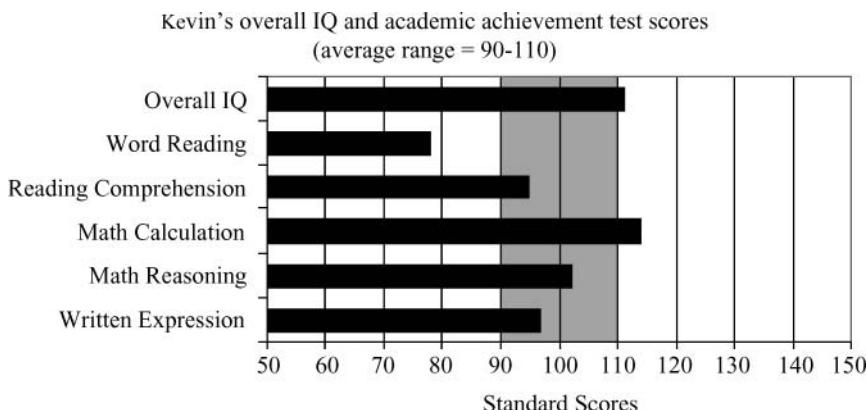


FIGURE 1 Summary Graph from the Psychoeducational Report Supplemented by Graphs.

readers' attention and accuracy (Hoadley, 1990), psychoeducational reports are generally printed from standard laser printers that contain only black ink and are often photocopied for members of the team to view. Therefore, using color graphics in the study would not be representative of the type of graphic that a parent would likely receive in a psychoeducational report.

Psychoeducational Report Recall Measure. Parents were asked to answer 12 questions about the test results presented in the report. The items on the Psychoeducational Report Recall Measure were placed in random order to reduce any bias that might result as a consequence of ordering the items. A multiple-choice format was chosen so that recall could be assessed independent of participants' writing skills. No basal or ceiling effects were observed. None of the participants answered all 12 questions correctly or got all of the items incorrect. The split-half reliability of the Psychoeducational Report Recall Measure was .47 based on the Spearman Brown coefficient of equal length.

Psychoeducational Report Satisfaction Measure. Participants were also asked to respond to three statements about the report using a 5-point Likert-type scale with 1 indicating *Strongly Disagree* and 5 representing *Strongly Agree*. The first item was, "This report was easy to understand." The second item was, "This report clearly described the child." The final item measured parents' overall level of satisfaction with the way information was presented in the report. The split-half reliability of the Psychoeducational Report Satisfaction Measure was .83 using the Spearman Brown coefficient of unequal length.

RESULTS

There was no significant difference in the number of parents in each group who reported that one of their children had been evaluated for or received special education services, $\chi^2(1, N = 144) = 1.33, p = .248$. Descriptive statistics for the Psychoeducational Report Recall Measure and the Psychoeducational Report Satisfaction Measure are provided in Tables 1 and 3, respectively.

Psychoeducational Report Recall Measure

To determine the main effects for report type (with versus without graphs) and educational level (high school and some college versus college graduates) a 2×2 analysis of variance (ANOVA) was calculated using the score on the recall measure as the dependent variable. Homogeneity of variance was tested by using Levene's test of equality of error variances. The error variance of the recall measure was found to be equal across the experimental

TABLE 1 Descriptive Statistics of Psychoeducational Report Recall Measure for Experimental (with Graphs) and Control (without Graphs) Groups by Level of Parent Education

Group	<i>N</i>	Mean (Percent Correct)	<i>SD</i>
Experimental			
High School/Some College	30	6.97 (58.1%)	2.24
College Graduate	42	7.79 (64.9%)	1.87
Total	72	7.44 (62.0%)	2.06
Control			
High School/Some College	28	5.82 (48.5%)	1.91
College Graduate	44	6.89 (57.4%)	1.67
Total	72	6.47 (53.9%)	1.83

and control groups, $F(3, 140) = .491, p = .689$. Descriptive statistics indicated that the data were slightly nonnormal, skewness = $-.155$ and kurtosis = $-.213$ (Gravetter & Wallnau, 1988). However, it has been reported that even when the sample varies slightly or even moderately from the normal distribution, acceptable results can still be achieved with ANOVA (Aron & Aron, 1999).

The mean score on the recall measure was greater for the experimental group ($M = 7.44, SD = 2.05$) than the control group ($M = 6.47, SD = 1.83$). This equates to an 8% increase in recall accuracy for parents who received the report enhanced with graphs. Parents of all educational levels who received a report with graphs scored higher on the recall measure (see Table 1). Results of the ANOVA indicated significant main effects for report type, $F(1, 140) = 10.00, p = .002$, and educational level, $F(1, 140) = 8.49, p = .004$. The interaction of report type and educational level was not significant, $F(1, 140) = 0.15, p = .704$ (see Table 2). A medium effect size for both report type and education level on parent recall was found (partial $\eta^2 = .067$ and $.057$, respectively). The relationship between parents' prior experience with special education and recall scores was not significant ($r = .06, p = .472$).

TABLE 2 ANOVA Summary for Report Type (with vs. without Graphs) and Education Level (High School and Some College vs. College Graduate) on Psychoeducational Report Recall Measure

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	Partial η^2
Report Type	36.17	1	36.17	10.00	.002	.067
Education Level	30.71	1	30.71	8.49	.004	.057
Report \times Education Level	0.52	1	0.52	0.15	.704	.001
Error	506.58	140	3.62			

TABLE 3 Descriptive Statistics of Psychoeducational Report Satisfaction Measure for Experimental (with Graphs) and Control (without Graphs) Groups by Level of Parent Education

Group	N	Mean ^a	SD ^a
Experimental			
High School/Some College	28	3.71	.55
College Graduate	40	3.86	.60
Total	68	3.80	.58
Control			
High School/Some College	27	3.43	.75
College Graduate	44	3.57	.73
Total	71	3.51	.74

^a On a scale of 1 to 5, where 1 was *most dissatisfied* and 5 was *most satisfied*.

Psychoeducational Report Satisfaction Measure

Assuming interval-level measurement (i.e., each item was assigned a score of 1 to 5), scores from the three Likert-type satisfaction questions were summed and averaged to arrive at a total satisfaction score for each participant. The mean score on the total satisfaction measure was greater for the experimental group ($M = 3.80$, $SD = .58$) than the control group ($M = 3.51$, $SD = .74$) (see Table 3). A 2×2 (report type \times parent education level) ANOVA was conducted, with scores on the Psychoeducational Report Satisfaction Measure serving as the dependent variable. A main effect was found for report type, $F(1, 135) = 6.17$, $p = .014$, but education level and the interaction between report type and education level were not significant (see Table 4). A medium effect size for report type on the satisfaction measure was found (partial $\eta^2 = .044$). The relationship between parents' prior experience with special education and satisfaction scores was not significant ($r = .07$, $p = .432$).

DISCUSSION

It was hypothesized that using graphs to supplement psychoeducational reports that already contained test results in textual and tabular formats would

TABLE 4 ANOVA Summary for Report Type (with vs. without Graphs) and Education Level (High School and Some College vs. College Graduate) on Psychoeducational Report Satisfaction Measure

Source	SS	df	MS	F	p	Partial η^2
Report Type	2.75	1	2.75	6.17	.014	.044
Education Level	0.67	1	0.67	1.50	.222	.011
Report \times Education Level	0.00	1	0.00	.004	.950	.000
Error	60.38	135	0.45			

increase parents' ability to recall information from the report. That hypothesis was confirmed: Parents who read a report with graphs performed statistically significantly better on a recall measure than did parents who read reports without graphs. A medium effect size indicated that report type accounted for almost 7% of the variance, which is consistent with the benefits reported for supplemental graphics in newspapers, instructional materials, and patient education information (Branin & Griemel, 1996; Davis et al., 1996; Griffin & Stevenson, 1992; Ramaprasad, 1991; Shah & Hoeffner, 2002). It also supports the recommendation that graphics should be included with reports of group standardized achievement test results (Goodman & Hambleton, 2004).

It was also predicted that parents with lower levels of educational attainment would be helped most by the addition of graphs. That hypothesis was not supported: All parents, regardless of educational attainment, were helped by supplemental graphs. There was a medium effect size in which approximately 6% of the variance was accounted for by parent education level. In terms of test scores, parents with high school or some college who received a psychoeducational report with graphs scored 9.6% higher on the recall test than parents with similar educational levels who did not receive supplemental graphs. In contrast, parents with college degrees who received supplemental graphs scored 7.5% higher on the recall test than parents with similar educational attainment who did not receive supplemental graphs.

These results are similar to prior studies in which parents with college experience recalled more information correctly than parents with less educational attainment regardless of the report format (Franks, 1998; Weddig, 1984; Wiener & Kohler, 1986). Other studies have shown that the use of graphics led to increased recall even in individuals with low literacy levels or low economic status (Davis et al., 1996; Haeran & Delvecchio, 2004; Houts et al., 2001; Reinking, Hayes, & McEneaney, 1988).

Finally, it was hypothesized that parents would be more satisfied with psychoeducational reports that contained graphs. That hypothesis was supported: Parents who read a report with graphs judged that it was easier to understand and more clearly described the child than did parents who read a report without graphs. As with the recall measure, a medium effect size (partial $\eta^2 = .044$) for report type was found, which was comparable to the anticipated effect size based on prior studies in medicine and education (Branin & Griemel, 1996; Davis et al., 1996; Murphy et al., 1999; Ramaprasad, 1991; Shah & Hoeffner, 2002) and slightly superior to teacher satisfaction ratings of psychological report styles (Pelco, Ward, Coleman, & Young, 2009).

Limitations

One limitation of this study was the lack of diversity among participants. The majority of parents who participated in this study were married, middle-aged,

college-educated Caucasian women from central Pennsylvania. No participant reported less than a high school education, and only one participant reported an ethnicity that was not Caucasian. Therefore, the educational level, ethnic background, and marital status of the participants were not representative of the national population. This limits the generalizability of the current results. Furthermore, the parents were members of groups that made themselves accessible by providing the phone numbers of their organizational leaders in the local newspaper or by advertising their meeting times and contact information. Consequently, parents who attended these parent group meetings and volunteered to participate may be different from parents who are not as willing to engage in school or community activities.

In addition, the data collection procedures used in this study might have compromised ecological validity. In actual practice, parents would be given a copy of the psychoeducational report for their records and would be able to refer back to it at their convenience. They would also have been given the opportunity to discuss the results with the school psychologist and other school personnel individually or in a team meeting. Parents would also be more invested in reading and understanding the report because it would be about their child. Ecological validity may also have been constrained because the report used in this study was limited in focus to simplify the task for participants. Information about social, behavioral, emotional, and adaptive behaviors commonly found in psychoeducational reports was brief to keep the focus on the intellectual and academic achievement scores.

Last, this study was designed to examine the ability to recall information soon after it was read. Recall may have been different if parents were asked about the information after a longer interval. Furthermore, true understanding was not assessed. For example, parents might be able to tell the school psychologist that their child has an above-average IQ, but not truly understand what is meant by that information.

Future Research

In an era in which students are regularly given group standardized achievement tests and 13% of the school-aged population receives special education following psychoeducational testing for determination of eligibility for those services (Hoffman, Sable, Naum, & Gray, 2005), it is important to continue research in this area. Improving communication of test results to parents will help strengthen relationships between parents and school personnel, which will facilitate active parental involvement in making educational decisions to benefit students.

To be able to generalize results to a larger number of parents who read psychoeducational reports, future research should systematically include participants that are male, from different geographic regions, members of various

ethnic groups, and from all educational levels. In addition, because this study limited the focus of the report to intelligence and achievement test results, future research should focus on all information commonly included in psychoeducational reports. Alternative assessment methods, such as response to intervention, should also be examined (Bender, 2007). If these analogue studies with diverse parents and report contents continue to demonstrate positive benefits from supplemental graphs, then quasi-experimental studies with parents involved in actual special education placement decisions should be conducted to ensure that the limitations in ecological validity associated with analogue methods did not bias the results.

Parents are not the only readers of psychoeducational reports. School personnel, mental health and medical professionals, and community agency service providers are also involved in educational planning (Ownby, 1987; Sattler, 2008). Research has shown that school personnel and mental health professionals differ in their comprehension of terms used in reports (Bucknavage, 2005, 2007; Cuadra & Albaugh, 1956; Rafoth & Richmond, 1983; Rucker, 1967; Shively & Smith, 1969). Future research should examine if school personnel and other professionals who work with students would also benefit from the addition of graphs to psychoeducational reports to aid in their understanding as well as their ability to explain results to parents.

Implications for Practice

Many school psychologists are aware that reports should be written so that parents of diverse literacy levels can read them. Indeed, it has been recommended that psychoeducational reports be written in a clear, concise manner in a traditional format at an appropriate readability level with few technical terms (Harvey, 2006). However, parental comprehension of psychoeducational reports may still be inadequate for their full participation in educational decision making. Researchers in other disciplines have found that adding graphics to written information helps to improve recall and satisfaction (Branin & Griemel, 1996; Griffin & Stevenson, 1992; Murphy et al., 1999; Peterson et al., 1992; Ramaprasad, 1991; Shah & Hoeffner, 2002), and school psychologists have recommended supplemental graphics when reporting psychoeducational test results (Dixon, 2000; Iddings, 2000; Schwean et al., 2006). Results from the current study support those recommendations. However, sample limitations in the current study make it difficult to generalize to diverse groups of parents. In the absence of research with more representative samples, applied school psychologists may be guided by the best available evidence (Hunsley & Mash, 2007), within a data-based problem-solving framework (Huber, 2007).

NOTE

1. Copies of the psychoeducational report, recall measure, and satisfaction measure are available at <http://www.public.asu.edu/~mwwatkin/Watkins3.html>.

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